Understanding the Role of Organizational Culture for Design and Success of Enterprise Architecture Management

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Abstract. Enterprise architecture management is considered a valuable means to guide the consistent design and evolution of increasingly complex information systems. Despite existing research on EAM methods and models, organizations often face serious difficulties making EAM effective. The paper proposes to take organizational culture as a highly aggregated construct describing the context of EAM initiatives for building situational—or for that matter culture sensitive EAM methods—into account. We find that organizational culture significantly moderates the impact of EAM's design on EAM's success. In group culture, hierarchical culture and developmental culture it is essential to develop EAM from a passive into an actively designing approach to make it effective. Particularly in group culture it is rewarding to strive for an EAM approach that impacts stakeholders outside the IT department.

Keywords: enterprise architecture management, EAM design, EAM success, organizational culture

1 Introduction

Corporate information systems (IS) have reached a considerable degree of complexity which is represented by an IS' number of components, e.g. its business applications, but also by the diverse dependencies and interfaces these components have. The "nature" of these components, like for example business processes, applications or IT infrastructure components, is unequal and requires specific skills and knowledge for their management. As a result, it can often be observed that corporate IS are not consistently developed but development and transformation happens in a number of locally optimized projects as opposed to globally optimized programs. Enterprise architecture management (EAM) is often discussed as an effective means supporting a consistent IS development and transformation by providing transparency on the components and their dependencies as well as by providing principles guiding an organization's development and transformation [1].

Despite the fact that EAM research and practice have delivered a number of EA models, methods and frameworks [2], it still is challenging for practitioners to intro-

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duce and sustainably anchor EAM in their organizations [3]. It is accepted that organizations being in different situations require different approaches to make EAM effective. A number of authors applied the concept of *situational method engineering* [4] to the field of EAM [5], [6], [7], [8] and identified contingencies that are relevant to EAM method design [9], [10]. However, it is challenging to identify the relevant dimensions of contingencies as a prerequisite to analyze their impact on EAM design. It has therefore been proposed to look at more *aggregated constructs* in order to describe the context of EAM method application [11]. In line with van Steenbergen [10] and Aier [11] we look at *organizational culture* as such a highly aggregated construct, describing fundamental values and beliefs of organizations which might be useful for implementing EAM. We consider the perspective of organizational culture for understanding the design of EAM valuable because (1) EAM is an *organization-wide approach* affecting a potentially large number of stakeholders with potentially conflicting goal systems and (2) because the nature of EAM is to aim at consistency by *restricting the design freedom* of these stakeholder [12].Whether or how such an approach can be effectively implemented in an organization is expected to be influenced by the shared basic assumptions of the organization that proved to work well enough to solve its problems [13], i.e. it is expected to be influenced by its organizational culture.

The purpose of this paper is to understand how EAM design and EAM success interact with organizational culture. We therefore build on existing work by Aier et al. [8] that identified eight factors describing EAM design. In the next section we discuss conceptual foundations of organizational culture. In section 3 we develop our research model and discuss the research methodology in section 4. We present the results in section 5 and critically discuss these in section 6. The paper ends with a conclusion.

2 Organizational Culture

There is a large number of publications conceptualizing *culture* [14],[15]. In this paper we adopt Schein's definition of culture which integrates many of the concepts found in literature. Schein defines the culture of a group as "[a] pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" [13]. Further Schein conceptualizes culture on three levels of visible *artifacts*, *espoused values* and *basic underlying assumptions* [13]. It is difficult to study basic assumptions because they are invisible and preconscious. It is also difficult to study artifacts, while being visible, they are not easily decipherable. Therefore, we and most other research on organizational culture [15] aim at analyzing culture on the level of the respective group's values by building on the *competing values model* (CVM) [16] as a theoretical foundation. CVM is a quantitative model to study organizational culture that is well reported in literature. It has a short and validated measurement instrument [17]. While there are alternative models to study or-

ganizational culture, e.g. [18], [19], these are either too complex, including more than 100 measurement items, or are used for qualitative analyses.

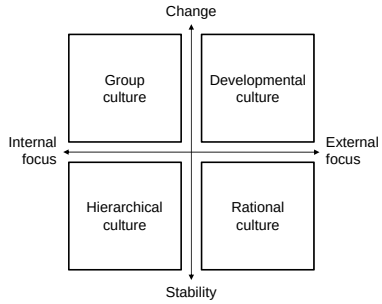

Fig. 1. Competing values model [20]

The competing values are positioned in two dimensions reflecting the competing tensions and conflicts inherent in any human system [20]. One dimension is *change* versus *stability* the other dimension is *internal focus* versus *external focus* (fig. 1). Change emphasizes flexibility and spontaneity, whereas stability focuses on control, and continuity. In the other dimension internal focus means integration and maintenance of the socio-technical system whereas external focus stands for competition and interaction with the organization's environment. The opposite ends of these dimensions form the competing values that may occur within the organization. Based on the resulting two-dimensional matrix four archetypes of organizational culture can be distinguished [20]:[1] *Group culture* is primarily concerned with human relations. It emphasizes flexibility and focuses on the internal organization. Maintenance of the group is a main purpose and belonging, trust, and participation are core values. Leaders in group culture tend to be participative, considerate, and supportive, teamwork is important. *Developmental culture* also emphasizes flexibility and change, but the main focus is on the external environment. Therefore, growth, resource acquisition, creativity, and adaptation to the external environment are important. Leaders tend to be entrepreneurial and idealistic, willing to take risks, and future-oriented. *Rational culture* emphasizes productivity, performance, and goal fulfillment. The purpose of organizations tends to be the pursuit and attainment of well-defined objectives. Leaders tend to be directive, goal orientated, instrumental, and functional, and are constantly providing structure and encouraging productivity. *Hierarchical culture* emphasizes internal efficiency, uniformity, coordination, and evaluation. The focus is on the logic of the internal organization and the emphasis is on stability. The purpose of organizations tends to be the execution of regulations. Leaders tend to be conservative and cautious, paying close attention to technical matters.

[1] It has to be noted that the original CVM which is well reported in research, e.g. [17], has in parallel been developed into the Competing Values Framework (CVF) [21] being a management approach for improving organizational effectiveness using different labels and varying measurement instruments.

These cultures described by CVM are archetypes. Organizations may reflect combinations of cultural types including paradoxical combinations [22]. CVM does not attempt to describe the unique qualities of an organization's culture, but broad categories. Recognizing that the specific content of an individual culture will vary widely, CVM assumes that the general dimensions will remain relevant across a wide number of settings [20]. CVM thus delivers on our goal to apply highly and purposefully aggregated constructs in order to describe the context of EAM design.

3 Research Model

The goal of this paper is to develop a general understanding on how EAM design and EAM success interact with organizational culture. We build on an aggregated research model in order to understand these general relations rather than focusing on specific EAM topics like EA planning or EA principles. We found it helpful to base our research model on the work of Aier et al. who identified eight factors for the description of EAM design [8]: Factor F1 describes EAM's *IT operations support*. F2 relates to the *support of management tasks by EAM*. F2 constitutes an antipole to F1 and shows that EAM may serve both IT and business management purposes. F3 denotes the *governance of EAM* which describes a central supervision of EA processes, models and data. F4 characterizes the *support of IT strategy and governance tasks* by EAM. F5 again characterizes a support task of EAM—its *information supply*. F6 summarizes aspects expressing the *integrative role* of EAM realized by a continuous exchange between EAM roles. F7 focuses on the *design impact* of EAM on IT or infrastructure, application or business architecture. Finally, F8 again describes a support function of EAM: *business strategy support*. In contrast to F2, F8 describes the support of explicit strategic tasks like enterprise development and product planning.

Aier et al. [8] further aggregated these eight factors by clustering their sample based on factor's values. They found three cluster: (C1) a balanced *active approach* to EAM, (C2) a *business-oriented approach* to EAM and (C3) an *IT-oriented, passive approach* to EAM. Based on the respective dimension and its values in C1–C3 we defined our core constructs describing EAM design on an aggregated level: The first construct is the *IT advisory mandate* (IAM, based on C3) of EAM which describes the passive support of IT strategy and management by EAM and its means for providing transparency. The second construct is EAM's *active design mandate* (ADM, based on C1) which represents EAM's claim not only to passively inform (IT) management but to actively engage EA design. The third construct is EAM's *business advisory mandate* (BAM, based on C2) which represents EAM's claim to also utilize EAM's methods and models outside the IT department and provide value to the business departments, e.g. by supporting strategy processes with relevant information and analyses. We use these three constructs (IAM, ADM, BAM) to describe the way EAM is designed into an organization on an aggregated level.

For describing EAM success we differentiate two perspectives (cf. section 4). The perspective of *EA consistency* (CON) describes how effective EAM has been in connecting the various "local optimizations" and providing a global view on the devel-

opment and transformation initiatives of the respective organization. While EA consistency can be influenced by EAM rather directly, the second perspective *EAM utility* (UTI) is seen as a consequence of consistency. EAM utility describes the actual goals of doing EAM like efficiency and flexibility to respond to external changes, reduced run and change costs or improved rates of innovation on business and IT side. Based on these constructs we define our core hypotheses (fig. 2).

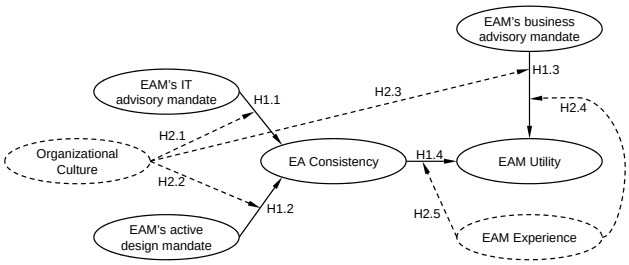

Fig. 2. Research model

H1.1. EAM's IT advisory mandate will positively influence EA consistency.
H1.2. EAM's active design mandate will positively influence EA consistency.
H1.3. EAM's business advisory mandate will positively influence EAM utility.
H1.4. EA consistency will positively influence EAM utility.

Based on our practical experience we believe that there is no one best way to achieve EAM success but that depending on the organization's values and experiences, i.e. its culture, an IAM, ADM or BAM approach or combinations of these might become effective which—from a statistical point of view—means that organizational culture moderates the hypotheses (H1.1)–(H1.3), i.e. affects the strength of the relations between the independent and the dependent variables. In the paper at hand we are particularly interested in detecting these moderation effects. This means that we are not primarily interested in whether or not EAM is in general more effective in one culture or another, but—from a design point of view—we are interested in understanding how to best spend the oftentimes limited resources for introducing and developing EAM in different organizational cultures. Therefore our further hypotheses are that the relations modeled by (H1.1)–(H1.3) are moderated by organizational culture. While H1.4 might also be moderated by organizational culture, we do not focus this question because it is less relevant from an EAM *design* perspective:

H2.1. Organizational culture moderates the relation between EAM's IT advisory mandate and EA consistency (H1.1).
H2.2. Organizational culture moderates the relation between EAM's active design mandate and EA consistency (H1.2).
H2.3. Organizational culture moderates the relation between EAM's business advisory mandate and EAM utility (H1.3).
Looking at EAM's utility it can be observed that EAM's utility also depends on the experience an organization has with EAM.

H2.4. EAM experience moderates the relation between EAM's business advisory mandate and EAM utility (H1.3).

H2.5. EAM experience moderates the relation between EA consistency and EAM utility (H1.4).

4 Research Methodology

In order to test our hypotheses we follow a quantitative empirical approach by means of a questionnaire used in a survey among enterprise architects.[2] Data collected in this survey is then used to test the hypotheses following a partial least squares (PLS) approach to structural equation modeling (SEM).[3] We have chosen PLS-SEM over traditional moderated multiple regression approaches since these are often afflicted with difficulties detecting weak moderation effects [24].

Our measurement model has three components (1) EAM design (IAM, ADM, BAM), (2) EAM success (CON, UTI), and (c) organizational culture. The measurement model regarding EAM design is based on [8]. The number of indicator variables (IV) used for measuring a latent variable (LV) regarding EAM design is between two and three. The measurement model for evaluating EAM success has also been adopted from [8] and is comprised of 14 items mostly found in practice driven publications [25-28]. We have rephrased two of these items because they seemed overloaded which resulted in 16 items. To better understand these 16 items we performed a factor analysis on these items which resulted in two factors we named EA consistency (CON) and EAM utility (UTI). The number of IVs used for measuring EA consistency (CON) is seven and the number of IVs used for measuring EAM utility (UTI) is nine. The measurement model for describing organizational culture is based on the original CVM questionnaire by Cameron [29] which is described in [30] and its modifications by Yeung et al. [31]. Each of the cultural archetypes defined by the CVM is measured by three IVs. Similar to the instrument's application in [17] we have, however, dropped one item during reliability analysis. The overview of all IVs and the respective LVs is given in table 1.

For testing moderation effects in PLS path models there are basically two options, (1) the group comparison approach and (2) the product term approach [32]. Given that we have measured each cultural orientation separately, we apply the product term approach here. We illustrate this approach on the example of hypothesis H2.1. Hypothesis H2.1 states that organizational culture moderates the relation between EAM's IT advisory mandate and EA consistency (H1.1). In fig. 3 it can be seen that we model the direct effect of the exogenous variable *EAM's IT advisory mandate* on the endogenous variable *EA Consistency* and the direct effects of the moderator variables (one for each cultural archetype) on the endogenous variable. In order to assess the actual moderation effects we additionally model the interaction terms as products of each exogenous variable with each moderation variable [24]. To avoid problems of

[2] The questionnaire has not been developed exclusively for the research reported here but also contained questions on EA principles reported on in a different paper [11].

[3] We used the PLS implementation in SmartPLS, version 2.0.M3 [23].

multicollinearity, which often arise when modeling moderating effects, we mean-centered all indicator values before multiplication [32]. We deal with the hypotheses (H2.2)–(H2.5) in the same way.

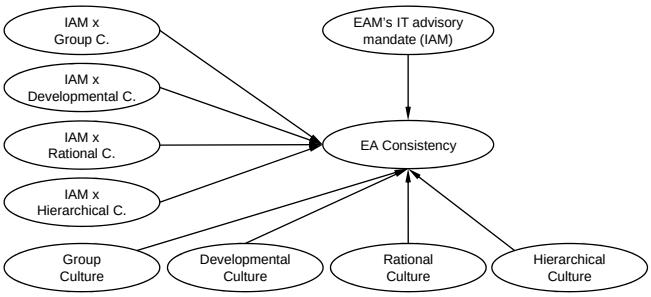

Fig. 3. Product term approach for modeling moderator effects

Data was collected by means of a questionnaire that comprised five sets of questions. The first set was related to demographics. The second set contained the measurement instrument for the CVM. The third set was comprised of items on the design of EAM in the organization. The fourth set was comprised of items regarding EA principles (not reported here, see [11]). The last set was comprised of items on EA success. For all items the respondents were asked to evaluate their organization's current implementation on a 5-point Likert scale ranging from "not at all" (1) to "completely" (5). We pre-tested the questionnaire with practitioners from six of our regular research partner companies. The pre-test resulted in minor adjustments of wording. Questionnaires from the pre-test are not included in the sample.

We collected the questionnaires on two practitioner events in Switzerland in 2010 (70 questionnaires) and 2011 (68 questionnaires). The resulting response rates are 61% and 64% for the respective events. A total of 138 data sets were collected that did not reveal substantial extent of missing data (10% at maximum).[4] While we cannot claim our sample to be representative, respondents have a strong link to EAM because all of them were participants of events that specifically addressed EA practitioners. Study participants came from Switzerland, Germany, and Austria. The survey was administered in German language only. The majority of respondents (>71%) worked for an IT unit rather than for a business unit. 88% of the respondents were actively involved in an EA function in their organizations. The respondents were primarily representatives of large organizations. More than 40% of the respondents came from very large companies (5000 employees and over), 27% from large companies (1000–4999 employees), 14% from medium large companies (250–999 employees), 17% from medium sized or small companies (249 employees or less). The majority of survey participants were well experienced in the field of EA. 39% of the respondents reported a long EA experience (more than five years), 26% three to five years, 17% two years and 18% one year or less. Survey participants were broadly distributed

[4] When analyzing the data in SmartPLS we used the "case wise replacement" algorithm for handling missing values.

among industries. The most frequently reported industries in the survey are financial industry (30%), software/IT industry (25%), followed by public services (8%), manufacturing (7%), telecommunication (4%) and others.

5 Results

We first tested the model without interaction terms, that is including direct effects only in order to evaluate the quality criteria [33] of the basic measurement and structural model. Afterwards we added all combinations of interaction terms in order to evaluate the entire model and to estimate all values necessary to determine the strength of the moderating effects [32]. The IVs used for measuring the LVs are documented in table 1. All LVs were operationalized in reflective mode. Significance tests were conducted using *t*-statistics applying bootstrapping with 500 re-samples.

Table 1. Survey items, construct reliability, and convergent validity

		Mean	Standard deviation	Loading	*t*-statistic	CR	AVE
IAM	**EAM's IT advisory mandate**					0.907	0.765
IAM1	EAM supports IT operations.	2.90	1.089	0.8912	44.7006		
IAM2	EAM Supports IT strategy and governance.	3.12	1.111	0.9099	54.0859		
IAM3	There is exchange between EAM roles.	2.84	1.068	0.8207	23.8805		
ADM	**EAM's active design mandate**					0.916	0.845
ADM1	EAM has actual design impact.	2.99	1.048	0.9181	60.3588		
ADM2	EAM is actively governed.	2.57	1.173	0.9200	68.5136		
BAM	**EAM's business advisory mandate**					0.893	0.736
BAM1	Business management uses EAM results.	2.85	1.160	0.8600	30.0144		
BAM2	EAM is an information supplier.	2.98	1.127	0.8555	22.7161		
BAM3	EAM supports strategic planning.	2.54	1.125	0.8579	34.0657		
CON	**EA Consistency**					0.928	0.650
CON1	Redundancy in EA is reduced.	2.89	1.033	0.7780	19.8672		
CON2	Change projects are well coordinated.	2.92	1.001	0.8055	23.6971		
CON3	Information silos are dissolved.	2.97	1.126	0.8479	28.6598		
CON4	Heterogeneity of technologies is reduced.	3.10	1.075	0.7946	21.4970		
CON5	Reuse of platforms, and functions is increased.	3.11	1.056	0.8638	36.8156		
CON6	Standardization of processes is increased.	2.98	1.012	0.7745	22.9071		
CON7	Standardization of applications is increased.	3.10	0.954	0.7731	19.9199		
UTI	**EAM Utility**					0.941	0.641
UTI1	Business/IT have a mutual understanding.	3.00	0.964	0.7514	15.1664		
UTI2	Business is satisfied with IT services.	3.03	0.912	0.7763	19.0914		
UTI3	Flexibility to respond to external changes is increased.	2.77	1.017	0.8045	24.3951		
UTI4	Efficiency of responding to customer or market requirements is increased.	2.78	0.947	0.8262	30.4405		
UTI5	There is lowered risk by being prepared for unplanned change.	2.68	1.013	0.7717	23.1509		
UTI6	Costs for run the business are reduced.	2.96	1.095	0.8107	28.1428		
UTI7	Costs for change the business are reduced.	2.70	1.068	0.8570	37.0411		
UTI8	Rate of business innovation is increased.	2.52	1.013	0.7950	23.1535		
UTI9	Rate of IT innovation is increased.	2.63	1.032	0.8070	23.9135		
GRC	**Group Culture**					0.840	0.644
GRC1	The company I work in is a very personal place. It is like an extended family and people seem to	2.96	1.2950	0.5849	3.3312		

		Mean	Standard deviation	Loading	*t*-statistic	CR	AVE
	share a lot of themselves.						
GRC2	The glue that holds the company I work in together is loyalty and tradition. Commitment to the company I work in runs high.	3.53	1.0195	0.8635	6.3989		
GRC3	The company I work in emphasizes human resources. High morale is important.	3.71	0.9714	0.9113	8.9534		
DEC	**Developmental Culture**					0.779	0.542
DEC1	The company I work in is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks	2.90	1.1586	0.6604	6.3691		
DEC2	The glue that holds the company I work in together is commitment to innovation and development. There is an emphasis on being first with products and services.	3.12	1.0944	0.8352	11.9052		
DEC3	The company I work in emphasizes growth through acquiring new resources. Acquiring new products/services to meet new challenges is important.	3.07	1.2200	0.7017	6.0686		
HIC	**Hierarchical Culture**					0.865	0.681
HIC1	The company I work in is a very formal and structured place. People pay attention to bureaucratic procedures to get things done.	3.18	1.1174	0.8090	9.8979		
HIC2	The glue that holds the company I work in together is formal rules and policies. Following rules and maintaining a smoothrunning institution are important.	3.07	1.1687	0.8418	15.3337		
HIC3	The company I work in emphasizes permanence and stability. Efficient, smooth operations are important.	3.62	0.9404	0.8240	17.0245		
RAC	**Rational Culture**					0.851	0.740
RAC1	The glue that holds company I work in together is an emphasis on tasks and goal accomplishment. A production and achievement orientation is commonly shared.	3.53	0.9160	0.8784	19.3482		
RAC2	The company I work in emphasizes competitive actions, outcomes and achievement. Accomplishing measurable goals is important	3.56	1.0395	0.8422	17.9128		
EXP	**EAM Experience**					1.000	1.000
EXP1	(1) <1, (2) 1-2, (3) 3-5, (4) >5 years	2.86	1.126	1.000			

The quality of the *measurement model* is determined by (1) construct reliability, (2) convergent validity, and (3) discriminant validity [34]. For testing *construct reliability* two parameters are relevant, composite reliability (CR) and average variance extracted (AVE). For a construct to be considered reliable the CR value should be greater than 0.6; AVE should be greater than 0.5 [34]. The estimated CR and AVE values are well above these threshold values for all LVs (table 1).

Convergent validity is given when the IV loadings on the respective LVs are sufficiently high and statistically significant. IV loadings in general should be above 0.7 [33] and should not differ too much for one respective LV [35]. Weaker loadings, however, are often observed. In reflective models IVs with loadings smaller than 0.4 should be removed [36]. For all but two IVs parameter estimation yields loadings well

above the 0.7 threshold value. The *t*-statistics indicate that all IV loadings are statistically significant at a 0.001 level at least (table 1).

Table 2. Correlation matrix (with the square root of the AVE on the main diagonal)

	ADM	BAM	DEC	CON	UTI	EXP	GRC	HIC	IAM	RAC
ADM	**0.919**									
BAM	0.685	**0.858**								
DEC	0.327	0.252	**0.736**							
CON	0.609	0.551	0.326	**0.806**						
UTI	0.499	0.510	0.328	0.796	**1.000**					
EXP	0.585	0.501	0.284	0.500	0.430	**0.801**				
GRC	0.376	0.211	0.339	0.278	0.296	0.105	**0.802**			
HIC	0.337	0.377	-0.069	0.425	0.411	0.293	0.149	**0.825**		
IAM	0.763	0.764	0.161	0.612	0.589	0.538	0.346	0.470	**0.875**	
RAC	0.405	0.309	0.491	0.447	0.475	0.403	0.311	0.399	0.366	**0.860**

Discriminant validity describes the degree to which the IVs of different constructs are related to each other. It can be assessed by comparing the square root of the LVs' AVE to the constructs' correlations [33]. The test shows discriminant validity, when the square roots of the LVs' AVE are significantly larger than any correlation between this LV and the other constructs. Table 2 shows the results of this test for discriminant validity. The square root of the LVs' AVE is strictly higher than any inter-construct correlation of the respective LV.

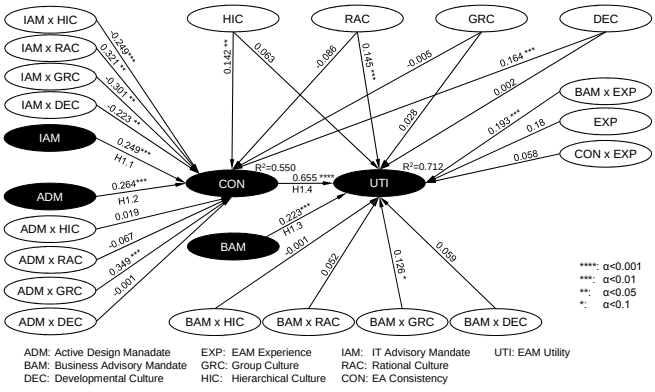

Fig. 4. Research model results

The *structural model* is constituted by the entirety of latent variables and their relationships including all interaction variables considered. The results of the evaluation

of the research model are depicted in figure 4. The core model of EAM design and its impact on EAM success is printed in inverted color all other LVs represent organizational culture archetypes and EAM experience and their respective interaction terms.

One important metric for judging the structural model is the endogenous LVs' *determination coefficient* (R^2) which reflects the share of the LV's explained variance [37]. There are no general recommendations on acceptable values of R^2. What is acceptable or not depends on the individual study and LV (Chin 1998). 55.0% of the variance in CON (EA consistency) is jointly explained by IAM (EAM's IT advisory mandate), ADM (EAM's active design mandate), all four LVs representing organizational culture (HIC, RAC, GRC, DEC) and the respective interaction terms. This value is encouraging. The R^2 values of UTI (EAM utility) is 0.712 which points to substantial explanatory power [37].

All path coefficients of the (invertedly printed) core model exceed the recommended 0.1 value [38] and even the 0.2 value [37] in conformance to the hypothesized directions and are statistically significant at the 0.01 level or even the 0.001 level (CON-UTI). If we look at the direct effects and the interaction effects of organizational culture, the results are more differentiated. As we are not particularly interested in the direct effects of organizational culture directly look at the moderating effects of organizational culture represented by the interaction terms and the respective path coefficients. Here we found that all of the analyzed paths (H1.1)–(H1.3) are significantly moderated by at least one cultural orientation. Interestingly, an organizations EAM experience (EXP) has neither a significant direct effect on EAM utility (UTI) nor does it moderate the relation between EA consistency (CON) and EAM utility (UTI). However, an organization's EAM experience (EXP) significantly moderates the effect a business advisory mandate has on EAM utility.

In order to determine the strength of the moderating effects, we calculated the effect size f^2 [39]. The f^2 value of all interaction terms on CON (EA consistency) is 0.12 which is between a small and moderate effect and is larger than what is found in most IS studies [24]. The f^2 value of all interaction terms on UTI (EAM utility) is 0.18 which represents a moderate effect. If we take all LVs that represent organizational culture (direct effects and interaction effects) these values change to 0.26 (CON) and 0.17 (UTI) representing moderate effect sizes (starting at a value of 0.15). However, a low effect size does not imply that the underlying moderator effect is negligible. They can be meaningful when the respective path coefficient changes are meaningful [24].

Finally we tested our model's *predictive validity* by means of the non-parametric Stone-Geisser test applying the blindfolding procedure implemented in SmartPLS. If the Stone-Geisser test criterion is larger than 0 the model is considered to have predictive validity [33] which holds true for our model (all Q^2 values are larger than 0.35).

6 Discussion

The model evaluation shows that our hypotheses regarding the moderating effect of organizational culture on EAM design and success hold. In order to make these results exploitable we discuss these findings in detail. The core model (printed

invertedly in figure 4) shows that the basic EAM service, i.e. advising IT management, has a significant and positive effect on EA consistency. Such a passive approach to EAM therefore may be a valuable starting point for an EAM initiative. However, the model also shows that extending this passive approach into an actively designing approach has an even stronger influence on EA consistency. This means that EAM assets, like EA models, should be leveraged by making a claim for an active EAM. It is important understand, that an IT-based EAM—passive or active—does hardly contribute to the common goals of EAM such as flexibility, efficiency, or innovation but that an IT-based EAM contributes to these goals indirectly via EA consistency. It is an important challenge for enterprise architects to explain these relations in practice. However, if EAM can generate impact outside the IT department by advising business departments, e.g. in strategy processes, it gains direct influence on the common goals of EAM such as flexibility, efficiency, or innovation. If we add the perspective of EAM experience, it is interesting to note that EAM experience above all moderates the relation between EAM's business advisory mandate and EAM utility. This is in line with the observation that the majority of EAM initiatives are started in an IT department and that it takes time to mature the EAM function within IT as well as to explain the potential value of an IT function for non-IT processes to business stakeholders.

Adding the perspective of organizational culture it is beyond the scope of this paper to analyze and interpret the effectiveness of EAM in different organizational cultures, i.e. interpret the direct effect of organizational culture. Instead, the analysis of the moderating effects of organizational culture is at the core of our research. Interestingly, the cultural perspective heavily impacts the influence of a passive IT advisory mandate on EA consistency. Only in *rational culture* this influence is significantly increased, i.e. in rational culture, where productivity is emphasized and leaders tend to be goal orientated and instrumental, additional support by EAM is valued and thus effective. In all other cultural orientations the direct effect of a passive IT advisory mandate is significantly neglected, i.e. a passive, IT-based approach to EAM will hardly be effective. This finding seems in line with the moderating effect of organizational culture on the relation between EAM's active design mandate and EA consistency. Except for *group culture*, organizational culture does not significantly alter the relation between EAM's active design mandate and EA consistency. In group culture, however, an active approach to EAM will have a significantly stronger influence on EA consistency. Summing this discussion up we can state that except for rational culture EAM needs to become an active approach to have a significant impact on EA consistency; particularly in group culture an active approach is beneficial.

Similar statements can be made for the relation between EAM's business advisory mandate and EAM utility. Particularly in group culture the business advisory mandate's effect on EAM utility is significantly increased, which means that in group culture the invest in gaining stakeholder attention outside the IT department is particularly rewarding. While in other organizational cultures there will still be positive effects of EAM's business advisory mandate, limited resources may as well be spend on different endeavors within an EAM initiative.

Our research shows that organizational culture—although not being the only factor—can be a significant instrument to better understand the effects of EAM's design in a given organization. Such an analysis can provide valuable information for practitioners who aim at applying IS artifacts in a specific situation. It can also be valuable for the researcher improving the utility of an artifact or the validity of a design theory, connecting valuable ends with effective means for a higher artifact mutability [40].

Our research has limitations. First, our data collection—although it took place in a controlled environment—did not yield a representative sample. Second, the reliance on single informants per organization does not account for the possibility of sub-cultures [41]. However, the homogeneity of the respondents regarding their role in the respective organizations limits the impact of possible sub-cultures on our findings. Nevertheless, it might be interesting and an opportunity for further research to repeat this survey with respondents having different roles in their organizations. Finally, it has to be noted that CVM as well as our core model only allows for an aggregated view on EAM in an organization.

7 Conclusion

Based on prior research on EAM and organizational culture in IS we developed a research model which hypothesizes the role of organizational culture for EAM design and EAM success. We found that EA consistency is positively influenced by EAM's IT advisory mandate as well as by EAM's active design mandate. EA consistency and as EAM's business advisory mandate were found to positively influence EAM utility. We also found that all these relations are significantly moderated by organizational culture in a way that ignoring these moderation effects may lead to unexpected results. For the design researcher concerned with EAM our findings may stimulate new approaches to conceptualize the often messy human situation they build their artifacts for [42]. For the action researcher concerned with EAM we might provide a useful instrument to observe and analyze the organizational shaping of their artifacts. We concede that this article is just one step towards conceptualizing the situational parameters that influence EAM success. Nonetheless, from our practical experiences we consider this a valuable step given the level of maturity of the core EA artifacts like models, tools, or planning approaches to make these artifacts more effective.

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References

1. The Open Group: TOGAF Version 9 – The Open Group Architecture Framework (TOGAF). The Open Group (2009)
2. Mykhashchuk, M., Buckl, S., Dierl, T., Schweda, C.M.: Charting the Landscape of Enterprise Architecture Management. In: Bernstein, A., Schwabe, G. (eds.): Proceedings of the

10th International Conference on Wirtschaftsinformatik WI 2.011, Vol. 1, 570–577, Zurich (2011)
3. Tamm, T., Seddon, P.B., Shanks, G., Reynolds, P.: How Does Enterprise Architecture Add Value to Organisations? Communications of the Association for Information Systems 28, 141–168 (2011)
4. Brinkkemper, S.: Method Engineering - Engineering of Information Systems Development Methods and Tools. Information and Software Technology 38, 275-280 (1996)
5. Bucher, T., Fischer, R., Kurpjuweit, S., Winter, R.: Analysis and Application Scenarios of Enterprise Architecture – An Exploratory Study. EDOC Workshop on Trends in Enterprise Architecture Research (TEAR 2006), Los Alamitos, CA, USA (2006)
6. Ylimäki, T.: Potential Critical Success Factors for Enterprise Architecture. Journal of Enterprise Architecture 2, 29–40 (2006)
7. Aier, S., Riege, C., Winter, R.: Classification of Enterprise Architecture Scenarios – An Exploratory Analysis. Enterprise Modelling and Information Systems Architectures 3, 14–23 (2008)
8. Aier, S., Gleichauf, B., Winter, R.: Understanding Enterprise Architecture Management Design – An Empirical Analysis. In: Bernstein, A., Schwabe, G. (eds.): The 10th International Conference on Wirtschaftsinformatik WI2011, Vol. 2, 645–654, Zurich (2011)
9. Leppänen, M., Valtonen, K., Pulkkinen, M.: Towards a Contingency Framework for Engineering an Enterprise Architecture Planning Method. Proceedings of 30th Information Systems Research Seminar in Scandinavia (IRIS 2007) (2007)
10. van Steenbergen, M.: Maturity and Effectiveness of Enterprise Architecture. Utrecht University (2011)
11. Aier, S.: The Role of Organizational Culture for Grounding, Management, Guidance and Effectiveness of Enterprise Architecture Principles. Information Systems And E-Business Management online first (2012)
12. Dietz, J.L.G.: Architecture. Building strategy into design. Academic Service, The Hague (2007)
13. Schein, E.H.: Organizational Culture and Leadership. Jossey-Bass Publishers, San Francisco (1997)
14. Kroeber, A.L., Kluckhohn, C.: Culture: A Critical Review of Concepts and Definitions. The Museum, Cambridge, MA (1952)
15. Leidner, D.E., Kayworth, T.: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. MIS Quarterly 30, 357–399 (2006)
16. Quinn, R.E., Rohrbaugh, J.: A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis. Management Science 29 363–377 (1983)
17. Iivari, J., Huisman, M.: The Relationship between Organizational Culture and the Deployment of Systems Development Methodologies. MIS Quarterly 31, 35–58 (2007)
18. Hofstede, G., Neuijen, B., Ohayv, D.D., Sanders, G.: Measuring Organizational Cultures: A Qualitative and Quantitative Study Across Twenty Cases. Administrative Science Quarterly 35, 286–316 (1990)
19. Detert, J.R., Schroeder, R.G., Mauriel, J.J.: A Framework for Linking Culture and Improvement Initiatives in Organizations. Academy Of Management Journal 25, 850–863 (2000)
20. Denison, D.R., Spreitzer, G.M.: Organizational Culture and Organizational Development: A Competing Values Approach. Research in Organizational Change and Development 5, 1–21 (1991)

21. Cameron, K.S., Quinn, R.E.: Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework. John Wiley & Sons, San Francisco, CA (2011)
22. Cameron, K.S.: Effectiveness as paradox: Consensus and conflict in conceptions of organizational effectiveness. Management Science 32, 539–553 (1986)
23. Ringle, C., Wende, S., Will, A.: SmartPLS 2.0 (beta). University of Hamburg (2005)
24. Chin, W.W., Marcolin, B.L., Newsted, P.R.: A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. Information System Research 14, 189–217 (2003)
25. van den Berg, M., van Steenbergen, M.: Building an Enterprise Architecture Practice: Tools, Tips, Best Practices, Ready-to-Use Insights. Springer, Berlin (2006)
26. Ross, J.W.: Enterprise Architecture: Driving Business Benefits from IT. CIS WP. Massachusetts Intitute of Technology, Center for Information Systems Research (CISR) (2006)
27. Wagter, R., van den Berg, M., Luijpers, J., van Steenbergen, M.: Dynamic Enterprise Architecture: How to Make It Work. John Wiley & Sons, Hoboken, New Jersey (2005)
28. Niemann, K.D.: From Enterprise Architecture to IT Governance. Elements of Effective IT Management. Vieweg, Wiesbaden (2006)
29. Cameron, K.S.: Cultural congruence strength and type: Relationships to effectiveness. University of Michigan, Michigan (1985)
30. Quinn, R.E.: Beyond rational management. Jossey-Bass, San Francisco (1988)
31. Yeung, A.K.O., Brockbank, J.W., Ulrich, D.O.: Organizational Culture and Human Resource Practices: An Empirical Assessment. Research in Organizational Change and Development 5, 59–82 (1991)
32. Henseler, J., Fassott, G.: Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures. In: Esposito Vinzi, V., Chin, W.W., Henseler, J., Wang, H. (eds.): Handbook of Partial Least Squares: Concepts, Methods and Applications. 713–735. Springer, Heidelberg (2010)
33. Götz, O., Liehr-Gobbers, K., Krafft, M.: Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In: Vinzi, V.E., Chin, W.W., Henseler, J., Wang, H. (eds.): Handbook of Partial Least Squares: Concepts, Methods and Applications, Vol. 1. 691–711.Springer, Heidelberg (2010)
34. Bagozzi, R.P., Yi, Y.: On the Evaluation of Structural Equation Models. Journal of the Academy of Marketing Science 16, 74–94 (1988)
35. Chin, W.W.: How to Write Up and Report PLS Analyses. In: Vinzi, V.E., Chin, W.W., Henseler, J., Wang, H. (eds.): Handbook of Partial Least Squares. Concepts, Methods and Applications. 655–690.Springer, Berlin/ Heidelberg (2010)
36. Hulland, J.: Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies. Strategic Management Journal 20, 195–204 (1999)
37. Chin, W.W.: The Partial Least Squares Approach to Structural Equation Modeling. In: Marcoulides, G.A. (ed.): Modern Methods for Business Research. Lawrence Erlbaum Associates, Mahwah, 295–336 (1998)
38. Lohmöller, J.-B.: Latent Variable Path Modeling with Partial Least Squares. Physica, Heidelberg (1989)
39. Cohen, J.: Statistical power analysis for the behavioral sciences. Lawrence Erlbaum, Hillsdale, NJ (1988)
40. Gregor, S., Jones, D.: The Anatomy of a Design Theory. Journal of the Association for Information Systems 8, 312–335 (2007)
41. Smircich, L.: Concepts of Culture and Organizational Analysis. Administrative Science Quarterly 28, 339–358 (1983)

42. Baskerville, R.L., Pries-Heje, J., Venable, J.: Soft Design Science Research: Extending the Boundaries of Evaluation in Design Science Research. Proceedings DESRIST (2007)