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How Enterprise Architecture Formative Critical Success Facets Might Affect Enterprise Architecture Success: A Literature Analysis

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Abstract. Though Enterprise Architecture (EA) is getting increasing attentions from both academics and practitioners, EA research around EA success factors remains modest and immature. This study explores how EA formative critical success facets/factors would affect the achievement of EA success. This research highlights the importance of four mediators, i.e., (I) Real and mature business needs; (II) Real and continuous commitment; (III) Actionable EA programs; and (IV) Well-controlled execution of EA programs. This study deepens our understanding of EA success and would be of explanatory contribution to EA value development and action-guiding contribution to EA adoption and implementation.

Keywords: Enterprise architecture success, Success facets, Formative factors, Casual relationship, Literature analysis

1 Introduction

Enterprise architecture now is emerging as an enterprise problem-oriented discipline [1], and actually problem-finding is more concerned than problem-solving [2]. Though Enterprise architecture gains increasing attentions from both academics and practitioners, “we are far from establishing a solid empirical base for enterprise architecture” [3]. EA is multi-dimensional [4, 5]. As a result, EA success sounds somewhat multi-dimensional. Similarly, formative EA success factors sounds multi-faceted. Partly due to this reason, still there is no single commonly agreed-upon definition for Enterprise Architecture [6, 7], as a result, “defining EA is highly debated in both academia and industry” [8].

Several studies around EA success factors (cf. [3, 9]) are dedicated to demystifying the potential formative success factors of enterprise architecture. Still, understanding of EA success remains modest. In practice, measure, trace and control of EA success look quite immature [8, 10-13] with inadequate success measurement [14]. The casual relationships between EA success factors and EA success are not well conceptualized and keep constantly unclear.

This research is dedicated to demystify these casual relationships. The rest of this paper is organized as follows. Section 2 details the research design. After that, Section

3 briefly presents the many EA success factors/facets. Then Section 4 as the core of this study proposes a synthesizing model. Finally, Section 5 concludes the paper.

2 Research Design

The research model is illustrated in Fig. 1. With EA success in the center, matters as to EA success factors in two directions are present in Fig. 1, i.e., (I) formative-affective EA success factors, and (II) reflective-indicative EA success factors. The inherent distinction between formative and reflective factors could be found in [15, 16]. It is noteworthy that *lag effects* and *EA reflective factors* are **excluded** in our focus; instead, as highlighted in **bold** in Fig. 1, we concentrate on EA formative factors and their relations to EA success.

Fundamentally, (time) *lag effect* between EA investment and its payoff objectively exists. Therein it is quite a challenge to make a balance between long-term interest and short-term payoff [17]. And it is somewhat necessary to “focus architectural decisions where the payoff is highest and maximize your likelihood of success”[18]. From the organization learning theory [19], lag effect is quite important in measuring EA success, but at the same time makes it quite problematic to measure EA success.

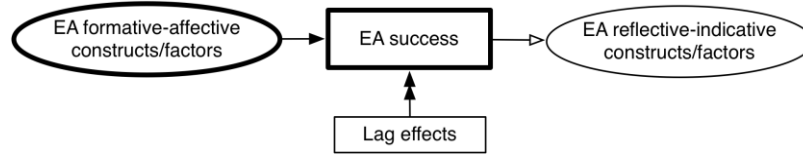


Fig. 1. Research model

Concerning EA reflective factors, EA quality as used in [9] includes process quality and outcome quality [5, 20, 21]. Therein, outcome quality includes design quality and implementation quality. Correspondingly, in EA implementation, project/program effectiveness and the achievement of objectives might be used to determine the extent of achieved success. Regarding process quality, EA maturity and EA capability could be employed as indicators.

Two research steps are applied, i.e.,

(I) Literature review to extract EA success factors/facets. In this step, we focus on identifying EA success factors. Further, by individual reflection and collective communication, the many identified EA success factors are categorized into four facets.

(II) Literature analysis and synthesis to reveal the connections. This step is the core of this research. Around the four facets, we analyze and synthesize the literature with our understandings. A conceptual model is presented to theorize the casual relationships between the four categorized EA success facets and EA success.

Further, the main research structure is summarized in Table 1.

Table 1. Research structure

Constructs	Notes
Research question	How does EA formative success factors/facets contribute to EA success?
Research objective	This study aims to demystify the casual relationships between the many potential EA formative success factors/facets and EA success.
Research assumption	<ul style="list-style-type: none"> As to different organizational EA adoption and implementation, we assume that there are some common EA success factors and those success factors could be organized to form some particular facets. We also assume that their (the success factors/facets) casual relationship to EA success is observable, somewhat objective, constructible and understandable.
Research methodology	<ul style="list-style-type: none"> Prescriptive literature analysis within which research critiques, analyzes and extends existing literature and attempts to build new groundwork [22]. Abductive reasoning
Research contribution	Theoretically, this study conceptualizes EA by connecting EA success factors/facets and EA success within four mediators. The four mediators are also of practical value as guiding checkpoints in EA adoption and implementation.
Potential pitfall	<ul style="list-style-type: none"> At present, no well-defined understanding of EA success with reflective indicators is openly-accessibly present. At present, no well-accepted collection of EA success factors/facets is openly-accessibly present.

3 EA Formative Success Facets

A pilot title search with keywords “enterprise architecture” from 1990 through 2012 was conducted in a website¹, where we can set our target database as the eight senior basket journals [23]. That test search got merely four relevant articles. Further detailed check showed that those four articles were actually irrelevant to our present research. Thus we changed our search strategy. With keywords of “enterprise architecture” and “success factors OR failure factors”, a computerized content search based on Google Scholar was applied to gather related materials. A three-step checking-verifying process was applied in order to identify pertinent literature and to exclude the irrelevant ones.

We **firstly** checked the *title* and *abstract*. If the material was relevant, then we went to the second step, otherwise, the material was left abandoned. The relevance of material was dependent on the answer to questions whether the material was about EA and whether it was possible for success factors to be addressed in the material. If ‘yes’ for both questions, then the material was labeled as relevant, otherwise, the material would be labeled as irrelevant. **Secondly**, we continued to check the content of the material. In this step, we questioned whether there were any insightful findings or summaries about factors in relation to EA success. If so, we went to the third step. Otherwise, the material would still be left abandoned. **Thirdly**, we would check the

¹ cf. URL: <http://www.vvenkatesh.com/ISranking/AdvSearch.asp>

socio-technical context in which success factors were presented and discussed. We would label the success factors if the specific context was compatible with lifecycle-long EA success.

From final 24 searched materials, we gathered 33 success factors. The labeled success factors are then categorized into four facets, as shown in Table 2. Avoiding the situation of EA as an end in itself [14] and regarding the objective existence of lag effect, Here the lens of lifecycle-long EA success, is employed in facet categorization. Consequently, four EA success facets overarch the many potential EA critical success factors, i.e.,

- *EA readiness and preparation.* This facet deals with organizational fundamental understanding towards EA, the introduction of EA to a specific, and organizational preparation for introducing EA. In principle, this facet affects not only EA introduction but also change execution in EA implementation.
- *Top Commitment and leadership.* This facet relates to the commitment from top executives and other stakeholders and provides sufficient power to perform organizational changes.
- *EA domain techniques.* This facet refers to the professional EA techniques, affairs or the skills what enterprise architecture should acquire.
- *EA governance and program management.* Factors in this category concern mainly management-control issues in relation to incremental EA implementation and lifecycle-long EA maintain.

Detailed meanings and potential contextual application of these success factors could be found in the literature. Due the limit of pages and that it is not the focus of this paper, hereby related information are not attached.

Table 2. EA formative success factors and facets

Facet	Factors terminology [3, 9, 24-43]
EA readiness and preparation	Terms, definitions, and understandings of EA Understanding of high-level business formal structure (e.g., strategy, vision, mission, objective, etc.) Purpose and EA scenarios Definition and refinement of the scope of architecture Business linkage (the extent for business to be linked in EA practice) Business cases (e.g., best practice) Organization culture Business model Sensibility and awareness of the need of change EA team skills Domain knowledge Training and education
Top commitment and leadership	Support & commitment from/of top executives Active involvement of top executives Identification of stakeholders Participation and coordination of stakeholders Communication between stakeholders Achieving consensuses

EA domain techniques	EA deliverables & artifacts Innovation and creativity in EA design EA resources and architecture repository management Architecture analyzing, satisfying, optimizing, assessing and evaluating Architectural principles Modeling techniques, languages & Software tools Architectural frameworks and methodologies, process
EA governance and program management	Governance model & structure and monitoring Sourcing and outsourcing (Involvement of external consultant service) Roles, accountability, responsibility Project and program management Transition management (The planning, arrangement of transitions in EA implementation) Risk control Cost control Investment policy (strategy)

4 The Synthesizing Research Model

With the research model in Section 2 at hand, based on literature analysis and synthesis, we develop a new conceptual model to illustrate how these extracted EA success factors could contribute to achieving EA success, as shown in Fig. 2. In the following subsections, we will explain the model step-by-step.

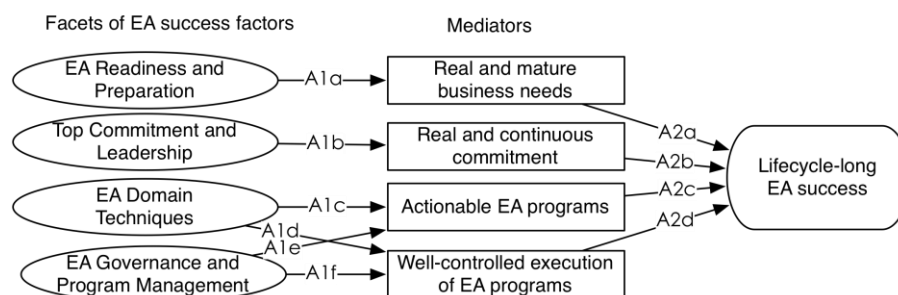


Fig. 2. Synthesizing model: revised research model

The many success factors together contribute to EA success through four mediators, including: (I) ensuring that there are real and mature business needs; (II) ensuring that real and continuous commitment is available; (III) facilitating actionable EA programs; and (IV) ensuring that there would be well controlled (in the sense of time, budget, and other resources) execution of EA programs in organizations.

4.1 Discussion

Obviously, in the synthesizing model, factors in the first two facets (i.e., *EA readiness and preparation* and *Top commitment and leadership*) bridges ‘**what - why**’-related issues. These two facets help to answer fundamental questions like ‘what is EA’ and ‘why to adopt EA in an organization’. The ‘what - why’-related issues help to ensure that EA is adopted necessarily, timely, readily and promisingly.

In contrast, factors in the latter two facets (i.e., EA techniques and EA governance and program management) address ‘**how**’-related issues of EA practice. The ‘how’-related issues connect the consequential affairs, including *creation, implementation, maintenance* and *upgrade* of EA design in accordance to the four steps (i.e., as illustrated in [44], *plan, do, check, action*).

In the synthesizing model, the arrows (A2a, A2b, A2c, and A2d) from mediators to EA success represent that there are full of pitfalls, risks, difficulties, resistances, problems, etc., in relation to the four mediators in achieving EA success. Any failure in relation to every single success factor, through the transfer of mediators, might finally lead to an EA failure.

It is important to differentiate every single factor from others. At the same time, we need to acknowledge that the many factors are actually interrelated to one another. The interrelationships will be left as a part of our future research. There seems to be a virtual success chain, in which the many factors are the connecting points. In such a success chain, the many factors could also be called *failure points*. Given that any point in the chain fails, the whole net might lead to a final failure.

4.2 Real and mature business needs

Business needs might explain the urgency and importance of EA adoption and implementation in a concrete organization. A mature, smooth application seems quite important for EA justification and legitimacy. The reason could be backed with the ambition to gain relative competitive advantage [45] and with the desire to improve the overall enterprise performance.

EA could not be cost-justified [46]. Potential EA benefits could just be realized ex post but should not promised ex ante in that a divergence between realizability and desirability of EA benefits really exists and matters [47]. Additionally, “the architecture effort’s effectiveness is only measurable by the degree to which it contributes to the business’ success”[11].

EA adoption and implementation could also be motivated by the existing enterprise-wide problems like misalignment of business and IT, etc. As well, the target (to-be) architecture in EA implementation might evolve with evolving business needs [48].

As to various EA application scenarios [49, 50] in different organizations, a common but serious problem is that business needs are **not** always **real** or **mature enough** for EA introduction and implementation. This implies that from the internal aspects, (an) enterprise might not have sufficient motivation to introduce EA as a tool to solve their enterprise-wide problems. Alternatively, if business needs (for EA adoption and implementation in an organization) turn weak or immature anytime

during EA adoption and implementation, EA adoption and implementation might become not so necessary anymore. More precisely, in this situation, the enterprise is then actually not in urgent need for EA adoption and implementation.

Therefore, real and mature business needs help shape, justify, and legitimize the foundation for enterprise to introduce changes.

Proposition A2a: Real and mature business needs are crucial for EA success.

EA readiness and preparation could positively affect the achievement of real and mature business needs [33]. A systematic understanding towards EA and a contextual understanding of an enterprise could help reshape and facilitate the fit between EA benefits and the real motivations in an enterprise. Business needs could also be assessed with such a fit. The understanding of this sort of fit could help (an) enterprise better comprehend where the enterprise is in the 'EA journey' and how to be better prepared towards its vision in the future,

Proposition A1a: Factors in the facet of *EA readiness and preparation* could promote EA success *by* facilitating the achievement of *real and mature business needs*.

4.3 Real and continuous commitment

People-Business-IT socio-technical changes in lifecycle-long EA management are quite common [39, 51, 52]. Change sometimes might confront organizational-political-cultural obstacles[53]. Essentially, socio-technical changes call for sufficient understanding, coordination, communication and support of stakeholders. In People-Business-IT socio-technical changes, enterprise architects are thought to just play a role of coordinator to understand the strategy, to create architecture models, and to gain power in order to execute changes [2, 4, 54, 55]. In this sense, commitment implies power providing. Only with sufficient power, could EA be implemented and could the obstacles brought about by involved changes be overcome.

Similar to business needs, a common but serious problem concerning commitment is that commitment in EA practice is **not** always **real**, **continuous** and thus not **adequate** [48, 56, 57]. If commitment turns disappeared or exhausted sometime during EA implementation, EA implementation would be doomed to fail in that no adequate resources would be available to do EA implementation.

Many matters might lead to an absence of adequate commitment, for example, problems relating to communication, trust, and some other socio-cultural-political issues, like change of leadership, cultural resistances, etc.

Therefore, sufficient power sounds crucial. Without sufficient power, it will be quite problematic to implement changes and to overcome obstacles,

Proposition A2b: Real and continuous commitment are crucial for EA success.

Unreal or discontinuous commitment will probably result in dangerous delays or final cancellations of EA implementation. Being aware of this reality, in accordance with the factors in the facet of top commitment and leadership, EA team in enterprises could keep more cautious and more realistic, which further would facilitate that the commitment is real and continuous,

Proposition A1b: Factors in the facet of *top commitment and leadership* could promote EA success *by* facilitating the achievement of *real and continuous commitment*.

4.4 Actionable EA programs

As addressed in [39], with given mature business needs and real, continuous commitment in EA adoption and implementation, another question arises: How and when will project/program plans be reviewed, assessed for EA compliance? Here good project/program plans would facilitate EA compliance, where, in principle, those plans are often made within given/reasonable time, budget and some other constraints. With these plans, gradually, EA implementation, which enable business IT convergence [58], becomes methodologically actionable [48, 59].

EA compliance is the core of EA management (cf. [7, 13]). In reality, the ground of EA practice relies much on the connections between enterprise portfolio management and tactic EA programs and then operational EA projects. To a large extent, compliance between the three levels of managements ensures correct executions of strategy.

Obviously, actionable EA programs would ultimately contribute to EA compliance. Particularly, actionable EA programs bridging enterprise top-level strategy, vision with EA operational detailed projects appear crucial for implementing EA smoothly, progressively and successfully.

From the contrary perspective, if real EA implementation proves that EA program/project plans are not actionable anymore, certain adjustments of organizational constraints need to be considered as to concrete business needs and commitments. In general, such kind of adjustments might happen at any time in EA implementation. From this point, validation of enterprise architecture design (and plans as well) before implementation is quite necessary and helpful [60].

In summary, we could come to the following propositions.

Proposition A2c: Actionable EA programs are crucial for EA success.

EA techniques provide philosophical supports for the forming and planning of EA programs. Methodological frameworks, method supports, and together with professional guidelines could help enterprises move towards doable EA planning. Systematic modeling and analyzing facilitate the improvement of EA design.

Proposition A1c: Factors in the facet of EA techniques could promote EA success *by* facilitating the achievement of actionable EA programs.

Contextual adjustment of EA programs could make EA programs more actionable. Systematic planning and aligning could make EA programs more orthogonally compatible to overarch the enterprise vision.

Proposition A1e: Factors in the facet of *EA governance and program management* could promote EA success *by* facilitating the achievement of actionable EA programs.

4.5 Well-controlled execution of EA programs

Execution of EA programs means that EA programs would be divided into concrete EA projects with concrete budget and time limits. Critical problems remain being there in controls of the execution. Often in EA practice, enterprise suffers from excesses of money or time to accomplish planned changes. Sometimes, the risk may go out of control. Another common problem is that the execution of EA programs might not be traceable in terms of accountability. These crucial issues relating to control and controllability of execution of EA programs are critical for EA success,

Proposition A2d: Well-controlled execution of EA programs is crucial for EA success.

Though there is no detailed auditing and accounting supports (like that in ITIL, Information Technology Infrastructure Library [61]) in present mainstream EA frameworks, still, methodological steps as provided in many EA frameworks could indeed more or less help to gain better control of execution of EA programs. The systematic guidelines with ‘steps after steps’ are quite prescriptively helpful in executing EA programs, i.e.,

Proposition A1d: Factors in the facet of EA techniques could promote EA success by facilitating the achievement of well-controlled execution of EA programs.

Well-controlled execution means that challenges [29, 62], pitfalls [11, 12, 63] are controlled according to the investment strategy. As well, the accountability as to risks, costs is also considered. An overall alignment between stage-crossing EA governance and concrete EA programs could facilitate better control in execution of EA programs.

Proposition A1f: Factors in the facet of *EA governance and program management* could promote EA success by facilitating the achievement of well-controlled execution of EA programs.

5 Concluding Remark

As a part of our continuous studies around EA success, the progress made here is an elaboration of connections between EA success facets and EA success. The emerged idea is that actually the four mediators in the synthesizing research model are crucial but at the same time quite problematic in real EA implementations. This might help explain why EA failure rate keeps high for years [64]. With regard to our theoretical synthetic analysis herein and our previous observation on EA practice in industry, this emerged idea seems to be of high generalizability.

This paper as an explanatory and exploratory study primarily provides a theoretical groundwork for further research in EA success and EA success factors. In addition, this elaboration deepens our understanding towards EA as a problem-finding and problem-solving tool by leveraging various complimentary boundary objects [2]. Besides this theoretical contribution, we believe that the four mediators as concrete checkpoints may potentially help increase the probability of EA success in practice.

The future research includes factors analysis with empirical data for better understanding the interrelationships between EA success factors. Another direction is to bridge EA formative success factors with EA reflective success factors.

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