Examining Enterprise Architecture for Digital Transformation

Daniel Rozo[a], João Moreira[a] and Marten van Sinderen[a]

[a] *University of Twente, Faculty of Electrical Engineering, Mathematics and Computer Science, Drienerlolaan 5, 7522 NB Enschede, The Netherlands*

Abstract

The Digital Transformation era has unlocked unique opportunities for organizations to disrupt and innovate with digital products and services by leveraging novel emerging technologies such as mobile computing, big data analytics, cloud computing, and the internet of things. Consequently, the emergence of this new digital generation has increased the awareness of disruptive innovations, posing multiple challenges to organizations that had adopted traditional Enterprise Architecture approaches, such as materializing digital business strategies with regard to federated applications. These business strategies must address the dynamic changes of the involved services and their data interfaces; and, therefore, require higher interoperability for seamless integration. This paper introduces preliminary results from conducting a systematic literature review focused on identifying the constituents of Digital Transformations reflected as new opportunities to improve conventional Enterprise Architecture practices. The findings are classified into four categories: (1) Customer Journey, Customer Experience and Value Creations Streams; (2) Architecture Agility & Evolution; (3) Architecture Modularity (Interoperability); and (4) Social and Cultural Alignment of the Enterprise.

Keywords

Digital Transformation, Enterprise Architecture, Enterprise Interoperability, Architecture Agility, Architecture Evolution, Architecture Modularity

1. Introduction

Apart from empowering people to collaborate and experiment with new emerging technologies, Digital Transformations require companies to change at multiple levels including organizational structures, operational processes, business strategies, and even corporate culture [26]. Highly competitive market conditions introduced by the new digital era have forced organizations to react quicker than ever before. Today's ruthless business environments pressure organizations to employ faster learning cycles that translate into shorter time-to-market strategies [22].

In the banking industry, for instance, new "born digital" start-ups have disrupted the market with the up-and-coming "Fintech" revolution. As a result, banks and financial institutions that have operated for decades are now expected to respond to dynamic market demands with outstanding business agility [21]. Furthermore, Digital Transformations revolutionize the way in which Information Technology and Business units collaborate. Highly cohesive teams are expected to constantly innovate and deliver solutions that result in enhanced customer journeys and experiences driven by new corporate cultures [22].

As a result, these substantial changes call out for management practices to govern these complex transformations [17], in which disciplines such as Enterprise Architecture (EA) can be understood as the new prosecutor of the new IT function, moving away from the traditional role of a service provider to those of a consultant, enabler and innovator [15]. EA has proven to be the discipline that best provides a basis for highly integrated environments, that are responsive to change and supportive in the delivery of the business strategy [12]. Moreover, it has provided guidance in form of a well-established

governance instrument to consistently align business and IT with strategies and goals to ensure adaptability, consistency, compliance, and efficiency [25].

However, organizations that have allocated resources and great efforts to become truly digital, criticize the EA practice as it fails to grasp the fundamental concepts from the nature of Digital Transformations [11]. Organizations have developed an increasing reluctance to undertake massive architecture efforts, as the complexity from the EA practice prevents simple projects to adopt practical solutions and quick adaptations to change [18]. In addition, companies who have embarked on Digital Transformation initiatives embrace the philosophy of "fail fast, learn fast" [21], allowing organizations to speed-up their learning cycles and become truly agile instead of falling into the trap of committing to years-long EA plans with "Big Designs Up-Front" [22].

Companies preparing for future digital disruptions are driving innovation through enhanced enterprise interoperability mechanisms [23]. Moreover, progressive journeys from monolithic to modular architectures address interoperability issues e.g. the new European interoperability framework (EIF) as a facilitator of Digital Transformation for citizen empowerment [14], promoting the establishment of well-architected digital ecosystems that characterize many digital business models [22]. The latter illustrates how Digital Transformation has begun to change the fabric of the EA practice and introduce enhanced approaches that enable organizations stay ahead of competition while keeping up the pace of the new digital generation. Certainly, this situation has caught our attention to perform this research.

1.1. Enterprise Architecture for Digital Transformation

According to [7], "Digital Transformation can refer to anything from IT modernization (for example, cloud computing), to digital optimization, to the invention of new digital business models." i.e. an operation or exercise to leverage new digital technologies that enable major business improvements and influence all aspects of customers' life [20].

Digital Business Transformation on the other hand, is defined by [8] as "the process of exploiting digital technologies and supporting capabilities to create a robust new digital business model". Hence, stipulating a method of using technologies to structure changes and modifications of business processes and strategies of an organization to meet customer requirements and dynamic market demands.

Further, [9] defines digitalization as "the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business". In practice, digitalization comes down to how digital technologies allow computing to be implemented into daily activities that traditionally were considered to be performed by human beings [26]. Finally, digitization is simply the conversion of any analog resources to digital form [15] e.g. converting a physical document from paper to a digital form.

As depicted in Figure 1, a conceptual model illustrates the scope of the terminology previously discussed, in the context of an organization and its extent in relation to EA. From a bottom-up perspective, digitization is implemented in the enterprise at the lowest level, where activities such as digitization of information, provide the enterprise new ways to access and share data across all business units. EA provides a clear set of work to map these technological mechanisms in response to business needs.

Digitalization initiatives focus on delivering projects and employ technology to automate, optimize or modernize business operations and processes of the enterprise. As a result, architecture and solution building blocks guarantee the logical integration of these complex relationships to deliver enhanced or new service capabilities.
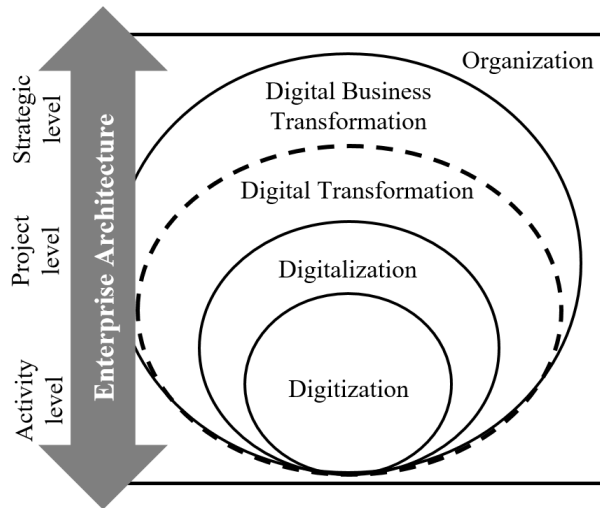
Figure 1: Digital Transformation and Enterprise Architecture

A vague distinction however, is made between the Digital Business Transformation and Digital Transformation since both terms relate to disruptive changes of new business models through the use and exploitation of digital technologies. Consequently, these concepts are treated in this research simply as Digital Transformation (DT) henceforth, as they both are conceived within the boundaries of the entire business or organization, include the integration of digitization projects to transform the business and its own strategy, and finally yet importantly, portray the extension and effective reach of the enterprise through digital capabilities.

1.2.   Problem Definition and Research Objectives

Preliminary observations from literature focused on EA in the context of Digital Transformation suggest that EA approaches are delivered as stable mechanisms for value creation, while Digital Transformations are characterized by context-sensitive value ecosystems [19]. In addition, organizations perceive EA and its related methodologies as complex, where strategy and processes are only considered marginally and with an IT focus [11].

As an example of complexity, EA has been criticized for providing "Big Designs Up-front", where conventional approaches impose rules and guidelines preventing simple projects to adopt practical solutions and quick adaptations to change [18].

In contrast, the concept of Digital Transformation and its companying technologies enable a fundamental reshaping of the businesses towards cross-functional, modular and distributed processes [2]. Not to mention that unlike the IT focus perspective characteristic of EA approaches, Digital Transformations come from a business-centric perspective, focusing on the transformation of products, processes and organizational aspects due to the adoption of new emerging technologies [17].

Ultimately, successful development and integration of Digital Transformation through digital businesses requires a high degree of agility in enterprises [24]. However, well-established EA approaches offer heavy and complex mechanisms with a vague perception of enterprise agility [11, 16, 18].

As a result, both these challenges and requirements have created a wide gap to deliver the expected results from EA approaches in the form of materialized Digital Transformations in organizations. Hence, the EA practice must cope with these by adopting new or enhanced building blocks that promote concepts such as architecture evolution, agility and modularity with context-sensitive value creation mechanisms. Therefore, the presented study intends to answer the following main research question.

How can EA best provide a basis for Digital Transformation initiatives in organizations?

Based on the main research question, sub-questions are formulated:

- RQ1: What constituents from Digital Transformation initiatives are not contemplated by the EA practice?

- RQ2: What EA frameworks, methodologies, and techniques are available that best provide a basis for Digital Transformation?
- RQ3: How are companies from a specific industry (e.g. manufacturing) relying on EA to deliver Digital Transformations into the organization?

2. Research Methodology and Preliminary Results

The Systematic Literature Review (SLR) performed for this study is based on the methodology provided by [10] for literature reviews in the Information Systems (IS) field. The four-phase method was applied to distinguish between the body of knowledge relevant for this review and the rest of the literature that is not aligned to the purpose of this analysis.

The scholarly literature search performed in this research aims to retrieve credible academic peer review content from well-known sources of scientific knowledge. Databases and search engines for scientific literature used in this research include Scopus, SpringerLink, ScienceDirect, and IEEExplore.

As part of the literature, recognized publications from large communities of practitioners in the field of EA were included in this literature study. Therefore, this research considers The Open Group® standards related to EA as relevant sources of knowledge aligned to the interests and objectives of this project. MIS Quarterly Executive, as a further reliable source of practice-based research with the largest number of publications in the last years in the context of Digital Transformation, contributes to the body of knowledge of this SLR.

Groundwork results that address RQ1 identify the following elements as the constructs that need to be contemplated into the conventional way of undertaking EA efforts in relation to Digital Transformation.

2.1. Customer Journey, Customer Experience and Value Creation Streams

Customer experience and project-to-product shifts are the major drivers for companies to embark on a Digital Transformation initiative. Architecture building blocks placed into adaptive operation models that comply with both digital and agile transformations will translate into successful customer journeys [22]. Traditional EA methodologies focus on Information Systems for stable value chains and customer needs, whereas digital transformation works with ecosystems and context-sensitive value creation [19].

Organizations developing Digital Transformation initiatives should not only be prepared to embrace continuous changes in business processes, information systems, and technology domains but also be aware of the value creation streams embedded into those domains to successfully materialize improved customer journeys and experiences.

2.2. Architecture Agility & Evolution

Current EA mechanisms are built to map complex structures in organizations that are perceived to be moving at the same speed, however, reviewed studies highlight the importance of agility in terms of multi-level speeds across the architecture to successfully deliver Digital Transformation initiatives [3, 13].

On the other hand, EA is based on waterfall mechanisms whereas Digital Transformation relies on an agile approach, in other words, lifecycle phases adopted by EA include development-maintenance-documentation, where agile adopts development-usage-maintenance-documentation [19]. In fact, concepts such as Minimum Viable Architectures [4] and Sacrificial Architectures [6] foster experimentation while accelerating the cycles of continuous innovation in organizations and embrace the fundamental principle of business agility from Digital Transformation endeavors.

Ultimately, proposals and modifications to current EA approaches include designing effective adaptive operating models. Consequently, extensions of such models must support guided and incremental change across multiple dimensions of architectures that have no end state, i.e. evolutionary architectures [5].

2.3.   Architecture Modularity

Easy ways to adopt architectures are also one of the main requirements from DT initiatives to EA approaches. In order to undertake DT projects, EA approaches must think modular, cross-functional with distributed business processes that allow higher interoperability within and amongst ecosystems [11]. These particular ecosystems are self-contained and self-adjusting systems that when grouped they create value. "Modularity is about decomposing a system into parts that are loosely-coupled" [22], where the system is any type of entity from a human to social to technical. Thus, materializing a Digital Transformation initiative through modularized architectures will bring flexible, adaptable and agile enterprises resilient to change while retaining value delivered to customers.

2.4.   Social and Cultural Alignment of the Enterprise

In order to cope with agile and flexible ways to work, organizations embarking on Digital Transformations projects are required to consider changes in roles and responsibilities across multiple business units. These changes must be delivered consistently while considering systematic changes in processes, technology, and data. Understanding such associations is a challenge while factoring complexities of EA design, where aspects such as culture and social alignment should also be a priority [1].

Digital Transformations transcend conventional architectural principles, striving organizations into new ways of operating and most importantly, collaborating. EA approaches should absorb new DT-driven cultures across the entire enterprise and outline its relationships across actors, technology, data, and underlying business processes.

3. Conclusions and Future Work

Preliminary results from this study show that the new era of Digital Transformation has brought a new set of challenges to today's EA practice. Concepts such as architecture agility and evolution, architecture modularity, social and cultural alignment of the enterprise, and context-sensitive value creation models present solid foundations to reformulate current EA approaches for a clear journey towards effective Digital Transformations.

Current research efforts include the exploration of the state-of-art regarding EA frameworks, methods and techniques for DT (RQ2) and their applicability to industries e.g. manufacturing (RQ3).

Future work will strive towards the adaptation of conventional EA practice to address the requirements of digital services regarding: (1) Customer Journey and Customer Experience; (2) Architecture Agility and Evolution; (3) Architecture Modularity (Interoperability); and (4) Social and Cultural Alignment of the Enterprise.

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