Untangling EA's Long Path of Becoming a Partner for Business Transformation

The Case of Swiss Federal Railways

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Abstract—We analyze the enterprise architecture management (EAM) ‘journey’ of the Swiss Federal Railways over the last twenty years. Fundamental organizational changes were matched by shifts of EAM’s focus from advocating an enterprise-wide perspective over developing the enterprise architecture toolbox to establishing business transformation support. Beyond maturity considerations, insights from this longitudinal case study can be gained from an institutional perspective, i.e., by describing the EAM journey not only as a process of establishing the EAM function, but also as a process that extends EAM effects beyond the boundaries of IT. We identify four principles that guided this process: (1) Consistency of norms and values (2) Focus on reinventing rather than maturing (3) Picking the right EAM ‘battles’, and (4) Playing on EAM’s holistic perspective.

Keywords—*enterprise architecture management; enterprise transformation; institutionalization; maturity*

I. Mastering an EA Toolset is Not Sufficient to Support Business Transformation

Following Rouse, a business transformation represents a “fundamental change that substantially alters an organization’s relationships with one or more key constituencies, e.g., customers, employees, suppliers, and investors” [1]. Business transformations are implemented by a number of concurrently running projects that involve diverse actors or actor groups. As a consequence, a business transformation affects many business processes, business units, regions, and/or information systems. Without an overarching coordination effort, business transformations can hardly be successfully implemented.

Because it provides a holistic view on an organization, which is a precondition for taking appropriate decisions, enterprise architecture management (EAM) is considered to be a premier candidate function for supporting business transformation. For a discussion on the role of EA for business transformation see [2]. Its holistic view is what differentiates EAM from other management disciplines like business process management or IT project (portfolio) management. “Holistic” refers to three dimensions:

1. EAM often covers the entirety of artifacts of a specific artifact type, e.g., all applications or all business processes of an organization, and their relations.
2. EAM often covers the dependencies between artifacts of different types across all layers of an organization’s business-to-IT stack. For an overview on the typical layers covered by EA see [3].

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3. EAM often covers architecture artifacts over their entire life cycle, i.e., their states at different points in time, in different planning scenarios, and their relations to relevant change projects.

If an organization's architecture is covered in such a holistic way, EAM can be expected to identify and leverage potential synergies that are beyond the scope of a specific process, a specific organizational unit, or a change project. This is what qualifies EAM as a premier function candidate for supporting enterprise-wide endeavors such as business transformation. For supporting business transformation, the most effective EAM deliverables are

- providing transparency on the affected components and dependencies of a transformation and
- coordinating transformation projects driven by different groups of actors in an organization.

Corporate practice, however, shows that business transformation management and EAM are often separated in organizations. For empirical data supporting this statement see [4]. For a discussion of the relation between EA and business transformation see [5]. Among the reasons for this separation are the different origins of the two disciplines and, as a consequence, the different vocabulary used. While business transformation is in most cases initiated, sponsored, and driven by the business side, EAM is mostly rooted in IT departments.

EAM has undergone a significant development since its origins in the early 1990s. Early work on EA includes [6, 7, 8]. Being initially concerned with application software development and information system modeling issues, EAM became a much more business-oriented support function. For an overview on early EA frameworks and their modeling approaches see [9]. Many developments contributed to this evolution, in particular the ones that we subsume under the term EAM toolset, such as models and meta models for structuring (and communicating) current and future states of the enterprise architecture, EA description languages, EA principles, EAM reference frameworks like TOGAF [10], and EAM software tools.

However, thus far only few organizations leverage the EAM toolbox for business transformation—despite the proven value of EAM [11]. We argue that the challenge of EAM for being effective in supporting business transformation is to institutionalize EAM among its business stakeholders and to generate impact outside the IT department, i.e., to reach “the other 90% in an organization that is not about IT” [2]. Put differently, it is not sufficient to master the EAM toolset, but an architectural thinking has to be institutionalized in the organization [12]. Architectural thinking refers to the way of decision-making in (transformation) projects that takes holistic (EAM like) design considerations into account [13].

The subject of this paper is to investigate how EAM may become more relevant and effective for business transformation. In the literature, few articles have theorized this issue. Based on theoretical accounts such as organizational culture and institutional theory, these articles underline the difficulty of entrenching EAM in the organization for the purpose of a more active role in business transformation [14]. Mentioned reasons for this difficulty are EAM's abstract nature, local (project) goals that contradict global EAM goals, lacking management support, EAM's roots in IT, EAM's emphasis on planning which may seem to contradict agility, and the restriction of design freedom that comes along with EAM, which may not always be perceived as useful in a business transformation context. However, organizations exist that have overcome these impediments and that have steadily institutionalized EAM work over time. One of these comparably rare examples is the Swiss Federal Railways (SBB).

In this paper we show how SBB's EAM function developed from its early beginnings to becoming close to an effective business partner who is co-responsible for business development, innovation management, and the digital transformation of SBB. Against the authors' background of more than 15 years of design-oriented EAM research, we selected SBB among many other organizations for an in-depth case study, as SBB has successfully institutionalized EAM in the organization and yields several good reusable practices.

The research method employed is a longitudinal single case study [15]. The authors have accompanied SBB's EA development since 2003. As part of this, SBB was regularly invited for EA talks and discussions. Additionally, “historic” SBB documents have been analyzed for this study. Finally, interviews with the chief enterprise architect have been conducted and evaluated.

II. The SBB Case

SBB is one of the most esteemed railway companies worldwide and one of the most respected companies in Switzerland. In 2013, SBB transported 366 million passengers on its 3,175 route kilometers of the overall 5,124 km rail network in Switzerland. With a total of about 31,000 employees, SBB generated a turnover of about nine billion USD. In international comparison, SBB cuts a fine figure: according to 2011/2012 data from the International Union of Railways (UIC), Switzerland has the most kilometers travelled by rail per inhabitant, and the highest railway network load (train density) worldwide.

We present the SBB case not only because of its successful EAM development, but also because of its relevance. It must be noted that public railways are of high societal interest in Europe, and also in other economies like Japan. The opportunities for business growth are, however, physically limited—SBB’s business is largely limited to its geographic boundaries and building more railways is neither feasible nor reasonable. Thus, what we can learn from SBB is how to achieve operational excellence, how to advance through efficiency gains and better controlling, and how to extend their traditional transportation business through new, digital services. One the one hand the underlying business transformations provided the use cases for EAM at SBB, on the other hand these business transformations shaped the EAM function in general and its establishment in the organization in particular. As a consequence of EAM’s role at SBB, just recently the corporate functions IT strategy, IT innovation, and IT business development were integrated under the umbrella of the *Architecture and Quality* unit. Next to security, Architecture and Quality is now the only corporate function within IT—with EAM in the lead. This development can be seen as the ultimate commitment and entanglement of EAM and business transformation.

Fig. 1. Phases of business transformations at SBB

The SBB case illustrates that the development of an EAM function is strongly related to an organization’s norms and values being reflected in the respective business transformations (Figure 1). In the 1990ies and early 2000s SBB was a largely decentralized organization with strong but autonomous functional silos that heavily invested in their local but interrelated business applications. The situation at that point did not support the development of SBB’s business and it caused significant operational risks.

This phase was followed by a recentralization particularly of IT functions until 2009. Along with this business transformation it became a legitimate value to coordinate projects and programs across the formerly independent silos, to standardize and centralize common services, and to build central integration approaches throughout SBB. Only on the basis of this change of SBB’s norms and values an EAM function could be developed. EAM represents these new norms and values and it supported SBB’s transformation that mainly focused on improved efficiency and effectiveness.

Around the year 2010 EAM was established and respected for its holistic, enterprise-wide perspective and its support of SBB's business transformation. However, the goals of SBB's business changed. The current business model focusing on the efficient and effective transportation of goods and people was bound by its physical and geographical constraints. New technologies such as mobile devices, trends such as "bring your own", and new business opportunities based on existing assets, such as developing business models utilizing corporate data assets, became more important and required different skill-sets than the previous centralization and efficiency phase.

We accompanied the case organization in a longitudinal manner from 2003 to today and we have analyzed documents going back to the 1990ies. In the following, we outline the development of the EA function at SBB as a result of thoughtful EAM work supporting and being driven by SBB's business transformation. Afterwards, we derive lessons learned from the case.

A. Phase 1: Understanding The Value of An Enterprise-wide Perspective (1990ies-2005)

In the 1990ies SBB's business was organized in *solid internal silos*. The central IT organization in general and (enterprise) architecture in particular was in decline at SBB. In a strategic, enterprise-wide decentralization move, IT budgetary power went to the business units, central IT services were outsourced, and IT people with expert knowledge, e.g., in the host environment, left the organization. The underlying norms and values of this business transformation focused on local and efficient decision making within the divisions. The norms and values of SBB at that time were clearly antipodal to an enterprise-wide architectural perspective. In consequence the architecture methodology group was dissolved.

In the early 2000s, however, the divisions started large-scale but local IT projects within their respective fields. A rather destructive pattern emerged that was later quoted as "every new business demand triggers a new project that creates a new IT system". The current and former SBB CIOs describe this era as "decentralized proliferation where the complex overall land-scape developed in an uncoordinated way and without planning". Still, these locally growing IT systems were not isolated. In fact, a number of cross-silo integration projects emerged. Due to the non-existent enterprise-wide perspective, these integration projects used diverse and opportunistic integration approaches and technologies, resulting in a highly complex IT architecture and significant operational risks.

Therefore, first attempts to establish an enterprise-wide perspective on (IT) architecture was discussed at SBB under labels such as enterprise application integration (EAI). Even though smartphones were not yet in existence, SBB had realized that an intelligent coupling of information systems, so far organized as *solid internal silos*, was required in order to present, e.g., train scheduling data consistently and efficiently across trains, railway stations, the web, and mobile phones. SBB heavily invested into a sophisticated and extensible *CUS* (Customer System) comprising cross-silo integration components.

In the second half of the year 2005 a new CIO was appointed in order to analyze and fundamentally restructure SBB's IT landscape reflecting the emerging cross-silo business processes. In consequence, corporate IT was recentralized and several EA projects were initiated as of 2006.

B. Phase 2: Developing the EAM toolbox (2006-2009)

This next era of EA at SBB was triggered by the appointment of the new CIO whose task was to analyze the current IT situation and its fit with SBB's business strategy in order to fundamentally reorganize SBB's EA and its underlying

Fig. 2. EAM Processes at SBB

IT planning, development, and operations. In this phase SBB's norms and values shifted towards a cross-silo consolidation, efficiency, and effectiveness. It was legitimate to take enterprise-wide perspectives and to spend additional efforts for centrally coordinating and aligning projects and programs.

Therefore, a central means of the new CIO was developing and establishing an EAM toolbox. The first EAM team was established in corporate IT. A first enterprise architecture database (inventory) was set up and made accessible through the intranet covering the *EA master plans*. EAM processes such as *EA planning*, resulting in *EA roadmaps*, and *project portfolios*, were established. A *request for architecture* (RfA) process offered the service of identifying enterprise-wide rules or guidelines for issues that needed to be approached consistently throughout SBB. Architecture principles were defined involving diverse stakeholder groups. The so called *architecture switch* was established as a quality gate, which provided EAM with a mandate to influence IT projects on an enterprise-wide scale (Figure 2).

C. Phase 3: Focusing on Business Innovation (from 2010)

The preceding era was much concerned with increasing IT transparency, establishing respective analyses, and setting the course for coordinating IT developments. This development was necessary for the pursued consolidation, which resulted in a significant reduction of IT operations costs. This consolidation was the precondition for the following IT driven business growth and innovation.

In 2010, the former chief architect became the new CIO of SBB. By then, EAM already became institutionalized and "lived" within the company. For example, enterprise architecture database releases are pushed to the intranet on a weekly basis and receive more than 20,000 hits per month. Furthermore, the *architecture switch* (architectural compliance stage gate) is passed by 150 project proposals each year, out of which 50 exceptions to architecture guidelines are granted in a pragmatic way.

The growth of SBB's core business, however, is limited by the physical and geographical constraints in Switzerland. Therefore, additional growth mainly focuses on further efficiency gains in the core business through the implementation of advanced IT systems such as a network-wide train coordination and control system for optimizing the railway net utilization and the trains' power consumption, both representing major cost factors of SBB. In addition to that, SBB started to develop new business models extending their current core business. EAM representatives are represented in steering committees of the largest business innovation projects and, for example, are currently leading the (business) innovation towards a new enterprise data strategy, which redefines the role of enterprise data for SBB's business model.

In 2013, the increasingly important role of IT in general and EAM in particular for SBB's business received additional credit when the CIO became a full member of the SBB board. As of 2014, the chief architect (leading the *Architecture and Quality* unit), reporting directly to the CIO, became responsible for IT strategy, IT innovation, and IT business development (next to EA, quality, and infrastructure). As such, EA has indeed become a partner for business transformation.

III. Discussion and Learnings

In the previous section we describe the three main phases of developing the SBB EAM function along with SBB's business transformation towards a true business support function. These activities are summarized in Table 1. Some of these activities represent the "usual way" of building an EAM function, others are the result of the specific case situation. However, in order to understand the underlying process of establishing the EAM function and extending its effects beyond the boundaries of IT, we found it helpful to look at this process through the lens of institutional theory. For an overview see [16]. The question is how EAM got a "rulelike status in social thought and action" [17]. Looking at the SBB case through this theoretical lens, one can understand why even in very successful cases, it takes up to ten years to build up an EAM function that ultimately is able to create significant impact. We believe that the described development took place in a logical way without any surprising leaps or occurrences that would render the case irrelevant for others. Rather, EAM starts off from IT complexity and fragmentation problems, and a need for coordinated action through the development of typical enterprise architecture artifacts all the way to a deep entrenchment in terms of structures, processes, and thinking due to EAM's accepted achievements.

TABLE I. The Development of EAM at SBB Over Time

Year	Activities	EAM institutionalization phase
Phase 1: Understanding the value of an enterprise-wide perspective		
1990ies and early 2000s	<ul style="list-style-type: none">• Divisional separation of SBB (including IT)• Outsourcing of IT operations• Enterprise architecture methodology group dissolved	EAM essentially not existent <ul style="list-style-type: none">• EA is unpopular and regarded as overhead• Uncontrolled proliferation of IT without planning• Growing complexity, as well as technology and market changes indicate the necessity of an enterprise-wide perspective
2005	<ul style="list-style-type: none">• Realization that countermeasures against proliferation of IT must be taken	
Phase 2: Developing the EAM toolbox		
2006	<ul style="list-style-type: none">• Appointment of new CIO• First EAM position at IT infrastructure• Recentralization of IT• First EAM team within corporate IT	EAM in a pre-institutionalized stage <ul style="list-style-type: none">• Political will and management support for EAM• Manifestation of enterprise architecture artifacts propagating EAM norms and values• Rise of regulative power and governance mechanisms• Active inclusion of and help for EAM stakeholders; growing acceptance and understanding of EAM
2007/2008	<ul style="list-style-type: none">• Developing the EAM toolbox<ul style="list-style-type: none">◦ Request for Architecture (RfA)◦ Architecture switch◦ Enterprise architecture database◦ Enterprise-wide architecture principles	
2009	<ul style="list-style-type: none">• First official IT strategy• IT governance with steering mandate	
Phase 3: Focusing on business innovation		
2010	<ul style="list-style-type: none">• Chief architect becomes new CIO	EAM becoming fully institutionalized and partner for business innovation <ul style="list-style-type: none">• Increased grounding of EAM in terms of roles and organizational structures• Responsible for all IT matters• Partner in every large project/transformation• Enterprise architecture artifacts are heavily used• EAM procedures (e.g., architectural compliance checks as part of project approval) are regarded as standard and taken for granted in thought and action• IT is perceived as innovative and progressive
2011/2012	<ul style="list-style-type: none">• All IT units organizationally integrated	
2013	<ul style="list-style-type: none">• CIO becomes full member of the board	
2014	<ul style="list-style-type: none">• Chief architect becomes responsible for IT strategy, IT innovation, and IT business development (next to EA, quality, and infrastructure)• EAM function leads the planning and realization of corporate data strategy (transformation project)	

However, beyond this almost classical development of EAM maturity at SBB (see for example [18]), there are a number of particularities, which we consider relevant for developing EAM to become a tool for business transformation, and which are well illustrated by the SBB case. In the following we highlight these particularities as four *principles*:

Principle 1: Consistency of norms and values: The EAM function at SBB has successfully become a tool for business transformation because it supported the underlying norms and values of the organization. In phase two of the business transformations at SBB the organization established the understanding that transparency and enterprise-wide, cross-silo consolidation programs were needed. The EAM function could directly contribute to these values and it supported the establishment of these values by providing transparency and guidance in consolidation programs.

In a similar way the EAM function in phase three has developed into an innovation support capability that utilized its enterprise-wide perspective for supporting business innovation, e.g., by providing an enterprise-wide perspective on data management. It has to be noted that such an innovation mode imposes totally different requirements on enterprise architects than a consolidation mode. In a consolidation mode enterprise architects tend to focus on plans, principles, and governance mechanisms enforcing these plans and principles in order to contribute to a better aligned or a more consistent overall architecture. The result of this mode is a *restriction of design freedom* [19, 20, 21]. In an innovation mode architects need to contribute new design options based on their enterprise-wide perspective. In order to be successful, the EAM function needs to support and demonstrate legitimate behavior in the organization [22].

Principle 2: Focus on reinventing rather than maturing EAM: Principle 1 addresses the fit of the EAM function and the (possibly changing) norms and values of an organization. This affects the way the EAM function needs to be developed over time. We often observe that organizations focus on respective development paths defined by relevant maturity models (e.g., [18]). However, the SBB case illustrates, that after a basic EAM toolset has been developed, organizations may build a mindset among architects to rather reinvent the EAM function as in “creative destruction”

rather than investing in evermore maturing the established EAM toolset. Thus architects may overcome the conceptual boundaries of an IT function and eventually provide value to the business users. This is a challenge in most scenarios since it does not necessarily support a cumulative development of capabilities as it is prescribed by most maturity models. Instead, a relevant capability, service, or method may be transferred from an EAM function to affected organizational units. This means that more architecture is not always better. Hence, EAM has to regulate itself and pursue the strategy of infusing the organization with architectural thinking, the belief in the benefits of an enterprise-wide perspective through project work and education, and to then take a back seat again.

Principle 3: Pick the EAM battles: SBB conducts a portfolio analysis of potential EAM projects alongside the dimensions *battle is winnable* and *battle matters*. For example, the standardization of a PDF viewer may be easily winnable, but would hardly matter. Standardizing client operating systems across the organization, on the other side, would matter moderately, but in most cases this battle is unlikely to be won in organizations with a highly heterogeneous user community. However, establishing a shared middleware or consolidating customer data can be characterized as tough to win, but substantially important—hence, they are in the corridor of attractive battles to pick.

The assessment whether or not a battle is winnable does not only depend on the respective battle, but it also depends on the EAM function's track record in the organization. Although principle 2 qualifies the role of EAM maturity, still the SBB case illustrates, that it took several years for the EAM function to develop a standing in and trust of the organization to be entrusted with top-management positions and strategic design tasks opposed to tasks of passive analyses.

Principle 4: Play on EAM's holistic perspective: Business transformations are multidimensional and multidisciplinary endeavors. Employing an EAM function in such environments, poses the threat of continuously growing the scope of EAM. This often triggers the question of what are the tasks and responsibilities of EAM, and for which tasks there may be other disciplines that may be better suited. For example, should EAM be responsible for IT strategy processes, for innovation management, or for IT cost accounting? The case of SBB shows that for defining EAM and its intended value contribution it is helpful to focus on EAM as the provider of holistic perspectives on the organization, spanning the three dimensions of covering all artefacts of a certain artifact type such as applications, covering artifacts and their relations from business to IT, i.e., covering the relations among otherwise locally managed domains, and covering different points in time and therefore covering the planned transformation of the organization.

IV. Conclusion

In conclusion of this case study, we believe that SBB's EAM journey of developing EAM into a tool for supporting business transformation, can be generalized to many other organizations, even though others may face different types of business transformation. As with every case, the SBB case has its particularities such as the chief architect became the CIO. However, we do not think that this limits the validity of our findings for establishing EAM as a true business transformation support function.

We believe that the fit of possibly changing norms and values of an organization within a business transformation with the aspired value contribution of EAM is crucial for EAM's success as a transformation support function. Analyzing the development of a specific EAM function alongside the respective organization's long running business transformations offers a fresh perspective on EAM. Institutional theory may not only provide a theoretical lens on establishing EAM within and beyond an organization's IT department, it may also allow transferring successful institutionalization practices from related fields to EAM where desired behavior is influenced without explicit and expensive governance (e.g., traffic safety, environmental sustainability).

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