Information Provision as a Success Factor in the Architectural Support of Enterprise Transformations

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***Abstract*— Enterprise transformations (ET) fail in many cases or do not accomplish the expected goals. Enterprise architecture management (EAM) is often considered to be an appropriate means to tackle this problem by providing information that is relevant to ET managers. Therefore, we analyze, which types of information provided during an ET contributes to its success. In addition we discuss if EAM can appropriately support ETs by providing relevant information. The results show that value can be provided to ET management when business-related information on a detailed level is offered. Examples are business requirements, business functions, or qualitative measures. We find information that can be provided by EAM to be an important success factor for ETs.**

Keywords— enterprise transformation, enterprise architecture management, empirical study, information, transformation success

I. INTRODUCTION

Enterprises from time to time have to go through changes that are not routine but fundamental and radical. These changes are designated as enterprise transformations (ETs) [1]. ETs substantially alter an enterprise's relationships with its key constituencies like customers or suppliers [1]. Examples of such fundamental changes are adaptions of the business model [2], mergers and acquisitions [3], or introductions and replacements of enterprise-wide information technology [4-6].

Managing ETs is a difficult task and many efforts fail [7, 8]. Thus, the topic should be in the scope of current research as the relevance for improving related management methods and research perspectives is given. As such, research concerning ET is conducted for decades in different research disciplines; including information systems (IS) research. However, Besson & Rowe [9] conclude that past and current work mostly focuses on psychological and socio-cognitive inertia (e.g., employee resistance)—socio-technical and economic inertia are underestimated, or even seem to be overlooked.

In order to deal with the complex challenge of transforming an enterprise, oftentimes enterprise architecture management (EAM) is seen as a valuable means [10, 11]. While enterprise architecture (EA) describes the fundamental structures of an enterprise, EAM is concerned with the establishment and continuous development of EA in order to consistently respond to business and IT goals, opportunities, and necessities [12, 13]. Thus, EAM is often found to support the management of ETs [10, 14] by guiding the necessary efforts [15-17] and eliminating flaws like local optimizations (as opposed to global perspectives) or expensive redundancies [18]. We refer to this support capability of EAM as the architectural support of ETs.

A prominent means for architectural support of ETs is the provision of decision-relevant information to ET managers. In line with Laudon & Laudon [19, p.14] we consider information as "data that have been shaped into a form that is meaningful and useful to human beings". The role of the enterprise architect is considered "one of making order out of chaos by taking the overwhelming amount of information available and presenting it in a manner that enables effective decision-making" [20, p.392].

However, in order to design an EAM function that is able to provide valuable ET support, we need to know, which information is available for planning and managing an ET and which impact such information has on the ET's success. Since there seems to be no regular application of EAM as a leading authority or as a support service for ETs yet [10, 21], we aim at understanding the requirements that such a service has to meet. We pose the following research questions:

RQ1: Which information provided for planning and managing an ET contributes to its success?

RQ2: Can EAM provide this information?

We proceed as follows: We discuss related work on the relation of ET management (ETM) and EAM in section two. We describe our research approach and survey design in section three. We present the results of the study in section four and discuss these results in section five[1]. The paper ends with a summary and conclusions in section six.

II. RELATED WORK

There are only a few articles that explicitly discuss the architectural support of ETs. Asfaw et al. [10] analyze enablers and challenges in driving ETs using EA concepts. They decompose ETM in three components: communications,

[1] Additional parts of the survey are presented and applied in [22]. The original contribution of this paper is the analysis of data related to the success of the ETs and the available information.

process, management support, and structure. Within these components they identify success factors like stakeholder involvement or guided application development. However, the authors conclude that architecture as such cannot cope with all challenges and thus, additional capabilities like change management are also needed. Radeke [23] discusses, how EAM can contribute to the strategic change process. He discusses the potential of EAM to improve the strategic fit of the enterprise with the market environment, business-IT alignment, and the preparedness for change by standardization and modularization of parts of the enterprise. Simon et al. [24] also recognize a high potential of EAM to support ETs, e.g., by assessing the enterprise's ET readiness.

Aier et al. [25] focus on the discipline of EAM and discuss past and future developments. Thereby, the authors distinguish EAM functions in stage one (basic IT architecture), stage 2a (passive IT EAM), stage 2b (proactive IT EAM), and stage 3 (strategic EAM). The latter is more differentiated and focuses on supporting business matters. For this purpose, not only aspects like business processes or organizational units are put into models, but instead the vocabulary of business units needs to be adopted and integrated in an EAM approach. Abraham et al. [11] explicate that architecture contains descriptive aspects (establishing transparency) as much as prescriptive aspects (restricting design freedom). Smolander et al. [26] describe different understandings of architecture by discussing various metaphors: (1) architecture as blueprint (high level description of a system, directly guiding more detailed implementation), (2) architecture as language (enabling a common understanding about the system among stakeholders), (3) architecture as decision (architecture represents decisions about design trade-offs) and (4) architecture as literature (documenting and transferring information over time).

In line with the second and the fourth metaphor, Strano & Rehamni [20] point out that architects are dealing a lot with information that needs to be processed and presented in a meaningful way. Information handling is also considered of major importance in the ET literature. When transforming an enterprise, a high number of decisions, many of them with major implications, need to be taken. In order to take these decisions on a sound basis, manifold information needs to be collected and consolidated [27-30]. Thus, a fit between the information demands and the information provision capability is crucial. This issue of information processing fit is discussed from a theoretical perspective in the organizational information processing theory (OIPT) [31-34] and its extensions for more specific problems [e.g., 35, 36]. The central concepts of the theory is the reduction of uncertainty—a concept that is also central to ETs [37-39]. Core elements of the theory are design decisions that allow for a reduction of information processing needs on the one hand and that allow to increase the information processing capability on the other hand [32].

Summarizing, the related work indicates that EAM is supposed to support ETs in different ways. An information perspective on ET is beneficial and especially from an IS point of view relevant. However, related work does not provide deeper insights about the details of the required and provided information, and about their impact on ET success. We aim at closing this gap.

III. Research Approach

Our main goal is to identify, the information that is provided during ETs and whether it has a significant impact on ET success.

A. Overall Research Project

The paper at hand is the final step in a research project that is comprised of three steps in total. In a first step, we conducted a literature survey [40] in order to understand the relation between EAM and ET management (ETM). The survey identifies activities conducted by ETM and the potentially necessary information that could be provided by EAM. In a second step, we conducted a qualitative study based on interviews with EAM and ETM experts [41]. The study provides a better understanding of current architectural support of ETs. The results of both steps were consolidated in order to develop the questionnaire for the study at hand. This study aims at analyzing the topic on a broader empirical foundation and at deriving insights from a larger set of ETs.

B. Identification of Items

We differentiate three groups of items: those describing the environment of the ET ("the organization"), the ET itself (goals, reasons, figures), and the ET support concerning the information provisioning. The unit of analysis is the single ET.

In order to identify items concerning the ET and the influence factors in the enterprise, we conduct a literature survey in databases and top journals of information systems and management science. We follow the Basket of Eight [42] and the JOURQUAL ranking [43]. We apply the search term "(((organizational OR enterprise OR business OR radical) AND transformation) OR "radical change")" in the title in combination with the term "(type* OR archetype* OR class* OR categor* OR taxonom* OR segment* OR dimension*)" in the abstract. The search delivered 397 results in total, after reviewing the abstracts; we consider 23 papers relevant for further analysis. Additionally we include sources from forward and backward analyses. We examine these sources in detail, in order to extract concrete items for the questionnaire.

In order to analyze the architectural support of ETs, we incorporate work that we conducted earlier (see section III:A). Thus, we consolidate the identified items from the studies above in one list. Finally, we end up with a list of information items that are potentially needed during an ET. This list is provided to the ET experts as part of the study at hand. The goal is to examine, which of the identified information contribute to ET success.

C. Questionnaire Design

The questionnaire starts with generic questions about the respondent. If consultants fill in the questionnaire, we ask them to provide information on a specific ET at a specific customer. We further collect data about the enterprise that has been transformed.

In the next section of the questionnaire, we collect facts about the ET itself. We ask the experts, whether the ET is already finished and if so, whether it has been successful. If the ET still is in progress, we ask for the respondent's prediction, whether it will be a success. In this case (and whenever

possible later on), we employ five point Likert scales [44]. In addition, we ask how long the ET took or is going to take. We ask for the drivers of ETs. Most of the respective items are provided by Romanelli & Tushman [45], stating that ETs usually are driven by strategic issues, changes in the power structure, or changes of the corporate structure. Due to the IT-centered understanding of EAM in many cases, we added "necessary changes in IT systems" which are also considered to be a driver of ETs [46].

In the next section, we ask the experts to state, which part of the enterprise is leading the ET and which parts are affected. We derive the items from Porter's value chain [47]. We add the "corporate management" as a separate part (instead of leaving it included in the corporate infrastructure, as defined by Porter) since other studies [8, 48] name leadership support as a success factor in ETs. We further ask the respondents, how many employees were executing the ET, how many external personnel was involved, and how many personnel was affected by the ET.

In the third part of the questionnaire, we ask for the actual availability of required information in the specific ET (similar to [49]). In addition we provide an explanation sheet for the items.

D. Pilot Phase

We provided the questionnaire to four practitioners employed with one enterprise. The participants have different job positions that deal with ETs. We want to make sure that the questionnaire is understandable and can be filled in in reasonable time. During this pilot phase we found that filling in the questionnaire takes about 30 minutes. Due to the complexity of the problem domain this is considered a reasonable amount of time.

During the pilot phase some items needed to be rephrased in order to increase their understandability. In addition the pretest was meant to identify further items that we would need to add. However, no further items were added by the experts, which might serve as an indicator for the quality of the original set of items.

E. Roll-Out

We provided the questionnaire to a group of executive students in an executive MBA program on ET. All participants are involved in ETs in leading positions in their respective enterprises. We additionally provided the questionnaire in an online version to the alumni network of this executive MBA program that are all holding job positions related to ETs. We further addressed ET managers in additional organizations that we are conducting research projects with. Thus, in total more than 700 contacts were provided with the questionnaire.

F. Resulting Dataset

We received a total of 57 responses by experts that hold positions like CxO, Programm Manager, or Head of Department over a period of three months. Most respondents are directly employed with the enterprise that was transformed (48) while only a minority (9) is, working for consulting or other service companies. The ETs take place in different industries (multiple answers possible), see table 1 for details.

TABLE I. SURVEYD INDUSTRIES

Industry	Number of analyzed ETs
Education	1
Utilities	9
Financial Services	13
Healthcare	3
Information & Communication	13
Public Administration	1
Production	10
Services	1
Transport & Logistics	1
Insurance	4
Other	7

IV. RESULTS

The results of our survey provide some interesting findings about ETs and their information support.

A. General Findings about ETs

Most of the ETs in the dataset are described as successfully finished or on the way to be successfully finished (almost successful or completely successful, 76%) while the average ET takes 3-4 years. Why are so many ETs in our dataset successful although other studies found that a large part of all ETs fail [8]? One reason might be that the respondents decided to rather report on successful ETs they were involved in. A second reason might be found in the specific executive training on transformation management the respondents have received. However, this arguably non-representative sample of ETs considering success rates does not limit our analysis of the relation between information provisioning and ET success.

The topmost important drivers of ETs are strategic changes, necessary changes in IT systems, introduction of new products or services, necessary changes of the culture, and changes in the environment (e.g., regulatory requirements). Oftentimes, the surveyed ETs are guided by the management of the enterprise. In addition, the IT and technology development departments of the enterprises play a guiding role in ETs. Less strongly but still involved in guiding the ETs are production and logistics departments. See table 2 for details.

TABLE II. GUIDING DEPARTMENTS

Department	Average Agreement	Standard Deviation
Inbound Logistics	1.37	0.95
Production/Operations	2.19	1.48
Outbound Logistics	1.38	0.87
Marketing	1.96	1.28
Sales	2.29	1.53
Customer Service	2.08	1.38
Firm Infrastructure (e.g., financials, planning, legal)	1.92	1.40
Human Resources	1.85	1.38
Technology/IT	3.17	1.67
Procurement	1.77	1.38
Corporate Management	3.62	1.59
Other	1.35	0.90

Likert scales, five would be "fully agree", multiple answers possible

The analyzed ETs represent huge endeavors: on average 513 full time equivalents (FTE) of internal staff are involved, supported by 33 external FTEs. On average, 8040 employees (in FTEs) are affected by the ET.

The collected descriptions of ETs show that these are indeed fundamental changes like described in literature. In the next step we analyze the influence of the provided information on ET success.

B. Available Information and ET Success

We provide our respondents with the question, whether ET related information is available. Independently from the success of the ET, we evaluate the general availability of the information. Information that is related to general goal descriptions is often available. However, information about the concrete business case or the history of ETs in the specific enterprise is less often available.

As a second step, we conduct a regression analysis (linear regressions with each information item as independent and ET success as dependent variable) in order to evaluate the impact of the availability of the information on ET success. We measure success employing a five point Likert scale. The average value for success in the dataset is 3.84, thus, ETs have been mostly successful. Data are summarized in table 3.

TABLE III. INFORMATION AVAILABILITY AND INFLUENCE ON ET SUCCESS

Category	Information	Mean Availability	Regression Coefficient	R^2	Significance
1. Information concerning general goal descriptions	Consistent goal description	4.04	.220	.104*	0.0307
	Important steps (e.g. roadmaps)	3.87	.218	.101*	0.0337
	Market situation	3.04	.163	.082	0.0594
	Drivers	3.89	.128	.042	0.1780
	Business Strategy	3.52	.005	.000	0.9570
2. Information concerning detailed goal descriptions	Business requirements	3.64	.383	.259**	0.0005
	Solution ideas (scenarios)	3.61	.236	.110*	0.0318
	Plan costs (budget)	3.05	.204	.169**	0.0068
	Business case for the transformation	2.86	.047	.006	0.6163
3. Information concerning existing business structures	Processes	3.18	.250	.174**	0.0054
	Organizational structure	3.98	.252	.156**	0.0088
	Product portfolio	3.91	.107	.028	0.2806
	Locations / location concept	3.60	.109	.046	0.1674
	Business functions	3.56	.303	.257**	0.0005
	Capabilities of the organization	2.98	-.028	.002	0.7822

** Significance < 0.01

* Significance < 0.05

TABLE III. (CONTINUED) INFORMATION AVAILABILITY AND INFLUENCE ON ET SUCCESS

Category	Information	Mean Availability	Regression Coefficient	R^2	Significance
4. Information concerning program management	Stakeholders of the transformation	3.91	.196	.094*	0.0434
	Overview of projects	3.23	.273	.261**	0.0006
	Redundancies between projects	2.87	.135	.060	0.1080
	Dependencies between projects / initiatives	3.11	.172	.104*	0.0347
	Project roles (including ownership)	3.59	.155	.083	0.0582
	Skills of employees	3.13	.109	.027	0.2884
5. Information concerning design options to achieve the goals	Outsourcing potentials	2.65	.033	.004	0.6982
	Evaluations of technology	2.80	.109	.048	0.1574
	Consolidation potentials	2.96	.169	.097*	0.0419
6. Information concerning method competence	Concrete methods for transformations	2.77	.176	.095*	0.0475
	Outsourcing support	2.12	.056	.007	0.6061
7. Information concerning change management	Stakeholder characteristics	2.96	.174	.096*	0.0405
	Cultural change	3.00	.021	.001	0.8189
	Common language	3.02	.080	.015*	0.4378
	Communication strategy	2.91	.263	.189**	0.0036
	Trainings	3.07	.296	.294**	0.0002
	Transformation history ("Good Practices" and "Lessons Learned")	2.11	.259	.157**	0.0085
	Organizational culture	2.64	.027	.002	0.7700
8. Information concerning performance management	Benefits of the transformation	3.14	.164	.098*	0.0461
	As-Is costs	3.21	.177	.117*	0.0287
	(qualitative) success control (e.g. Expert opinion)	2.91	.246	.189**	0.0045
	(quantitative) success control e.g. measure "process time")	3.07	.251	.217**	0.0021
9. Information concerning external stakeholders	Business partners	3.09	.087	.027	0.2938
	Shareholders/investors/owner structure	3.07	.063	.016	0.4240
	Suppliers	2.79	.098	.030	0.2754
	Customers	3.05	.043	.006	0.6265
	Master agreements/contracts	3.09	.244	.202**	0.0032
10. Information concerning risk management	Risk assessments	3.23	.392	.426**	0.0000
	Legal regulations	3.26	.328	.396**	0.0000
	Security aspects	3.02	.204	.147*	0.0132
	Internal guideline/standards	3.39	.261	.227**	0.0014
11. Information concerning IT	Data structures	3.29	.170	.099	0.0514
	Applications (incl. interfaces)	3.32	.097	.038	0.2362
	IT-Infrastructure	3.29	.123	.052	0.1569
	IT-Security aspects	3.00	.154	.076	0.0850

** Significance < 0.01

* Significance < 0.05

V. DISCUSSION

A. Impact of Information Availability on ET Success

We are aware that regression analyses can merely provide hints on relation among all the variables under consideration. However, we consider discussing the results as valuable since tendencies can be derived.

The first category, denominated *general goal descriptions* addresses strategic aspects of the ET. While information is often available, its relation to ET success remains diffuse. For the availability of consistent goal descriptions and of necessary important steps, we find a significant relation with ET success. An interesting aspect is the availability of information on business strategy. Currently, we do not find a significant relation to ET success (which contradicts other sources that consider business strategy being an important part of successful ETs [e.g. 50]). This might have different reasons: First, more data needs to be collected to provide more detailed discussions about single information items. Second, it could also be the case that business strategy in general is not detailed enough to guide ETs or changes too often. The reason could be the ET itself—when it is initiated this usually happens due to the business strategy. For the subsequent ET, though, the business strategy has no further significance. This hypothesis is supported by the results of the next category.

The information concerning *detailed goal descriptions* are much stronger (and significantly) contributing to ET success. Here, information like business requirements and solution ideas (e.g., in terms of scenarios) are considered and used as input by ET managers. Especially concrete business requirements seem to be strongly related to ET success and should be considered important information.

During the ET, many existing *business structures* are affected. To develop the above mentioned scenarios, these structures need to be known [1]. For the information about processes, organizational structures, and business functions, we find significant relations to ET success. For the capabilities of the enterprise we cannot identify such a relation. This might be, because the concept of capabilities is oftentimes blurry and difficult to understand for ET managers.

The operational part of the ET usually is guided and coordinated by *program management [51, 52]*. Non-surprisingly, an overview of projects and information about the stakeholders of the ET contributes to ET success. Information about dependencies between projects also contributes to ET success. Interestingly, no significant relation is observable between the information about redundancies among projects and the overall ET success. The reason might be that certain redundancies are helpful and could be tolerated during the ET.

Concerning information about *design options to achieve the goals*, only information about consolidation potential has a significant impact on ET success. Technology evaluations and information about outsourcing potentials are not found to be significantly contributing to ET success.

Many authors claim that ET-guiding *methods* have influence on ET success [48]. The empirical data at hand supports this claim. We find a positive impact of information availability about ET methods on ET success. The outsourcing support does not explicitly contribute to ET success.

An important aspect of ETs is *change management* [8]. We find that information about trainings have a very high and significant impact on ET success. This includes information on necessary and available trainings. Also information about a communication strategy and the ET history (experiences and lessons learned) is found to have a significant impact on ET success. Surprisingly, no significant impact is found for information about cultural change or information about organizational culture. Why could this be the case? We assume that the construct of organizational culture as such is too abstract to directly contribute to ET success. It is rather represented in other information, e.g., ET history, business requirements, or other artifacts that might be different depending on the predominant culture [53].

Information concerning *performance management* is necessary to monitor the progress of the ET [54]. Information in this category has a significant influence on ET success. The relation concerning success control is particularly strong. While this is not a surprise, it is remarkable that not only quantitative measures need to be considered but also qualitative ones have a similar impact on ET success.

The impact of information concerning *external stakeholders* is less strong than we expected. While the availability of information about master agreements has a high impact, other information (e.g., on customers, suppliers, shareholders) is not found to be significant. The reason might be that contracts describe the relation between the enterprise and its external stakeholders in more detail while information about who the external stakeholders are is not sufficient.

Information concerning *risk management* has a significant positive impact on ET success. Especially information about legal regulations and the results of risk assessments is considered to be a major contribution to ET success. Also internal guidelines and standards are highly significant and positively related to the success. Thus, a solid risk management can be considered a major success factor in ETs. This finding is in line with the current literature about ETs, e.g. [55].

Finally, we analyze the availability of information about *IT*. In this category no significant relation to ET success is found. While we still have too little data to make definite claims here, one possible reason might be that the significance of IT on ET depends on the ET type. (e.g., those that aim at replacing an ERP system). Since we did not distinguish different types of ETs in this study, no significant effect could be recognized.

B. Architectural Support of Enterprise Transformations

The discussion shows that information provision adds to ET success. Such information can be provided by different disciplines and functions that exist within an enterprise. One of these is EAM. A question that is often posed is, can EAM provide the information necessary for ETs? [10, 56]

From an information perspective, we discuss the question by considering the information we found most significant for ET success. This is information about business requirements, business functions, projects, communications strategy,

trainings, ET history, qualitative and quantitative success measures, master agreements, risk assessments, legal regulations, and internal guidelines/standards. Can EAM deliver this information? Based on The Open Group Architecture Framework (TOGAF) [12] and a survey of other sources [40], we discuss the potential of EAM to support the provisioning of this information (table 4).

The discussion shows that an EAM that supports ETs needs to focus on business aspects rather than on IT architecture. Especially the collection of business requirements, qualitative success measures, and different structural information (e.g., business functions) seems to be an important starting point.

TABLE IV. ARCHITECTURAL SUPPORT

Information	Architectural Support
Business requirements	By using business models, business requirements can be collected and broken down into more detailed ones.
Business functions	Business functions are a core object that EAM deals with. Thus information about the existing ones and an analysis about affected ones in the ET is possible.
Overview of projects	Architects are usually well-informed about occuring projects and work hand-in-hand with project management in order to provide information about these.
Communication strategy	The communication strategy is rather not the focus of EAM.
Trainings	Information about trainings can partially be provided by EAM but in general this task is conducted by human resource departments.
ET history	Can partially be provided by EAM but other departments are also heavily involved.
(qualitative) success control (e.g, expert opinion)	Collecting qualitative measures is a task that EAM can conduct since an overview of business requirements and functions as much as of goals exists.
(quantitative) success control, e.g., measure “processing time“)	Is rather in the scope of management accounting, not of EAM.
(Frame-)Contracts	Contracts can be documented, thus support by EAM is possible.
Risk assessments	Risk assessments are conducted by many architects, thus architectural support can be provided concerning this information. Other disciplines need to be also involved.
Legal regulations	Not part of EAM, rather provided by legal departments.
Internal guidelines/standards	Core strength of EAM to moderate, coordinate, and provide information about internal guidelines and standards.

VI. SUMMARY & CONCLUSIONS

ETs are endeavors that in many cases fail or do not achieve the expected goals [7, 8]. Thus, current research in the field of ET management should contribute insights on dealing with this challenge. In the paper at hand, we analyzed, which information provided during an ET contributes to ET success. In addition we discussed whether EAM can appropriately support ETs by providing relevant information.

The results show that value can be provided to ETM when business-related information on a detailed level is offered. Examples are business requirements, business functions, or qualitative measures. Thus, considering information as an important factor in ETs is a valuable perspective.

However, we did not differentiate types of ETs, e.g., based on the importance of certain information. Instead, we focused on identifying the most influential information for ET success in general. While this step already provides valuable insights in how an ET support from an information perspective should look like, this nevertheless constitutes a limitation of our work. We plan to further detail and distinguish information support for different types of ET in future work.

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