Introducing a Coordination Perspective to Enterprise Architecture Management Research

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***Abstract*—Enterprise Architecture Management (EAM) is a prominent discipline for purposefully guiding the complex, co-evolutionary business-IT relationships in organizations. Means to realize such guidance are, among others, mechanisms to coordinate heterogeneous and potentially conflicting stakeholder concerns. Yet, organizations face challenges to successfully leverage their EAM initiatives, often as a result of coordination mechanisms that only reach specific stakeholders or selected contexts. In the paper at hand, we aim at introducing coordination as a research lens for analyzing and designing EAM approaches. To this end, we substantiate the abstract notion of coordination through its underlying formal and informal mechanisms, which are implemented by artifacts, as well as through artifact modalities in an analysis framework. For illustrative purposes, we apply the developed analysis framework to The Open Group Architecture Framework (TOGAF). We find informal mechanisms (lateral relations, communication, and socialization) comparably underrepresented, which limits not only coordination effects but may also limit the success of the overall EAM approach. Our findings call for an extended and more comprehensive perspective on coordination in EAM, motivating the complementarity of informal mechanisms as an avenue for future research.**

Keywords-Enterprise architecture management (EAM); coordination; coordination mechanisms; artifact modalities; The Open Group Architecture Framework (TOGAF)

I. INTRODUCTION

Since the late 1980s, the concept of *enterprise architecture* (EA) has gained significant interest among information system (IS) scholars and practitioners [1]. The Open Group [2] defines enterprise architecture (EA) as a "formal description of a system, or a detailed plan of the system at component level to guide its implementation, including structure, interrelations, and the governance of design/evolution over time".

EA management (EAM) goes beyond the descriptive notion of EA. By the use of artifacts, such as frameworks or models, it aims at prescriptively guiding local IS development endeavors toward enterprise-wide goals [3, 4]. In practice, EAM initiatives have become challenged by an enormous growth of uncertainties, dependencies, and interrelations in information technology (IT) and business landscapes. These challenges commonly stress the necessity to *coordinate* constantly changing requirements of heterogeneous architecture stakeholders in different organizational units [5].

Coordination has been an ever-prevailing topic of interest among organization theorists. It is defined as the act of managing interdependencies between actors to achieve a certain goal and as the act of working together harmoniously [6]. More generally, coordination seeks to realize "concerted action" wherever actors pursue interdependent activities, such as by constrained tasks, shared resources, or shared goals. Coordination success becomes realized through *coordination mechanisms* [6], which provide the abstract means to achieve "integration among different units within an organization" [7].

Yet, EAM literature does not entail an explicit intuition to coordination as a research lens. While recognizing challenges and potential limitations of EAM approaches in growing and ever-dynamic environments [8, 9], we aim at introducing coordination as an analytical perspective to prospective EAM research. As artifacts represent the integral instruments for realizing coordination success in EAM approaches, we formulate our research question (RQ) as follows:

RQ: How is coordination reflected in EAM artifacts?

In order to afford a coordination perspective, we develop an analysis framework. For illustrating the framework's applicability to EAM approaches, in the paper at hand, we opt for one of the most comprehensive EAM approaches, i.e. The Open Group Architecture Framework (TOGAF).[1] According to The Open Group, TOGAF is used by 80% of the global 50, and by the majority of all Fortune 500 companies as an EAM approach.[2] On over 600 pages, TOGAF provides detailed mechanisms and methods for linking and integrating organizational units and their affected stakeholders [2]. It comprises a large number of EAM artifacts that offer a vantage point for reflecting coordination.

The paper at hand is structured as follows: First, we provide the conceptual foundation on coordination. Next, we present the research method, the developed analysis framework, as well as its application to TOGAF. Finally, we discuss findings and implications for future research.

[1] In this research, we use TOGAF Version 9.1.

[2] While only a very few organizations may have fully implemented TOGAF, it is reasonable to assume that many organizations' EAM approach is informed by TOGAF.

II. Conceptual Foundation

A. Coordination

The term *coordination* originated from Latin, *coordinare*, meaning *to arrange* and *to put in order*. Although widely addressed, there is no "widely agreed theory of coordination" [10]. Moreover, coordination theory has been described as a developing body of "theories about how coordination can occur in diverse kinds of systems" [11]. Compared to its manifold formulations, lenses for studying how coordination occurs have been applied with a focus on coordination mechanisms, such as planning, formalization, standardization, communication, and control [12-15]. Likewise, these mechanisms have been widely promoted for developing, establishing, and maintaining an organization's EA as well as to ensure EAM success [3, 4, 16]. Notwithstanding the importance of these mechanisms for EAM success, EAM literature lacks and may benefit from an explication of coordination as a research lens for analyzing, designing, or facilitating EAM approaches.

In order to introduce a more explicit coordination perspective to EAM research, in this study, we focus on the constitutive elements of coordination by the work of Thomas Malone and Kevin Crowston. Both were among the earliest contributors to provide a structured foundation for the development of a coordination theory in the IS discipline [17]. In a seminal work toward a coordination theory, Malone and Crowston [6] analyze coordination in terms of actors performing interdependent activities to achieve certain goals. In order to engage in concerted rather than interdependent action, they highlight the role of coordination mechanisms. Thus, we infer four constitutive elements of coordination (Figure 1): *Actors*, *interdependencies*, *goals*, and *mechanisms*.

Following Malone and Crowston [6], *actors* are considered as individuals, groups (e.g., project team, unit), or as the whole organization. *Interdependency* is defined as the extent to which one actor is contingent upon another actor [15, 18]. Malone and Crowston [6] distinguish three major sources of interdependencies, by which actors become contingent upon others namely, shared goals, shared resources, and interrelated tasks. In order to realize certain coordination goals, Malone and Crowston [6] have emphasized coordination *mechanisms* to manage interdependencies. Coordination mechanisms are defined as means to achieve "integration among different units within an organization" [7]. Mechanisms address problems of emerged dependencies and thus permit coordinated action among actors in pursuing their goals [19, 20]. In a nutshell, "mechanisms are the subject of coordination theory" [15] in successfully realizing coordination *goals* (Figure 1) [6]. Coordination success hence increases with the appropriateness of a mechanism to a specific dependency (e.g., task-task, task-resource, and resource-resource) [15].

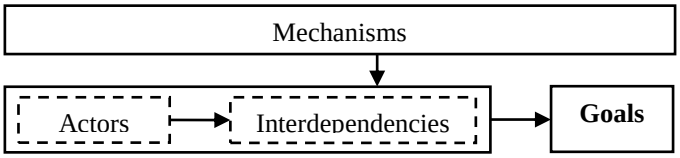


Figure 1. Constitutive elements of coordination [6].

B. Coordination in Enterprise Architecture Management

Actors. In the face of growing IS investments, IS landscape dependencies and complexities, EAM represents an enterprise-wide capability to make effective use of technology distributed across different organizational units [4]. Actors are represented by stakeholders who guide (e.g., chief architects, architecture teams, business/IT representatives) and those who are guided. Stakeholders at the project level are guided, such as business (unit) managers, project managers, and project workers toward enterprise-wide goals [3, 21]. Likewise, it is the central promise of EAM to guide multiple, interrelated projects [22]. Here, EAM and enterprise architects foster alignment among projects and their stakeholders beyond the scope of local project endeavors [23, 24].

Interdependencies. In the literature, we find interdependencies between local and enterprise-wide levels as well as between the business and IT side. These represent a potential coordination problem as in most of today's large (and geographically dispersed) organizations business units are allowed to manage their IT resources in creative and flexible ways [14]. From a coordination perspective, this is primarily a resource-task (e.g., special IT support for special business operations) concern. In addition, while creating local IT solutions that may lead to local performance improvements, dispersed technological solutions often cause integration/alignment efforts on the enterprise-wide level. From a coordination perspective, this primarily represents a goal-goal (e.g., flexibility versus standardized solutions), resource-task (untailored solutions for specific business needs), and resource-resource (e.g., incompatible technological standards across different levels) concern [25, 26].

Goals. According to Schmidt and Buxmann [27] as well as Lange et al. [28], EAM generally aims at effectiveness outcomes (e.g., the achievement of business goals, business-IT alignment), general efficiency outcomes (e.g., mitigated IS landscape complexity, harmonized IS solutions), and general flexibility outcomes (e.g., utilization of applications, fast and easy identification of required technological changes).

EAM aims at realizing these goals on primarily two levels [29]: At the project level, EAM aims at contributing to scaled and leveraged work performances, among others [29-31]. Performance effects are realized by integrated tasks and goals between enterprise architects and their project stakeholders; furthermore, tasks and goals among project stakeholders have to be aligned [24]. At the enterprise-wide level, goals of EAM include, among others, reduced cost for the IT infrastructure, mitigated risks, and shorter IT development projects [32]. Furthermore, EAM efforts aim at achieving higher performance in IT heterogeneity and IT integration management [4].

Mechanisms. Depending on the mode of governance, EAM applies a broad set of artifacts for coordinating interdependent actors to meet enterprise-wide and long-term objectives. These artifacts are used mainly for planning, analyzing, specifying, and communicating the enterprise architecture, fulfilling the needs of the different stakeholders involved. Coordination mechanisms are carried by EA artifacts, for instance, metamodels [33], EA models [34], plans [16], blueprints [3], and EA principles [35] as well as their underlying methods and techniques [3, 36].

C. Coordination in TOGAF

TOGAF represents one of the most common and widely established EAM approaches. It is a comprehensive approach for designing, planning, implementing, and governing the EA. TOGAF entails a set of artifacts employing diverse coordination mechanisms for different coordination purposes:

TOGAF spans four interrelated layers, namely, the domain-architectures of business, application, data, and technology. At the heart of TOGAF are five artifacts: The *architecture development method (including guidelines & techniques) (ADM)*, the *architecture content framework (ACF)*, the *architecture capability framework (ACPF)*, the *enterprise continuum and tools (ECT)* as well as the *technical reference model (TRM)*[3]. Along this scope, TOGAF focuses continuous planning, developing, and integrating, by which the EA becomes iteratively tailored to an enterprise's needs.

Actors described in TOGAF are twofold: *Firstly*, there are guided actors. These are referred to as "persons, organizations, or systems that have a role that initiates activities" and that have a "legitimate interest or interaction with the process or outcome of architectural guidance" [2]. TOGAF's obligation is to cater architectural guidance to local levels ("operational entities"). While local stakeholders are interdependent with legitimate interests in local utilities, the promised benefit of TOGAF lies in guiding these local actors toward enterprise-wide goals. *Secondly*, there are guiding actors, i.e. a centralized IS governance body of enterprise architects. Following TOGAF, these are represented by enterprise architects, architecture boards, committees, teams, specific roles, or taskforces [2].

The goals of an enterprise-wide guidance can be broken down into business, IT, and project benefits [2]. On the business side, improved operational efficiency (e.g., lower operating cost), workforce productivity and flexibility, as well as improved business capabilities (e.g., agility) count toward the promoted goals of TOGAF. On the IT side, improved IT efficiency, (technological) capabilities, higher interoperability, reduced complexities, lower change, development, support, and maintenance costs are aimed at as goals of an enterprise-wide guidance. Finally, project benefits are promoted along higher returns on investment, flexibility, reduced cost, and reduced risks. In order to realize enterprise-wide goals among various interdependent actors in different contexts, a coordination lens—focusing mechanisms and modalities in particular—becomes necessary.

III. Analysis Framework

In the course of introducing coordination as a research lens, we developed a framework that comprises two key components for the analysis of coordination (Figure 2). Firstly, coordination mechanisms shall be reviewed, which are the integral constitutes to any coordination approach [6]. Regarding our object of analysis, we aim at investigating the reflection of coordination mechanisms in TOGAF's artifacts (i.e., *ACF*, *ADM*, *ECT*, *TRM*, *ACPF*). Secondly, artifact modalities shall be reviewed, which are orthogonal to coordination mechanisms. Modalities explain the success of EAM artifacts based on the underlying coordination mechanisms. In our case, modalities allow to indicate TOGAF's level of success in coordination, depending on the mechanisms of its artifacts in place (and those eventually not in place). Figure 2 illustrates our analysis framework; the two key components, i.e. the review of coordination mechanisms as well as artifact modalities, will be explained in the two following subsections.

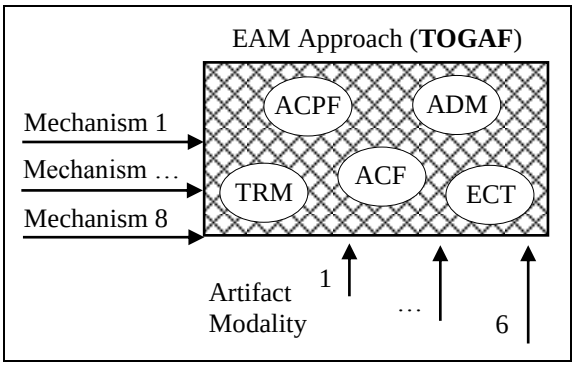


Figure 2. Analysis Framework.

A. Coordination Mechanisms

In order to review coordination mechanisms in a structured way, we opt for Martinez and Jarillo's [7] classification scheme of coordination mechanisms, which has been explicitly promoted in the work of Malone and Crowston [6, 20]. Martinez and Jarillo [7] studied multinational corporations (MNC). Assuming that large MNCs are essentially shaped by a high degree of specialization and differentiation among their subsidiaries, they found several patterns on how MNCs successfully integrate their subsidiaries.

Through the review of prior literature, Martinez and Jarillo synthesized eight categories of coordination mechanisms, grouped in five formal (structural) and three informal (subtle) modes [7]. As formal mechanism, *departmentalization* refers to the arrangement and structural design of organizational units. *Decision-making* is illustrated as a form of authority command, exercised on either centralized or decentralized levels. *Formalization/Standardization* describe the extent to which rules or guidelines are documented and established through standardized processes and routines. *Planning* refers to processes of budgeting, scheduling, and goal setting. Finally, *control* encompasses both output and behavior control. As informal mechanism, *lateral relations* are defined as direct forms of contact cutting across formal structures, which are fostered by (temporary or permanent) task forces, teams, committees, or integrator roles. *Communication* can be found in any form of information and knowledge exchange. Finally, *socialization* refers to a cultural system of ideology, comprising shared values, norms, or objectives that co-exist to the formal, structural design of an organization.

Martinez and Jarillo's work focuses on intra-organizational coordination, which makes it unique compared to many other (often too stakeholder-specific) mechanism classifications [7]. Their level of mechanism classification has an adequate level of abstraction that qualifies for a comprehensive coverage of mechanisms. In addition, Martinez and Jarillo [7] differentiate

[3] In the following, we focus on these artifacts for the review of TOGAF.

between formal and informal mechanisms, which has been strongly emphasized by early coordination mechanism literature [37].

B. Artifact Modalities

In order to review the appropriateness of EAM artifacts in a given EAM approach—as demanded by Malone and Crowston [15]—we use a scheme based on Taxén and Riedl [17], who evaluated 40 papers on coordination. At the core, they discuss six activity modalities, which refer to the appropriateness of exercising coordination: Depending on how activities are exercised, coordination may be more or less successful [17]. While not focusing activities in the paper at hand, in the following, we demonstrate their modalities along artifacts. In particular, we aim at explaining how an EAM approach may or may not be successful in coordination, depending on the underlying mechanisms of its artifacts:

Contextualization stresses the necessity of being able to contextualize a specific environment. It demands a precise description of the context that is set out for coordination impact. *Objectivation* asks for a precise understanding of the target to be coordinated: Coordination must direct its attention to the object in focus. *Spatialization* refers to the degree of relevant information required for managing interdependencies. Following the modality of spatialization, coordination must recognize how the targeted objects are in relation to each other and what properties are conferred on them. In *temporalization*, temporal circumstances need to be considered in coordination. *Stabilization* asks for norms and routines in coordination. In order to successfully realize coordination, for instance a well-rehearsed project team with skilled team members should be in place. Finally, *transition* demands consensus about how a specific coordination endeavor needs to stay in line with other coordination endeavors (e.g., taking place in parallel). In short, transition asks for a common understanding about how coordination endeavors should interact with one another.

IV. Demonstration of Analysis Framework

In this section, we demonstrate our analysis framework by applying it to TOGAF (Table I). Drawing on the distinct definitions by Martinez and Jarillo [7], we screened for, analyzed, and summarized each group of coordination mechanisms reflected in TOGAF's artifacts. While coordination mechanisms can be directly discussed, artifact modalities—to a large extend—depend on TOGAF's implementation at a given organization. Therefore, the success of TOGAF in coordination can only be indirectly discussed based on the underlying/lacking coordination mechanisms of its artifacts. Still, its discussion serves the illustrative purpose of this section.

A. Coordination Mechanisms

Departmentalization. In TOGAF, departmentalization refers to a description of the organization of work (e.g., grouping of workforces) as well as of the organization as such (e.g., structural arrangement of work units). Regarding the latter, TOGAF considers the organization in its entirety and its coherency, highlighting the design of the organization with a structuring impact on the promoted guidance approaches: For instance, workflows, processes, and the technology landscape shape the direction and targets of architectural guidance (*ADM*). Also, business goals, dependencies, and the structural design of units are essential considerations in the direction and domain-specific formation of architectural guidance (*ADM*, *ACF*). In this vein, departmentalization spans several domain-specific architectures, such as the IS, technology, and also the business architecture (*ADM*).

Furthermore, departmentalization is a product of architectural guidance, referring to the organization of work. As the "enterprise architecture should be treated like a business" [2], TOGAF promotes the operationalization of architectural guidance under centralized organizational bodies, such as (domain-specific) architecture teams, architecture boards, special architecture roles, and responsibilities that cater the perspective and associated guidance contributions of the EA throughout the organization (*ACPF*, see also *ADM*).

Decision-Making. TOGAF supports decision-making processes throughout various hierarchical levels. At the core of guiding these levels is the identification of stakeholders, ranging from the strategic (e.g., CIO) to project-specific (e.g., project owner), and to local layers (e.g., data engineer). To each of these different hierarchical levels, TOGAF considers different types of guidance methods, mapped to their respective concerns and individual goals (e.g., different diagrams for specific needs) (*ADM*).

Notwithstanding the explicit focus on supporting decision-making processes of its targeted stakeholders, the formation of decision-making authority itself plays an important role, to which TOGAF contributes. A key indicator is the promotion of architectural guidance under centralized organizational bodies, such as architecture roles, teams, or EA boards (see departmentalization) (*ACPF*). What these formations have in common is a high degree of centralization, leaving less decision-making authority to affected stakeholders outside of these functions.

Formalization/Standardization. TOGAF is a thoroughly formalized approach by itself. So are its provided artifacts for designing, planning, implementing, and governing the EA. Regarding formalization, we find guidelines, frameworks, graphics, reference models, taxonomies, methods, and procedures (*TRM*, *ADM*, *ECT*, *ACPF*, *ACF*). Furthermore, TOGAF represents a generalized approach to be individually tailored to specific needs. At the core is a continuous iteration cycle, by which guidelines become adjusted and concretized (e.g., see *ECT*, *ACF*). This procedure strengthens the interpretation of standardization [7].

As for the re-use of architectural guidance, standardization is highlighted by the interplay of generalization and adaptation. In this regard, standardization is promoted for example in the enterprise continuum (*ECT*, see also architecture repository) by the means of structuring single building blocks so as to adapt them for future specific use cases.

Planning. In TOGAF, planning processes guide the activities and actions of interdependent units and concretize the tasks and actions of architects. TOGAF outlines several explicit planning artifacts, such as tools, plans, roadmaps, models or formulated/externalized goal settings, by which activities of involved actors become channeled and integrated (*ECT*, *ADM*, *ACF*). In addition, we find activities of scheduling, resource calculating (e.g., budgeting), as well as the definition of building blocks, responsibilities, and accountabilities (*ADM*, *ECT*) closely related to what Martinez and Jarillo [7] define as planning mechanisms.

Another planning mechanism comes with the enterprise continuum, a concept that introduces a broader drill-up/drill-down logic to architectural guidance, explaining how generic solutions can be aggregated (*ECT*, see also architecture repositories). This aggregation can be, in turn, specialized to meet specific solution requirements for different stakeholders in different corporate entities. Considering generalization as a means for future purposes, it can likewise be understood as a planning mechanism.

Control. According to TOGAF, the application of architecture artifacts, governance, and related guiding processes should be maintained and developed under a pertinent degree of control (*ADM*, *ACPF*). More prominently, mechanisms of process and output control are evident in TOGAF. For process control, we find formalization as a key enabler: Externalizing architectural guidance in the form of frameworks, models, or blueprints allows a potentially large range of diverse stakeholders to commonly follow architectural guidance (*ECT*, *ADM*, *ACF*). We further find activity models (also called process models), resources control (i.e., the regulation of the consumption of resources), use case models, and class models that contribute toward a controlled exercise of (behavior and) activities (*ACPF*).

An important output control mechanism is the as-is/to-be analysis. The continuous identification and monitoring of risks, threats, and potential benefits under economic (i.e. cost, liabilities) and behavioral (e.g., acceptance, communication) aspects furthers a controlled development of the architecture (*ADM*). In this vein, we also find performance measures, product catalogues, and the management footprint (achievements of authorized responsibilities) as output control mechanisms (*ADM*). Finally, ex-post control to architectural guidance is important, as to any IS change or development endeavor, the validation against the initial needs/utilities follows *n* iterations of a continuous development cycle, which exposes architectural guidance as a strong controlled mechanism (*ECT*, *ADM*).

Lateral relations. One could assume that TOGAF, as a holistic guidance "encompassing all components of a system and their interrelationships", likewise comprises lateral relations among stakeholders within and across different organizational entities. However, TOGAF reveals only selected implications of lateral relations. Implications refer to activities of corporate personnel (e.g., engagement in concerted action), social networks (e.g., ties of mutual goals or needs), and information exchange/communication (e.g., stakeholders with complementary knowledge levels) (*ADM*).

Communication. Communication becomes largely visible by the means of formalization and externalization, taking place between architecture bodies and their targeted stakeholders. We find communication in information artifacts, such as guidelines, models, frameworks, or repositories, as well as in the processes of externalizing and spreading their information essence (e.g., systems, technical tools) (*ECT*, *ADM*, *ACF*).

Another form of communication occurs in informal, rather personal modes. While not explicitly promoted by TOGAF, it can be inferred as a coordination supplement to formal communication, occurring in vertical and horizontal directions. The mechanisms for vertical communication can be assumed as forms of authority command (e.g., architects, line managers) that communicate non-externalized/non-codified information. Alternatively, informal communication may occur in lateral, non-hierarchical (i.e. horizontal) directions, for instance in exchanging the often too sophisticated information value of architectural guidance among local stakeholders toward a mutual alignment of the same.

Socialization. Shared norms or values that co-exist to the formal structure of an organization are hardly touched by TOGAF. Selectively, TOGAF considers shared "strategic objectives", a product of architectural guidance catered especially to local levels, and antecedent to organizational culture [7] (*ACF*). Also, a shared approach toward the definition and development of an enterprise architecture balances visions, needs, and intentions among different corporate stakeholders, and might thus lead to an internalized system of ideology (*ADF*, *ACF*).

TABLE I. DEMONSTRATION OF ANALYSIS FRAMEWORK ON TOGAF

Coordination Mechanisms	Artifact Modalities
▪ Holistic reflection of organizational design and structure ▪ Guided decision-making activities across hierarchical levels ▪ Strong degree of formalized means/methods and standardization ▪ Variety of explicit planning artifacts and activities ▪ Strong focus on process and output control ▪ Selected implications of lateral relations (e.g., social networks) ▪ High focus on formalized communication, yet not informal modes ▪ Few considerations of shared objectives and organizational culture	▪ Limited reflection of personal/social coordination modes ▪ Hardly consideration of horizontal/lateral directions of coordination ▪ No focus on non-sophisticated/less hierarchical coordination methods ▪ No consideration of time aspects in coordination ▪ Lack of "how to" exercise architecture artifacts (e.g., skills, norms) ▪ Untailored applicability of architecture artifacts with regards to the organization structure, work environments, and workflows

The term "culture" finds particular reflection in the mitigation of risks between stakeholders and their adherence to the developed architecture (i.e. how the organization as a whole and individual stakeholders respond to it). On the one side, the identification of stakeholder concerns and "cultural factors will shape how the architecture is communicated" (*ACF*). On the other side, culture also moderates how an architecture is implemented, anchored, and further developed (*ACF*, *TRM*).

Based on our overall review, we find two groups of coordination mechanisms distinctively covered by TOGAF artifacts: Apparently, what Martinez and Jarillo [7] conceptualize as formal mechanisms (i.e. departmentalization, decision-making, formalization/standardization, planning, and control) are more prevailing, more facilitated, and more explicitly developed. Contrary, informal mechanisms (i.e. lateral relations, informal communication, and socialization) appear to be hardly considered by TOGAF.

B. Artifact Modalities

In the following, we review artifact modalities: Finding informal mechanisms comparably underrepresented, we demonstrate several conclusions on the successfulness of TOGAF in coordination.

Contextualization. TOGAF's artifacts mainly draw from the structural and formal arrangement of work environments (see departmentalization), while the underlying personal/informal relations that form and provide social meaning to these environments remain obscure. Notwithstanding TOGAF artifacts' adherence to a great level of detail in describing the organizational design, the negligence of the personal/informal mechanisms potentially limits a full, contextualized understanding of coordination.

Objectivation. TOGAF entails various specific descriptions of stakeholders and interdependencies to be tackled. These descriptions span not only heterogeneous functions, but also vertical heterogeneity in hierarchical relationships, and suit to the formal, hierarchical approach of TOGAF overall. However, stakeholder groups are also interdependent on the horizontal axis, and therefore often need to collaborate. This process necessitates less hierarchical and rather personal/lateral alignment, to which TOGAF's artifacts lack support.

Spatialization. TOGAF's artifacts promote a broad scope and high level of detail in catering the architecture perspective toward local levels. Though it may remain not always necessary to deliver guidance by such high degree of sophistication to any affected stakeholder in any particular context. Particularly the business side, being certainly less affine about blueprints and technical artifacts, might not always be reachable by such a high degree of information detail and sophistication, as promoted by TOGAF's artifacts.

Temporalization. A general shortcoming of TOGAF's artifacts is the lack of considering temporal circumstances. On the one side, there is no temporal tracking of the guidance actions taken. This limits a validation of coordination successfulness ex-post. On the other side, TOGAF's artifacts lack to consider future outcomes of its guidance approaches. This could eventually prevent to recognize necessary adjustments to coordination ex-ante.

Stabilization. While TOGAF's artifacts selectively acknowledge skills and training as important elements, yet there is no explication of how to anchor architectural guidance on a more personalized and informal level, for instance in social thought and action, throughout the organization.

Transition. TOGAF promotes its deliverables in a rather generic fashion, "which may be replaced or extended by a more specific set, defined in any other framework that the architect considers relevant" [2]. It can be expected that enterprise architects will adapt TOGAF's artifacts to define a tailored approach that is integrated and tailored more to the processes and organization structure. For this reason, it would be helpful to introduce a broader perspective on the adaptability of TOGAF's artifacts and the (changing) organizational environment, to which TOGAF seeks to respond.

V. DISCUSSION

Having illustrated the developed analysis framework by a review of TOGAF, we found the second group of coordination mechanisms—*informal mechanisms*—comparably underrepresented, which may not only limit coordination effects but also the success of the overall EAM approach. In the following, we discuss informal mechanisms as a vantage point toward a broader coordination perspective on EAM approaches.

Informal mechanisms are reflected in lateral relations, communication, and socialization [7]. They all appear to take place rather on the personal, lateral level (between actors) in the organization. Arguably, if actors have to work together in the absence of hierarchy and top-down control to realize linkage and mutual integration, concerted action is what they ultimately achieve [38]. Even organization theorists who have been discussing the distinctiveness of formal and informal mechanisms [37, 39], acknowledge the complementarity of informal mechanisms on coordination success. This provides us with a broader perspective, in which EAM research may extend the limited focus of formal to also informal and more personalized mechanisms of coordination that may be implemented by EAM artifacts.

Merely due to firmly formalized EAM approaches, an often discussed shortcoming is EAM's too sophisticated method support [40, 41]. Due to the high degree of sophistication, involving particularly business stakeholders seems to be a difficult task on which EAM falls short [8, 42]. Recent studies [9, 43] indicate that more mature EAM functions do not necessarily lead to business value; moreover, EAM often creates image and acceptance problems among those stakeholders it aims at guiding [44]. Hence, we argue that given a certain maturity level, EAM research and practice should not only be focused on further developing complex and strictly formalized mechanisms, but also on bringing down the coordination approach to a personalized, less formalized level [45-47].

A relevant literature stream toward a broader coordination perspective has been recently introduced to EAM research. In this stream, EAM is motivated as a learning mechanism, i.e. when decision-makers (particularly on the business side) learn to consider enterprise-wide objectives in (local) design decisions [9]. Winter [43], Aier et al. [42], Lattanze [48], as well as Brosius et al. [23] argue that architectural coordination could be anchored more sustainably in decision-making—throughout hierarchical levels—when equipped with appropriate mechanisms. To this end, we find less formal, less hierarchical, and more utility-centered (i.e. bottom-up) coordination mechanisms explicitly promoted. Through the complementarity of these mechanisms, prospective research may shed light on how to successfully coordinate local decision-makers toward enterprise-wide goals. In addition, future research may understand more comprehensively what mechanisms foster coordination success (in a particular organizational environment or temporal circumstance), and more coherently how the underlying modalities shape and constrain the success of the overall EAM approach over time.

Informal mechanisms might further lead to revelatory insights in the environmental context in which EAM is nested (see also *contextualization*). As formal, regulative means have often lacked flexibility in coping with dynamically changing organizational environments [49], we motivate prospective research to study on normative and cultural mechanisms in EAM approaches. Following Hjort-Madsen [50] as well as Weiss et al. [51], a suitable theoretical lens to study this proposition could be institutional theory, focusing the adoption of coordination not only as a regulated product, but also informal mechanisms (such as normative and cultural-cognitive forces) that shape, structure, and constrain the organizational environment, and thus raise meaning to coordination success.

In the paper at hand, we reflected coordination through coordination mechanisms and artifact modalities. While mechanisms essentially shape many of TOGAF's artifacts, particularly artifact modalities offer a vantage point for prospective research: On the one side, modalities may provide further insights on the implementation of coordination mechanisms in a real life setting and so ultimately account for a more facilitated perspective on coordination success. On the other side, artifact modalities do not necessarily depend on mechanisms for realizing coordination success. Hence, it remains a fruitful task for future research to investigate modalities independently from coordination mechanisms.

VI. Conclusion

By the means of an analysis framework, this study introduced coordination as lens and illustrated its pertinence with a first application to an EAM approach.

We reviewed the reflection of coordination mechanisms and artifact modalities in TOGAF—the most prevailing EAM approach in practice. Particularly, we found TOGAF concerned with mere formal approaches to EAM, in which coordination is—to a large extent—reflected in impersonal and formalized mechanisms (departmentalization, (de-/centralized) decision-making, formalization/standardization, planning, and control). Despite their individual utility, our findings stress the opportunity for a broader coordination perspective in EAM. For prospective EAM research, we emphasize to consider the complementarity of informal mechanisms (i.e. lateral relations, communication, and socialization). Furthermore, we emphasize to consider artifact modalities—dependently and independently from coordination mechanisms—for future research.

Our study is limited to TOGAF, which accounts for a finite—though compact—set of analyzable coordination mechanisms. Furthermore, EAM initiatives exist in multiple facets for a diverse range of stakeholders, and these are adapted to different organizational environments. Hence, our results remain only limitedly generalizable. We encourage prospective research to shed light on different EAM approaches in diverse use cases through the lens of coordination in order to enrich the findings of the paper at hand. Furthermore, artifact modalities highly depend on TOGAF's implementation at a given organization. While studying TOGAF as conceptual approach, we set out artifact modalities for a more detailed investigation in the process of implementing an EAM approach.

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