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Goal-oriented Decision Support in Collaborative Enterprise Architecture

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Abstract: Decision-making in the field of Enterprise Architecture (EA) is a complex task. Many organizations establish a set of complex processes and hierarchical structures to enable strategy-driven development of their EA. This leads to slow and inefficient decision-making entailing bad time-to-market and discontented stakeholders. Collaborative EA delineates a lightweight approach to enable EA decisions but often neglects strategic alignment. In this paper, we present an approach to integrate the concept of Collaborative EA and goal-driven decision-making through collaborative modeling of goal-oriented information demands based on ArchiMate's Motivation extension to reach a goal-oriented EA decision support in a collaborative EA environment.

Keywords: Collaborative Enterprise Architecture, ArchiMate Motivation extension, Strategic Alignment, EA Decision Support

1 Introduction

Enterprise Architecture Management (EAM) is a commonly accepted method to support enterprises in their continuous transformation processes. EAM provides a systematic approach to enhance transparency, to support business and IT-alignment and to enable the strategy-driven development of the Enterprise Architecture (EA) as a whole [Ha12]. Key to EAM is the systematic evolution of the EA over time. EAM commonly uses a model-based approach to document the EA as a basis for decision-making. For EA the modeling language ArchiMate is a well-established standard [TOG12]. The complexity of the EA and the impacts of a change over different layers of the EA require the involvement of many stakeholders. To handle such a complex system, frameworks like The Open Group Architecture Framework (TOGAF) [TOG09] assist organizations with a holistic approach for EAM. The TOGAF Architecture Development Method (ADM) [TOG09] details processes to develop an organization's EA. Albeit it is a complex and frustrating task to establish a complex system of EA processes as described in TOGAF and other frameworks. To address this issue lightweight collaborative processes can support a manifold stakeholder team to enable well-founded decisions concerning the EA. Bente et al. outline an improvement approach for EA based on the following three guidelines: (1) Establish a lean set of processes and rules instead of overloading stakeholders with bureaucratic processes and unsolicited artifacts; (2) adopt evolutionary problem solving instead of extensively blueprinting the future rigidly on a drawing

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board; (3) foster and moderate open participation in decisions on the ground instead of relying on experts and top-down wisdom [BBL12]. We consider (3) to be a very important capability for Collaborative EA that may conflict with the hierarchical structure found in many organizations. To reach Collaborative EA with participation in decisions many different stakeholders that are locally distributed need to have the possibility to interact and share information. Nevertheless, the stakeholders need to have a good understanding of the causal effects of the decision alternatives on the organization's goals before making a decision [JE07]. Whereas Jugel et al. describe a method for documenting decision-making processes [JSZ15]; we take a step back to focus on the collaborative decision support of the ArchiMate Motivation extension that can be used to model the motivation of architectural efforts [TOG12]. We use this ArchiMate extension to model and document relevant motivational knowledge especially needed in collaborative EA processes. This can be seen as a basis for EA decision-making in a collaborative EA environment.

In this paper, we utilize the approach of Bente et al. to integrate social software platforms and EA [BBL12] and add a concept based on the ArchiMate Motivation extension [TOG12] that covers information demands needed to support collaborative EA decisions. Thereto we analyze how to enhance the ArchiMate extension to reach a better goal-oriented decision support in a collaborative EA environment. We exemplify our approach with a collaborative decision-making scenario.

We describe existing approaches towards Collaborative EA, goal-oriented EA decision-making processes and the Motivation extension of the EA modeling language ArchiMate in Section 2. In Section 3 we analyze how to cover additional information demands of Collaborative EA with the aforementioned ArchiMate extension and add further going aspects to it. A collaborative decision-making scenario in Section 4 exemplifies the goal-oriented decision support of our enhanced ArchiMate Motivation extension. Section 5 sums up our contribution and gives an outlook.

2 Related Work

Bente et al. outline an approach for Collaborative EA by describing principles and a set of building blocks [BBL12]. The authors recommend Collaborative EA for improving EA processes and state that a network of peers under suitable circumstances has a higher capability to shape complex systems than a hierarchical top-down organization. Thereto the authors apply lean and agile principles to the field of EA to enhance flexibility in EA processes and to realize their aforementioned guidelines of Collaborative EA. To support participation in EA decisions the authors propose the use of social software platforms to introduce a concept called *IT opportunities bazaar (ITO bazaar)*. They use the ITO bazaar to find new opportunities and evaluate if these opportunities gain sufficient interest by the community. ITOs contain an effort estimation, which can be backed by the community in form of offering a certain amount of work time. If the estimated effort can be

covered by the offered work time, the ITO will be checked by the project portfolio management whether all participants can fulfill their shares. The authors propose the revision of each ITO by a team of EA specialists before opening for participation as a possible regulation of the *ITO bazaar* [BBL12]. We consider the realization of the *ITO bazaar* without any regulation as in conflict with the task of EAM to enable the strategy-driven development of the EA as a whole proposed by Hanschke [Ha12]. Reviewing ITOs concerning their business value by a team of EA specialists is a fundamental quality gate to reach strategic alignment of EA shaping projects. This aligns with the integration of EAM processes and strategic planning outlined by Ahlemann et al. [Ah12]. Bente et al. do not give detailed information about how to review and assess ITOs concerning their strategic alignment.

Making good decisions concerning the shape of the EA is very important to the field of EAM. Johnson et al. recommend a goal-driven approach for EAM to avoid indiscriminate modeling and especially address how to model decision-relevant information [JE07]. Johnson et al. state that architecture-related goals have to be operationalized to provide a foundation for the decision-making processes. Therefore the authors propose a set of activities needed for decision-making: (1) The decision maker must settle on a goal or success criterion; (2) decision alternatives have to be identified; (3) effects of the decisions on the goals must be elicited; (4) the decision-maker needs to decide on what information to collect with respect to the different decision alternatives; (5) information needs to be collected; (6) collected information has to be consolidated into an aggregated assessment. (7) Finally the decision needs to be made. These activities underline the need of a clear understanding of goals and their breakdown to make good decisions concerning architectural efforts. Johnson et al. refer to a role called „decision maker“ to address the person responsible to decide; they do not focus on how the EAM organization is structured [JE07]. Whereas these activities can be aggravated by disruptive factors such as unclear goal definitions, a lack of expert knowledge or uncertain information in a hierarchical organization, these activities can be much more difficult in a collaborative EA environment. Collaborative EA is described by Bente et al. as an EA organization that utilizes a network of peers to shape the EA with lean and agile processes [BBL12]. In particular, these processes are dependent on the competence and the decision-making ability of the engaged stakeholder team.

In general, EAM uses models and visualizations of relevant information to support stakeholders in their collaborative tasks [Ma08]. Bente et al. mention the use of models in their collaborative data modeling approach called *objectPedia* [BBL12]. Models and visualizations can be used to support Collaborative EA in describing, documenting and sharing relevant knowledge needed for a goal-oriented decision support in a collaborative EA environment. Many enterprise modeling approaches advocate collaborative modeling concepts and their advantages. Sandkuhl et al. propose a workshop approach for participatory modeling [Sa14]. The authors deem the involvement of stakeholders with the best knowledge to be valuable to reach a particular workshop goal. Additionally stakeholders are able to contribute to an architectural effort, which increases the acceptance of created models [Sa14]. We consider collaborative modeling sessions as an

integral part of Collaborative EA. Besides moderation mentioned by Sandkuhl et al. [Sa14], applying collaborative modeling techniques to the field of EA decision-making entails a focused and goal-oriented process. We propose to establish a lean and standardized decision-making process as defined in the aforementioned decision-making activities outlined by Johnson et al. [JE07].

The ArchiMate Motivation extension extends the core language of ArchiMate through a metamodel of motivational concepts [TOG12]. ArchiMate offers the Motivation extension to capture the motivation of architectural efforts and the EA design. The Motivation extension contains the elements *Stakeholder*, *Driver*, *Assessment*, *Goal*, *Principle*, *Requirement* and *Constraint*. A *Stakeholder* can be the role of an individual, a team or an organization that has interests related to the EA and can be linked to an element of interest. Permitted *Stakeholders* define, change and emphasize *Goals* that they intend to achieve in a collaborative manner. A *Goal* is a desirable end state that a *Stakeholder* wants to achieve. This can be for example a „reduction of IT operational costs by 10%“. Factors that initiate the process of change within an architecture are called *Drivers*. *Drivers* can either be internal or external. Internal *Drivers* also named as concerns are usually associated with a *Stakeholder*. This enables transparency especially if it is used in a collaborative EA environment. Before *Goals* can be derived from *Drivers*, the *Drivers* can be analyzed to generate a set of *Assessments*. *Assessments* may uncover strength, weaknesses, opportunities and threats of analyzed *Drivers*. Positive findings can directly be translated into *Goals*. Negative findings however have to be translated into *Goals* that negate their effects. *Principles* and *Requirements* represent desired properties concerning the realization of connected *Goals*. *Principles* define intended properties that are broader in scope and more abstract, whereas a *Requirement* is defined as a concrete statement of need that must be realized to achieve a *Goal*. In contrast to a *Requirement*, a *Constraint* is a restriction that has to be respected during the realization [TOG12].

3 Modeling goal-oriented information demands

We have already seen that modeling of decision-relevant EA aspects can be utilized with the ArchiMate Motivation extension [TOG12] to support a manifold stakeholder team in their decision-making tasks. In the following, we investigate which additional modeling demands are important to document EA specific information that is especially needed in collaborative EA processes. We focus on an exemplary integration of additional elements that are not covered by the ArchiMate extension. Johnson et al. present a goal viewpoint in [JE07] that contains *Goals* that can be broken down hierarchically; *Problems* that hinder the achievement of *Goals*; *Initiatives* that fulfill a *Goal* and resolve *Problems*; and *Prerequisites* that delimit *Initiatives*. A *Problem* that hinders a *Goal* is an element that is not mentioned in the ArchiMate extension. Whereas ArchiMate uses *Assessments* to model weaknesses and threats that can be considered as problems, they need to be addressed by *Goals* that “negate” these weaknesses and threats. There is no possibility to model problems that hinder the achievement of a *Goal* itself. We consider

Problems as an important concept to document results of former stakeholder efforts. Furthermore, *Problems* can be a link for new or further going architectural efforts that can be connected to the existing goal breakdown. Whereas the ArchiMate extension uses *Requirements* to realize a *Goal*, the goal viewpoint of Johnson et al. uses an element called *Initiative*. *Initiatives* are undertaken to fulfill a *Goal*. We identify *Initiatives* to be a more general concept of capturing *Requirements* and parts of their realization aspect in a single element. ArchiMate covers the realization of *Requirements* in the Implementation & Migration extension. Hence, we do not see the need of introducing an *Initiative* element. However, ArchiMate allows cross-aspect dependencies between motivational elements and core elements. The relationship of motivational elements and core elements is an important capability to break down goals as recommended by Johnson et al. [JE07]. *Prerequisites* delimit the conditions under which Initiatives can be taken. Because we utilize ArchiMate's *Requirements* instead of *Initiatives*, we are able to express restrictions through Archimate's *Constraints* and do not need *Prerequisites*. Fig. 2 illustrates our integration of *Problems* into the ArchiMate Motivation extension [TOG12]. Added elements and relationships not covered by the ArchiMate extension are visualized with thick borders or lines.

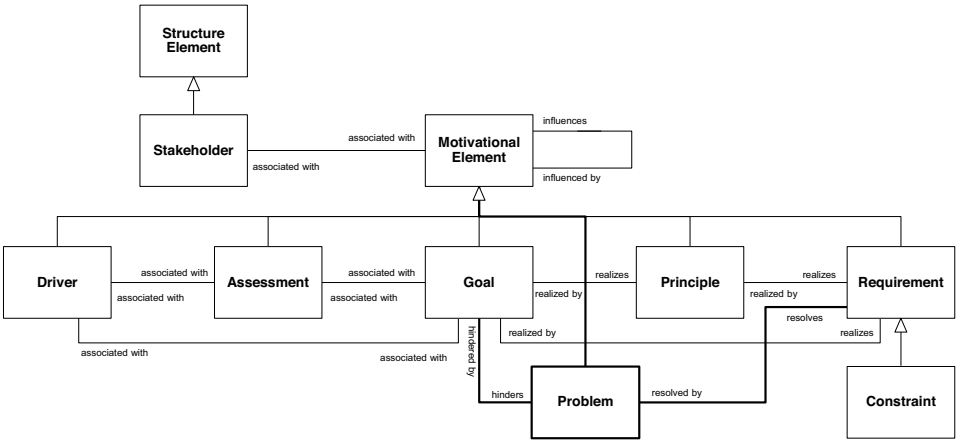

Fig. 2: ArchiMate Motivation extension [TOG12] with integrated concepts

4 Collaborative decision-making scenario

This collaborative decision-making scenario should exemplify the goal-oriented decision support based on our enhanced ArchiMate Motivation extension [TOG12] to review and assess ITOs concerning their strategic alignment. The scenario is based on the concept of an *ITO bazaar* due to Bente et al. [BBL12] and the goal viewpoint example presented in [JE07]. The scenario outlines a collaborative modeling workshop similar to the work-

shop approach by Sandkuhl et al. [Sa14] and realizes decision-making activities outlined by Johnson et al. [JE07] to reach a lean and standardized decision-making process. Based on the premise that participants of EA decision-making processes are locally distributed, we need the possibility of stakeholders to interact and share information. We utilize the ideas of the cockpit approach proposed by Jugel et al. [JS14] as a vehicle to support interactive functionality for a distributed stakeholder team. We especially prefer the possibility that every stakeholder is able to select a set of specific viewpoints to analyze the EA. Additionally we assume an underlying information model corresponding to our enhanced ArchiMate Motivation extension, a goal viewpoint containing the fundamental elements *Goal*, *Problem*, *Requirement* and *Stakeholder*; and the possibility to edit existing models collaborative through manipulation of the viewpoints.

ArchiShop is a young company selling fashion products to customers. They have 100 stores all over the world and an online shop. ArchiShop's headquarter is located in London. The ArchiShop EA team established an ITO bazaar [BBL12] to enable their employees to participate in architectural efforts with their own ideas. Today the business value of an ITO proposed by John has to be evaluated by the EA team. John is a customer communication manager at ArchiShop in Munich and has the idea to integrate a new payment method to address customers that do not want to enter their credit card information. This idea corresponds to many customer responses sent to ArchiShop the last few months. In cooperation with Mike, a member of the software development team, he postulated the development of a new payment service based on the popular e-commerce payment service offered by the company PayOnline. The estimated effort of 20 person days is already covered by the offered work time of other software developers, who like John's idea and want to contribute. To assess John's ITO the EA team invited to a meeting. Participants in Munich are John, Mike as technical advisor and Sarah of the local EA team in Munich. Additionally the two strategy specialists Jack and Maria and the enterprise architect Carl of the EA team in London join the meeting. The meeting takes place in the newly created enterprise architecture cockpits of Munich and London respectively. Sarah and Carl establish a connection of the two cockpits and the meeting starts. John gives a short overview about the current state of the ITO and the reasons for submitting it. After a short review of the current goal hierarchy Maria proposes to link the *Problem* of payment methods that distract customers from ordering with the existing goal "increase customer satisfaction". John affirms the proposal and a new *Requirement* "provide new payment method" is added additionally to the goal breakdown. Thereby the decision-making activity (1) proposed by Johnson et al. is finished. Reviewing the goal hierarchy Jack finds another subgoal of "increase online sales" named "increase visitors on website". This *Goal* is itself broken down into the subgoals "increase links from other sites" and "increase visibility on search engines". The *Problem* "other sites don't voluntarily link to other sites" is already addressed by another *Requirement* named "provide incentives for others to direct visitors to our website". This *Requirement* is connected to the *Business Service* "Online Advertising". After a short call with the responsible manager, Jack and Maria consider the expansion of "Online Advertising" as a decision alternative to John's ITO and propose to check the effects of both alternatives in detail. Thereby the activities (2) and (3) of Johnson et al. are finished. The stakeholder

team decides to elaborate a detailed realization plan for both alternatives including financial estimation. Additionally John and Mike have the task to analyze the submitted ITO regarding architectural impacts (4) (5). In the next meeting, the collected information will be consolidated into an aggregated assessment (6) to make a final decision (7). Fig. 3 illustrates the described goal viewpoint. We used a simple triangle for the notation of *Problems*. This figure does not show all possible elements (e.g. *Stakeholders*) and relationships for the sake of comprehensibility. Collaborative aspects of the scenario (e.g. stakeholder participation) are detailed in the prior description.

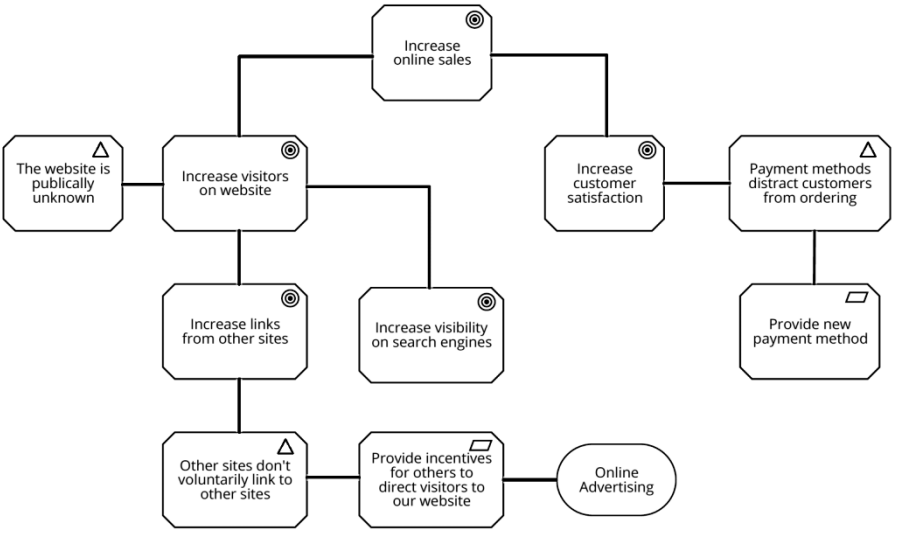

Fig. 3: Goal viewpoint [JE07] of our collaborative decision-making scenario

5 Conclusion and Future Work

In this paper, we state that Collaborative EA needs to link decision-making to the organization's goals to support strategy-driven development of the EA. Based on this premise our approach addresses how the concept of an *IT opportunities bazaar* outlined by Bente et al. [BBL12] can be enhanced by the ArchiMate Motivation extension [TOG12] to catalyze a goal-oriented decision support in a collaborative EA environment. In Section 3 we analyze what additional concepts can be used to model goal-oriented information demands especially needed in a collaborative EA environment. Our scenario shows that participation in EA decisions and strategy-driven development of the EA can be combined in a lean and collaborative decision-making process to enhance the business value of EA shaping projects. Future work should encompass the validation of this approach through case studies. Furthermore, it could be interesting to analyze how ITOs in our case or Projects respectively can be linked to *Requirements* in order to document current

actions realizing a *Requirement*. We consider the ArchiMate Implementation and Migration extension [TOG12] to be a good starting point.

However, Collaborative EA as outlined by Bente et al. [BBL12] delineates a new approach of establishing EA processes and is still a young subject in EAM. Research in this field may be relevant for many organizations in the future because Collaborative EA can unleash the capability of a collaborative stakeholder team to enable well-founded EA decisions without entailing slow decision-making through complex processes.

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