DESIGN PRINCIPLES FOR HETEROGENEITY DECISIONS IN ENTERPRISE ARCHITECTURE MANAGEMENT

Research-in-Progress

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Abstract

Adopting an engaged scholarship, particularly design science research approach, we explore design principles for heterogeneity decisions in enterprise architecture management (EAM). The holistic design of an enterprise's business processes and the architecture of IT systems has been an important IS research topic for many years, but the majority of past studies in our discipline took predominantly a decision-making perspective. There is a significant gap in our current understanding on how to design and plan an EA in order to serve strategic enterprise requirements. Thus, with this research-in-progress we address this gap in the literature and leverage the complementarities between EAM problem domain and design science research knowledge. In particular, we draw upon the latter as a methodological guideline for developing design principles and on the former as a conceptual guideline to develop design principles that address the particular class of heterogeneity problems in EAM.

Keywords: Design Principles, Design Science Research, Engaged scholarship, Enterprise architecture, Heterogeneity
Introduction

The holistic management and design of the enterprise’s IT systems and business processes, also referred to as Enterprise Architecture Management (EAM), is increasingly receiving attention of top management and IS literature (e.g., Ross et al. 2006). However, despite the obvious ‘architectural design’ character of this topic, the majority of past studies in our discipline adopted predominantly a decision making perspective, focusing among other things on Enterprise Architecture (EA) maturity, potential benefits of EA, and management processes or mechanisms of EA (e.g., Ross et al. 2006; Tamm et al. 2011a). The architectural design facet of EAM has been investigated far less and only recently (e.g., Greefhorst and Proper 2011; Winter and Aier 2011). This provides a fruitful motivation for this research-in-progress, which focuses particularly on the exploration of under-researched design principles for a core problem class in EA planning, namely heterogeneity decisions. We understand EA heterogeneity as diversity of attributes of components in an EA. The degree of heterogeneity (esp. as a result of IT governance and standardization efforts) was repeatedly identified by previous research as a salient enabler for EA business benefits (e.g., Boh and Yellin 2006; Ross et al. 2006; Tamm et al. 2011a). Therefore, we address the following research question: Which design principles should guide heterogeneity decisions in EAM?

EA management in general and EA planning in particular can be viewed – from an engaged design science perspective – as a class of practical problems for which solutions need to be developed. A problem solution in this context can take the form of design principles as illustrated by prior design science research (e.g., Markus et al. 2002; Yang et al. Forthcoming) as well as EA research (Aier et al. 2011; Richardson et al. 1990; Winter and Aier 2011). Thus, due to the identified parallels between past EA and design science research, we argue that an engaged design science research approach is particularly suitable to study EA planning. However, since the influential study by Richardson et al. (1990) there has not been much further research that proposes EA design principles. This is rather surprising, given the obvious close relationship between the architectural design component in EA and the methodological approach of engaged scholarship (Van de Ven 2007) in general and design science research in particular (Hevner et al. 2004). In summary, in this research-in-progress we adopt a complementary EA problem domain and engaged design science research perspective, based on the insight that design principles have been subject to prior research in both domains, albeit in different contexts (Richardson et al. 1990; Yang et al. Forthcoming).

This paper is organized as follows: The next section introduces the topic of heterogeneity in EA and analyzes the nature of design principles. In the third section, the chosen engaged design science methodology is described. Subsequently, we propose three general design principles for heterogeneity decisions in EAM. This research in progress article closes with a discussion of findings, limitations and an outline of the next steps.

Theoretical Background

The Contribution of Business Value by Enterprise Architecture Management

The (IEEE 2000) defines an architecture as the fundamental organization of a company’s information system, i.e. the systems “components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.” (p. 3) Drawing upon and extending the IEEE perspective, several further definitions have been proposed in the IS literature, some depicting in a narrow sense only the technological and others also the business components of EA. Table 1 provides an overview of commonly used definitions. In this article we build upon the definition by Ross et al. (2006) and therefore explicitly consider business processes and infrastructure (i.e. hardware and software) as components of the “system” EA (cf. also (IEEE 2000) definition).

The literature on EA distinguishes between “as-is” architecture (i.e. the status quo) and “to-be” architecture (i.e. the desired state). (Aier et al. 2011) One primary goal of EAM is to define a “to be” architecture of the enterprise and to provide guidance on how to achieve this state based on the current EA (Tamm et al. 2011a) – hereby EAM has to be closely aligned with the business strategy. From a system perspective (cf. IEEE 2000), the business strategy can be understood as part of the environment of the system. The connection between strategy and EA is further emphasized by Ross et al. (2006): EA should
provide a clear view of the enterprise’s “operating platform”, i.e. the technological foundation and the business processes that provide the basis of the company’s core capabilities.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Overview of commonly used definitions of the term “Enterprise Architecture”</th>
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<tr>
<td>(Richardson et al. 1990)</td>
<td>“[Enterprise Architecture] defines and interrelates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture.” (p. 386)</td>
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<td>(Ross et al. 2006)</td>
<td>“Enterprise Architecture is the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company’s operating model. The enterprise architecture provides a long-term view of a company’s process, systems, and technologies so that individual projects can build capabilities – not just fulfill immediate needs.” (p. 9)</td>
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<td>(Jonkers et al. 2006)</td>
<td>“Architecture at the level of an entire organisation is commonly referred to as “enterprise architecture” (EA). It is a coherent whole of principles, methods and models that are used in the design and realisation of the enterprise’s organizational structure, business processes, information systems, and infrastructure. EA captures the essentials of the business, IT and its evolution.” (p. 64)</td>
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<td>(Tamm et al. 2011a)</td>
<td>“EA is defined as the definition and representation of a high-level view of an enterprise’s business processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared by different parts of the enterprise.” (p. 147)</td>
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<tr>
<td>(Bradley et al. 2012)</td>
<td>“Broadly defined, EA is the organising logic for an organisation’s IT infrastructure and business processes.” (p. 98)</td>
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In literature, the process by which EAM aims to achieve the translation of business strategy to EA is oftentimes structured into different tasks or layers. For example, (Schmidt and Buxmann 2011) propose a framework of EAM tasks that distinguishes between a strategic and an operational layer. Furthermore, (Tamm et al. 2011a) differentiate between the task of EA planning and the enactment of these plans. In this paper, as explained later in greater detail, we focus on heterogeneity decisions that form a crucial constituent part of EA planning.

![Figure 1: Relationship between Enterprise Architecture Management, Benefit Enablers, Business Strategy, and Organizational Benefits](image)

The business value contribution of EAM has been extensively analyzed in past research. (Tamm et al. 2011a) recently conducted a comprehensive meta-analysis based on 50 studies and the authors find twelve potential organizational benefits of EAM, including among others “reduced (IT) costs” (illustrating the importance of cost-benefit analyses for any types of EA-related decisions) as well as “business-IT
alignment” (illustrating the strategic importance of EAM). However, the relationship between EAM and organizational benefits is typically not considered to be a direct one (cf. Figure 1), but mediated by “benefit enablers” (Tamm et al. 2011). Furthermore, the success of leveraging benefit enablers for the creation of business benefits depends on the business strategy (Ross et al. 2006). In this paper we focus on the degree of heterogeneity of the IT landscape as salient benefit enabler of EAM. Note that the management of the IT’s heterogeneity is not the only benefit enabler of EAM discussed in the literature (e.g., Tamm et al. 2011a). Nevertheless, management of “heterogeneity” (respectively “homogeneity”) is identified as important benefit enabler of EAM by various studies. For example, (Richardson et al. 1990) state in an early study, “It is our opinion that a homogeneous architecture throughout the enterprise will aid in achieving the following goals: improved information flow among entities, reduced support costs for overall system, and portability of software from one segment to another.” (p. 389) In the same manner (Ross and Westerman 2004) reason that EA reduces lower IT costs due to technology, data, and process standardization. (Boh and Yellin 2006) find significant relationships between the usage of EA standards (i.e. a homogeneous EA) and the “heterogeneity of physical IT infrastructure”, “replication of IT infrastructure services”, “business applications integrations” and “enterprise data integration”.

**IT Heterogeneity Decisions in Enterprise Architecture Management**

We define the degree of IT heterogeneity as diversity of attributes of components in an EA (Schneeberger and McLean 2003; Widjaja et al. 2012) – hereby we consider business processes as well as infrastructure elements as components of an EA.¹ Note that EA components exhibit different attributes: application software (as component of an EA) exhibits for example “vendor”, “implemented communication standard”, “programming language” as attributes. Therefore, the degree of “vendor”, “communication standard”, and “programming language” heterogeneity of software components could be analyzed. This suggests a pluralist perspective on the problem and is in line with other classifications of heterogeneity in the related literature – (Sheth and Larson 1990) present in a hierarchical model heterogeneity related to database systems, operating systems and hardware. In another study, (Sheth 1999) divides the heterogeneity of information systems into system heterogeneity (e.g., diversity of hardware, operating system, database management system) and information heterogeneity (e.g., semantic or syntactical heterogeneity of data).

Beside classifications we identified three distinct streams of literature on IT heterogeneity: A first stream of the literature analyzes the causes of heterogeneity in IT architectures. Heterogeneity can increase as a result of the “historical growth” of the IT landscape: Newly acquired components of the IT landscape are often operated in parallel to already existing components rather than replacing them (Ross et al. 2006). “Legacy” components (or sub-systems) are working stably and are often poorly documented, thus consequences of a shutdown are hard to predict. The heterogeneity of IT landscapes can increase if investment decisions are decentralized (Dewan et al. 1995). (Weitzel et al. 2006) propose a formal model to explain the lower degree of standardization in decentralized organizational regimes, i.e., the tendency to heterogeneity. Mergers and acquisitions are another reason for heterogeneity in IT landscapes. Particularly, if two companies choose to keep coexisting IT systems, heterogeneous IT environments often result.

Another set of past studies proposes measures to manage (i.e. often to reduce) special types of heterogeneity. For example, Härder et al. (1999) present an approach to solve conflicts of structural heterogeneity in databases by introducing a mapping language. (Park and Ram 2004) propose a framework to automatically detect and resolve semantic conflicts in heterogeneous information systems. Finally, (Boh and Yellin 2006) study the effect of EA standards on IT heterogeneity.

The third stream of literature addresses the cost-benefit trade-offs induced by heterogeneity decisions (e.g., Notkin et al. 1988; Notkin et al. 1987). Since various advantages are associated with a certain level of heterogeneity, a trade-off exists between the cost of managing heterogeneity and the benefits of having a homogeneous IT environment.

¹ An organizational phenomenon related to EA heterogeneity and which has been studied extensively is “differentiation”. Lawrence and Lorsch (1967) define differentiation as “the state of segmentation of the organizational system into subsystems, each of which tends to develop particular attributes in relation to the requirements posed by its relevant external environment.” (p. 3) “EA heterogeneity” is clearly related but different in the sense that the components constituting the system are not “people who are performing a task” (Lawrence and Lorsch 1967) but business processes and technical infrastructure components (Ross et al. 2006).
heterogeneity, an increase of heterogeneity may also be a conscious decision of the IT architect or the CIO. Due to the diversity of EA components, studies regarding the cost-benefit trade-offs related to the heterogeneity degree of those components can be found in different parts of IS literature. In the following we will briefly discuss as one example the well-studied cost and benefits related to vendor heterogeneity: A high degree of vendor heterogeneity increases competition (Lacity and Willcocks 1998), allows best of breed systems (Light et al. 2001), reduces strategic risks (Rottman and Lacity 2006), and decreases the degree of dependency on a distinct vendor (Cousins and Spekman 2003). On the other hand a relative small number of vendors induces high-quality customer-vendor relationships (Bakos and Brynjolfsson 1993), reduces coordination efforts, and improves resource utilization (Cousins and Spekman 2003). Note that similar (often ongoing) discussions regarding the “optimal” degree of heterogeneity can also be found regarding other EA components, like communication standard heterogeneity, semantic heterogeneity in databases, and hardware heterogeneity, among others.

**The Nature and Specification of Design Principles in IS Research**

Principles have not only been proposed and examined in the above reviewed domain of EAM (Richardson et al. 1990), but also in other domains and sciences of design. First of all, as the majority of prior EA studies has been conducted and published by IS researchers, it seems important to review the development and proposition of design principles for IS phenomena as a basis to develop EAM design principles. Most IS studies that propose design principles adopt a design science perspective and there are several well published examples in the literature. Markus et al. (2002) develop what they call “design and development principles” for the class of problems referred to as emergent knowledge processes. These principles form a core component of their design theory. An examination of the principles by Markus et al. (2002) illustrates that they may be focused either on aspects of ‘form and function’ or ‘development’ (Gregor and Jones 2007), on the design ‘product’ or ‘process’ (March and Smith 1995; Walls et al. 1992), or on both at the same time. For example, the principle ‘design for customer engagement’ can be understood as a guideline for the design and development process itself, while Baskerville and Pries-Heje (2010) characterize Markus et al.’s principles consistently as ‘meta-solution components’ with a clear focus on the outcome and product of design. Thus, there is obvious ambiguity in the IS literature as to the exact nature of design principles. This ambiguity is also reflected in two very recent exemplars of design principles development in IS that use the term without building upon a clear definition and conceptualization (Chaturvedi et al. 2011; Yang et al. Forthcoming). We thus conclude from our IS literature review on design principles that there is a significant lack of concept clarity.

The domain of EAM seems to have advanced further with respect to understanding the exact nature of design principles (Aier et al. 2011; Greefhorst and Proper 2011; Richardson et al. 1990; Winter and Aier 2011) In a very early publication, Richardson et al. (1990) state that “principles provide guidelines and rationales for the constant examination and re-evaluation of technology plans” (p. 389). Furthermore, in their study they not only state clearly each principle and the rationale behind it, but also explain the implications that follow. Accordingly, the rationale and implications are viewed as integral components of the design principles themselves and need to be stated clearly, as also recognized by IS scholars that have started to extend the conceptualization of the above mentioned study (e.g., Lindstrom 2006; Winter and Aier 2011). In a very recent EAM study, Greefhorst and Proper (2011) also propose that architectural principles are best specified by providing (1) a clear statement of the principle, which should succinctly communicate the fundamental rule (2) the rationale behind that statement, which should highlight the business benefits of adhering to the principle, and (3) the implications that follow, which should highlight the requirements for carrying out the principle. Accordingly, our understanding about the nature and specification of design principles in the EA domain seems to be more advanced than the general IS design science literature.

IS design science literature has viewed principles as components of design theory (Markus et al. 2002). Gregor and Jones (2007) distinguish between principles of form and function on the one hand, which addresses the product component of a design theory (Walls et al. 1992), and principles of implementation, which addresses the process component. However, these two different types of principles are only two elements of design theory that according to the authors consists of more. Thus, while IS design science literature in generally may probably benefit from the knowledge developed in the EAM domain on the nature and specification of design principles, the EAM domain may still have much to learn from the general IS design science literature in terms of relating the development of principles to the overall
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objectives of developing scientific theory. The implication for this research-in-progress is that we may start with the existing conceptualization of principles from our main problem domain, i.e. EAM, but have in mind for the future development of our work that there might be the potential to extend the principles that we develop to a more generalizable design theory.

Methodology: Engaged Design Science Research

In this engaged IS research project, we address a class of problems in EAM practice called heterogeneity decisions. Thus, the goal of this research is to develop novel and practically relevant insights on the appropriate design and implementation of an EA with a particular focus on heterogeneity decisions. Until to date, this research-in-progress has consisted of two steps, with a focus in this paper on describing the current status of the second, most recent step of our research process. In the following, we describe how our research process unfolded to provide an understanding of the emergence and development of the presented research outcomes so far.

Step 1: Artifact Design

The first step of our research process, conducted by the first author of this paper mainly between 2008 and 2010 involved the construction and evaluation of an IT artifact, i.e., a prototype for assessing the degree and nature of IT heterogeneity for EAM (Widjaja and Buxmann 2009). This research step followed a DSR approach, which is generally viewed as a research paradigm (Baskerville 2008; Iivari 2007), entailing a unique perspective and mode of conducting research. In this specific research project, the DSR approach that was initially followed was focused on the construction and evaluation of a technical IT artifact, i.e., a ‘tool’, that proved to be useful for EA architects in practice to support EA planning decisions. The experience from this first research step and the desire to develop more generalizable theory about the addressed class of problems drove the two authors of this paper to engage in a joint research project, which triggered the subsequent step 2 that focuses on developing design principles.

Step 2: Design Principles Development

In the second step of our research process, currently being conducted in close collaboration between the authors of this paper, the objective is to build generalizable design principles for EA heterogeneity decisions. Thereby, the insight emerged in the author team that the adopted DSR approach could be complemented by guidelines for engaged scholarship provided by Van de Ven (2007), who explicitly recognizes DSR as a type of engaged scholarship. Van de Ven’s engaged scholarship model focuses on building practically relevant theory and has been integrated with DSR (e.g., Gregory and Muntermann 2011). The model for building a theory involves three intertwined steps, i.e., abduction (conceiving a theory), deduction (constructing a theory), and induction (validating a theory). In this research-in-progress, design principles are presented that have been abductively conceived and in parts already deductively derived (see the section ‘next steps’ for more details on the further evolution of this research). Thereby, the development of the presented design principles is influenced by the experience of the first author of this paper who has been engaged with design activities as described in step 1. In addition, the design principles development was enabled by a careful review and joint application of EAM literature of the two authors of this paper, which formed the main basis for this paper.

As a result of the above described research steps 1 and 2, our overall research approach can be best described as an ‘engaged DSR’ approach. This approach seeks a combination of the practically relevant (in our case technically oriented) DSR approach and the focus on theory building advocated by Van de Ven’s engaged scholarship model. Our selected research approach fits particularly well with the topic of our research project, which focuses on EA. Thus, there is a design or architectural component embedded in the topic of our investigations itself. We argue that the development of design knowledge, including IT artifacts, design principles, and design theory more generally, may be of particular interest and value to the domain of EA, which essentially deals with a design and architectural construction problem. In addition, after reviewing carefully the existing literature in the domain of EA, we conclude that there is a significant gap in our understanding of how to design and implement an appropriate EA.

The overall goal of this research-in-progress is to develop design theory in the form of design principles, as done before in IS research (e.g., Markus et al. 2002). Thereby, we view design theory and other types of
Design Principles for IT Heterogeneity Decisions in EAM

In this section we develop and propose three tentative design principles for IT heterogeneity decisions in EAM. We structure the principles following the rationale proposed by (Hall and Hagen 1969), who present a (generic) view on systems: The aim of EA (i.e. the relation of the system to the environment) is the support of the enterprise strategy (cf. principle I), EA consists of components (cf. principle II) and relation between components (cf. principle III). Furthermore, we draw upon EAM domain literature for the specification of our principles and distinguish between the following interrelated elements: statements, rationale, and implications (Aier et al. 2011; Greefhorst and Proper 2011; Richardson et al. 1990; Winter and Aier 2011). Note that the proposed principles aim to guide the definition of a to-be EA (Aier et al. 2011) and can be instantiated for heterogeneity regarding all EA components (e.g., vendor heterogeneity of applications, version heterogeneity of hardware components, semantic heterogeneity in databases, etc.).

Principle I: EA heterogeneity decisions are consistent with the business strategy of the enterprise.

Rationale I: EAM should “translate the broader principles, capabilities, and goals defined in the strategies into systems and processes that enable the enterprise to realise these goals” (Tamm et al. 2011, p. 142). (Ross et al. 2006) emphasize that the EA should provide a clear view of the “operating platform”, i.e. the technological foundation and the business processes that provide the basis of the company’s core capabilities. Therefore, the aim of EA is to support business strategy (Schmidt and Buxmann 2011; Tamm et al. 2011a) and heterogeneity decisions should reflect this aim (cf. Figure 1). If, for example, the customer experience during the sales process is an important part of the company’s differentiation strategy and various sales channels are supported by distinct applications (provided by niche vendors), a high heterogeneity (i.e. best-of-breed-strategy (Light et al. 2001)) in this EA domain is justified. Note that the relation between the business strategy and the heterogeneity decisions is not a uni-directional “top-down” relation rather than a need for alignment.

Implications I:
- The degree of heterogeneity and the business requirements are aligned.
- A change of the business strategy induces a change of heterogeneity of the “to-be architecture”.
- A change of heterogeneity of the “to-be architecture” induces a change in business strategy.
- The documentation of the rationale of the heterogeneity decision highlights the connections to the business strategy.

Principle II: EA heterogeneity decisions are EA component type specific.

Rationale II: The optimal degree of heterogeneity is driven by cost-benefit aspects that are rooted in the considered component types (cf. section two). Note that those cost-benefit aspects are often not deterministic and if more than one component type in an EA is affected, this can result in intertwined trade-offs. For example, regarding the “vendor heterogeneity” of software components a rich stream of
literature in our field identifies factors that influence the “optimal” degree of heterogeneity: “competition among vendors”, “reduction of risks” and “decrease of dependency” are reasons for a high vendor heterogeneity, while “high-quality relationships”, “reduction of coordination efforts” are benefits of relying on few vendors. Currently, some evidence exists that a small set of vendors (e.g., Bakos and Brynjolfsson 1993; Kaiser and Buxmann 2012; Rottman and Lacity 2006) might be favorable in most cases. Note that other types of heterogeneity induce other cost-benefit trade-offs.

**Implications II:**
- Component-specific cost and benefit dimensions are identified and weighted based on the enterprises requirements (cf. principle I).
- The degree of heterogeneity reflects the underlying component-specific cost-benefits trade-off.

**Principle III:** EA heterogeneity decisions consider the relations between components of the EA.

**Rational III:** The components of an EA (and therefore also the component types) are related (cf. definition of (Hall and Hagen 1969; IEEE 2000)) and these relations can induce dependencies between different heterogeneity decisions of components. For example, if heterogeneity regarding communication standards is considered – network externalities (e.g., Katz and Shapiro 1985; Liebowitz and Margolis 1994) and possible incompatibles between the standards can enforce homogeneity (Weitzel et al. 2006). These dependencies are typically reflected by industry standards that induce EA domain models that ensure high intra-domain coherency and low inter-domain dependency of (sub-)domains. Beside relations between components of the same type, also relations between different types of components exist. Therefore, enterprises structure EA typically in layers, whereas a higher layer typically defines “requirements” for the lower layers and the lower layers “support” the execution of components on the higher layers (Sheth and Larson 1990). For this reason EAs are often standardized (i.e. show a low level of heterogeneity) on the lower (i.e. more technical-oriented) layers.

**Implications III:**
- Existing dependencies between components and component types are documented.
- If dependencies induce conflicts regarding the desired heterogeneity type, these conflicts are resolved under consideration of principle I.

**Discussion and Next Steps**

This research-in-progress proposes a design perspective on EAM. We contribute to the literature of EAM in two different ways: First, we propose three tentative generic design principles for EA planning with in particular focus on heterogeneity decisions. Second, we identify complementarities between EA problem domain and design science research knowledge.

The next steps of our research include the refinement and further development of the proposed principles, which essentially means completing the ‘deduction’ cycle explained in the methodology section. Hereby we plan to focus on the following issues: A) Identification of further relations between component types in an EA. B) Analyzing EA decisions that affect more than one heterogeneity type and the resulting intertwined cost-benefit trade-offs. C) Furthermore, we are aware of the fact that the current focus on cost/benefit trade-off is limited – it might be fruitful to consider a “broader” view like e.g. (Schmidt and Buxmann 2011; Tamm et al. 2011b) and incorporate the effects on “agility”, “efficiency” of the EA.

Furthermore, our goal is to verify and test our ideas in an upcoming ‘induction’ cycle as explained above. Accordingly, we plan to conduct multiple case studies with organizations experiencing EAM-related problems to identify those component types in an EA, whose degree of heterogeneity have crucial effects on business strategies (principle I). Based on this, we will also refine the presented generic design principles 2 & 3 by carving out the implied cost-benefit trade-offs and relationships of those identified component types. Thus, as recommended by Van de Ven (2007), ‘abduction,’ ‘deduction,’ and ‘induction’ cycles will become more and more intertwined over time in our subsequent research process. Finally, the refined principles will then be tested with a combination of empirical and other research methods suitable for design evaluation.

An interesting insight that emerges from our research-in-progress is that design science and EA domain
researchers have much to learn from each other, supporting the notion in existing literature that the design and behavioral science paradigms are complementary in nature (Gregor 2006; Holmström and Ketokivi 2009). In particular, from a design science research perspective, there is still much to learn from EA problem domain literature. The development of design principles, which in design science research has gained popularity in recent times (Chaturvedi et al. 2011; Yang et al. Forthcoming) has been a focus of research in the EA problem domain for a much longer time, even though not linked explicitly to the design science research paradigm (Richardson et al. 1990). Based on insights from the EA domain literature, we explore not only principles statements in this research-in-progress, but also the rationale behind each statement as well as the implications that follow. A suggestion for future design science research is to learn from the insights developed in the EA domain over a long time period with regards to the specification and explanation of design principles (Greefhorst and Proper 2011). Similarly, the EA domain has also much to learn from the extensive amount of knowledge that is now available in IS design science literature. For example, adopting the guidelines provided by Hevner et al. (2004), the recommendation not only for our research-in-progress but also for EA design science research in general is to view the search for appropriate design solutions and theory as an iterative search process in which interaction with the organizational environment recurrently provides new insights and the necessity of evaluating design outcomes. Taking these and related guidelines for engaged design science into account might enhance significantly the results of principles-based EA research (Richardson et al. 1990). In summary, we find a complementary relationship between EA domain and IS design science literature. The identification and recognition of this complementary relationship will also guide the next steps of this research-in-progress.

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