Digital Enterprise Architecture Management in Tourism – State of the Art and Future Directions

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Abstract. The advance of information technology impacts Tourism more than many other industries, due to the service character of its products. Most offerings in tourism are immaterial in nature and challenging in coordination. Therefore, the alignment of IT and strategy and digitization is of crucial importance to enterprises in Tourism. To cope with the resulting challenges, methods for the management of enterprise architectures are necessary. Therefore, we scrutinize approaches for managing enterprise architectures based on a literature research. We found many areas for future research on the use of Enterprise Architecture in Tourism.

Keywords: Enterprise architecture management · Tourism · EAM · SOA · Analytics · Hospitality

1 Introduction

Tourism is offers its products based on complex service-systems [1] with a multitude of operand and operant resources [2]. This service-nature of the tourism industry makes it particularly susceptible to technological changes in Information Technology (IT). Therefore, it does not surprise that ICT has reshaped the value chain of the tourism industry by enhancing the ability to produce competitive advantage [3]. No other industry is so strongly impacted by the application of ICT (Information and Communication Technology) [4].

Digitization [5] triggers disruptive changes in business processes, value chains, and business models of Tourism. Tickets formerly printed on paper are now purely digital links between an individual and a service. The electronic tickets in aviation are a prominent example. Value chains are extended and shortened [6]. New intermediaries improve matching between offer and demand. Traditional intermediaries are excluded by short-circuiting provider and consumer of services [6]. E.g. many hotels offer their services directly to their customers. New business models arise, with platforms at their core, that can fulfill customers' demands without own resources [7]. In summary,

digitization in tourism leads to low transaction costs, lower barriers and to the possibility to obtain more information about tourists' activities and transactions to build a stronger relationship with them [8].

Digitization creates new opportunities but also new challenges arise in Tourism. For instance, in the past, the consumer behavior and their preferences could be hardly observed. Nowadays, many customers share information (e.g. in social networks) and as a result [9], the data become available for the Tourism enterprises. However, this newly available data have to collected and processed before being useful for improving processes and decisions. For managing this new data sources appropriately, the design and implementation of an proper IT architecture becomes a key challenge for companies within the tourism sector.

In literature, the general advantages of IT-systems are investigated quite well. IT-Systems are defined as computers and communication technologies used for the acquisition, processing analysis, storage, retrieval, dissemination and application of information [10, 11]. In particular, many authors emphasize the advantages of the application of IT-Systems in terms of the competitiveness, [3, 10–12] productivity and performance of managing information as well as building closer relationship with the stakeholders [11, 13].

Derived from this research, the use of IT-Systems to digitize processes in tourism, e.g. travel, hospitality, and catering industries is advisable. IT-systems enable partnerships for developing customer-centric strategies as well as the increase of profitability [8]. However, there is only few research specific to tourism. Werthner et al. [14] highlighted the benefits and opportunities that IT brings to each layer of the tourism ecosystem composed of: (1) individual, (2) group/social, (3) corporate/enterprise, (4) network/industry, and (5) government/policy. As Berne et al. [3] state that ICT increases the vertical and horizontal relationship by enabling a large volume of information exchange among sellers and buyers. Furthermore, geographical barriers are eliminated quick and easily. This is especially advantageous in the Tourism sector, where suppliers and consumers are typically widespread.

With regards to the importance of enterprise architecture management and modern ICT in Tourism, we want to address the following research question: *"What is the state of the art of enterprise architecture management research in Tourism?"*.

To investigate this question, we first implemented a systematic literature review. Afterward, we analyzed and summarized our findings with regards to the research question. Finally, we concluded and described interesting possibilities for future research.

2   The Need for Enterprise Architecture Management in Tourism

A huge number of external factors impact enterprises in tourism. In this way tourism companies are continuously challenged to extend their capabilities [15] and adapt their Business Operating Model [16]. Enterprise Architectures (EA) as the architectural part of IT Governance [17] provides a foundation for the conceptualization and planning of initiatives.

Enterprise Architecture covers the logic for business processes and the IT infra-structure model as well as reflecting the dimensions of standardization and integration of the business operating model [16]. Enterprise Architecture Management (EAM) [18] and Services Computing [19] are approaches of choice to align strategy, organize, build, utilize, and distribute capabilities for the digital Enterprise Architecture [5, 20].

Enterprise Architecture requires changes in traditional cultures of enterprises and the development of specific architectural capabilities and roles. Typically for EA is the close interrelationship between an architectural framework [21], which defines a set of aligned architectural viewpoints by a set of visual and procedural elements, an architectural modeling language [22], and an architectural development process, like the architecture development method ADM [21]. Important EAM frameworks and reference models are [23, 24]: The Open Group Architecture Framework (TOGAF), Zachman Framework, US Federal Enterprise Architecture Framework (FEAF), Enterprise Services Architecture Reference Cube (ESARC).

Enterprise Architecture addresses issues typical for industries such as tourism, where many stakeholders cooperate to provide services. Enterprise Architecture provides an open path for stakeholder collaboration, joint analytics, and cooperative decision support [25]. By describing the participating entities in tourism industry, Enterprise Architecture Management provides leadership for business and IT with a powerful decision support environment [26]. In fact, this ranges from strategy development and support for the management to support the digital transformation of enterprises with digitized customer-oriented products and services. As a result, Enterprise Architecture enables organizations to adapt more flexibly, quickly, and effectively. EAM provides an important benefit for enterprises and organizations [27].

An example for enterprise architectures is the "ESARC" (Enterprise Services Architecture Reference Cube) [28] (Fig. 1). ESARC specializes existing architectural standards of EAM – Enterprise Architecture Management [21, 22] and extends them for service-oriented digital enterprise architectures. ESARC defines an integral classification model within eight architectural domains. These architectural domains cover specific architectural viewpoint descriptions [29] in accordance with the orthogonal
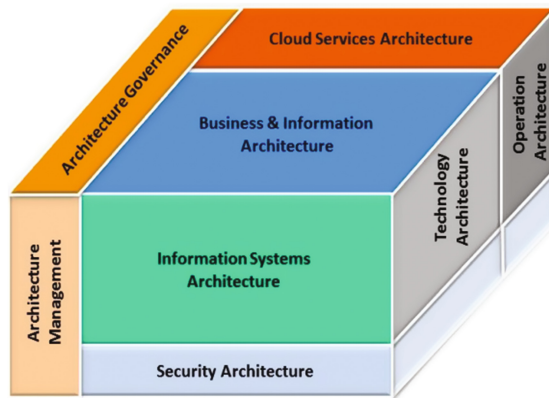

Fig. 1. Enterprise Services Architecture Reference Cube [24, 30]

dimensions of both architectural layers and architectural aspects [30]. ESARC abstracts from a concrete business scenario or technologies: ESARC is an architectural framework, which is applicable for concrete architectural instantiations to support the digital transformation of products and services. The different dimensions the ESARC contains and describes are depicted in the following figure (Fig. 1):

3   Research Method and Data Collection

For investigating the state of the art of enterprise architecture management in Tourism, we designed a systematic literature review [31]. Regarding this research approach, we looked up for research papers in this area in scientific databases like SpringerLink, AISel, ScienceDirect, IEEExplore. Therefore, we searched for keywords such as "EAM", "Enterprise Architecture Management", "Enterprise Architecture", "Tourism", "Hospitality", etc. The timeframe of our search was defined for the last 20 years regarding the development of modern ICT systems in general and particularly in Tourism.

We carefully reviewed every single one of the collected papers. Following this, we extracted only papers, which are in scope of our research question. Besides, we also found interesting research about other topics like "Easy Access Market's" or "efficiency achievement measure" in our literature review. But, because of the sparse congruence with the actual research question, we had to drop. Finally, we selected ten papers for our final review. According to Fig. 2 research with regards to our topic was published from the year of 2000 until now.
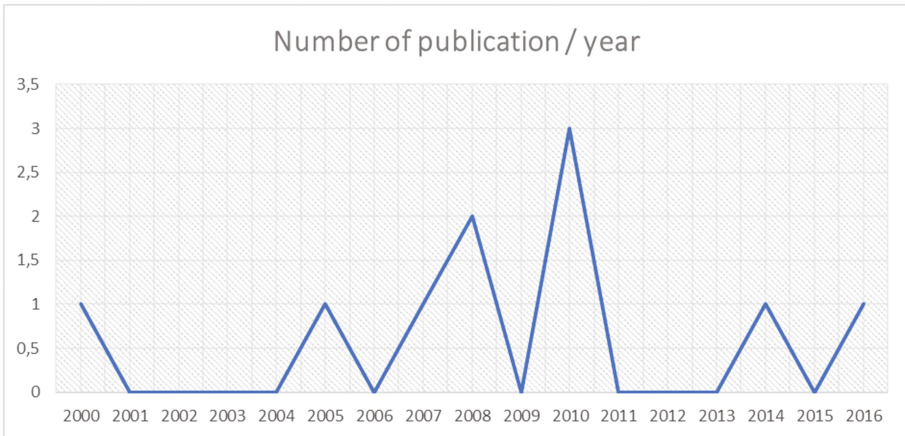

Fig. 2.   Overview of the collected publications per year

In the following section, we analyse the collected publications.

4   Results

The selected publications built the basement of our final review. Finally, we analyzed the collected papers with regards to our research question. The following table shows the results we finally got from our systematic literature review (Table 1).

Table 1. Results of the literature review

Reference	Authors	Year	Short description of the aspects of EAM in Tourism
[32]	Abdi and Dominic	2010	Evaluation of an alignment of IT and Business strategy related to a service-oriented architecture (SOA) with a sample of IT managers in hospitality
[33]	Afsarmanesh and Camarinha-Mato	2000	Define the requirements for enterprise inter-operation in the tourism sector based on task sharing and federated information management
[34]	Engels et al.	2008	Development of a method for engineering of a service-oriented architecture. A Tourism sample case was used for illustration
[35]	Franke et al.	2010	Survey of Trends of Enterprise Architecture Management. Some participants of the study are from the Tourism sector
[36]	Hess et al.	2007	Approach for structuring application landscapes. The application landscape of Tourism enterprises was part of the empirical observation/project experience
[37]	Keller et al.	2016	Possibilities of data-centered platforms in Tourism based on Big Data and Predictive Analytics
[38]	Ramasubu et al.	2014	Aspects of service and enterprise architectures with one sample Tourism case "animal reserve"
[39]	Schuck	2010	Design of an enterprise architecture for a national park case
[40]	Vom Brocke et al.	2008	Tourism sample case for illustration of a method for service-oriented process controlling
[41]	Weill and Ross	2005	A hospitality and travel group as a sample case for aspects of IT Governance and related aspects of IT architecture

First of all, there is obviously sparse research in the field of EAM in Tourism in general. Franke et al. [35] show in their research about trends of enterprise architecture management that experts from Tourism sector are interested in this topic because they are participating in this study. Hess et al. [36] developed an approach for structuring application landscapes of enterprises within different domains. Tourism enterprises were

observed and consist of different applications in their enterprise architecture with, e.g., different business functions, business objects as well as channels.

Other papers use Tourism cases for the illustration of their EAM method or model. For instance, vom Brocke et al. [40] provide insights into the use of service-oriented process controlling illustrated by a Tourism example. The same was conducted by Engels et al. [34]. Therefore, some research uses Tourism as an example case, but do not focus on EAM in Tourism in a deep and fundamental way. In our systematic literature review, we found only some papers national park protection by Schuck [39], which focusing mainly on aspects of EAM in Tourism. Weill and Ross [41] showed different aspects of IT Governance and related IT architectural consequences based on a Tourism and Hospitality Group case. Abdi and Dominic [32] evaluated aspects of a service-oriented architecture based on IT Business alignment with managers from the hospitality sector.

In [37] different important requirements for data-centered platforms in Tourism are defined. Enterprises in the Tourism sector consists of many different, heterogeneous information systems for different business divisions. Old (transactional) information systems should be adapted as well as integrated to a more analytical oriented infrastructure. Furthermore, the authors show how Big Data can be used in different areas in Tourism. This paper shows that a more flexible and analytical architecture is needed in the future to process a high volume of structured and unstructured data. Furthermore, more external data providers should be integrated into the architectural landscape. This transformation to a more analytical architecture can support more business goals and processes [37]. For instance, the provided information could help to deepen the understanding of the customers about a local and seasonal or even typical event. This could be the starting point for improved marketing activities with regards to new target groups or even to increase the positive experience of the participants by focusing on favorable aspects mentioned in the past. Another interesting aspect could be seen in the reorganization of existing offers and services. Due to the available data and information the menu of a restaurant could be readjusted in terms of vegan dishes or organic food, for example.

In conclusion, enterprise architecture in the field of Tourism consists of many different (heterogeneous) information systems (e.g. for marketing, financial and HR planning.) within the enterprise as well as outside of them (e.g., supplier and customer as well as governmental systems). The integration of processes, data, functions, and organizational aspects [42] are more or less automatic. Data silos are inherent. Furthermore, some research argues for flexible architectural paradigm like service-oriented architectures (SOA). Architectural research with focus to a more analytical enterprise landscape is in an early stage. The current enterprise architecture is designed to process more or less only structured data. There is a need to align architectural components to process semi- and unstructured data (e.g., from social media [37]).

In fact, there exists no big picture and structured research for the whole Tourism sector. Some research papers only uses Tourism as an example case. However, there might be more specific research in some special segments of Tourism. Regarding the importance of ICT in Tourism and the opportunities of EAM in this sector, this topic

should be more discovered in the future. Especially in a more common sense with possible generalizability.

In the following, we provided a short abstract overview of the general architecture of a Tourism enterprise (Fig. 3) based on the reviewed literature:
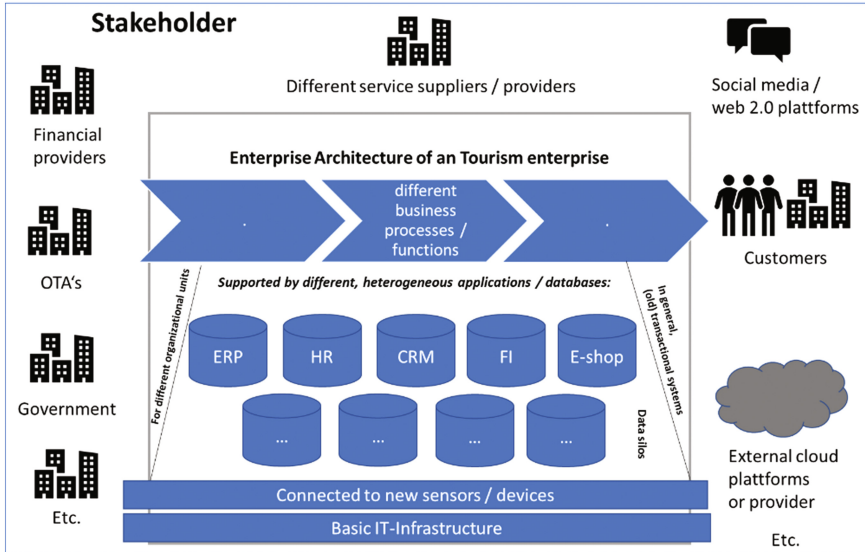

Fig. 3. Abstract overview of the general architecture of a Tourism enterprise based on previous work

5   Conclusion and Future Directions

Enterprise architecture management is important to manage the complex information systems infrastructure in Tourism needed to achieve Business and IT goals. Furthermore, it is essential for coping with the challenges of the more and more technology driven environment of the Tourism sector. Unfortunately, there is only sparse research about EAM in Tourism from a general point of view. We contribute to the current research literature by describing the state of the art of EAM research in Tourism.

Practically oriented users can be better informed about this important and challenging topic in information systems as well as Tourism. Limitations of our research can be found in the used methodology. We cannot address all possibilities of keywords and databases. We only selected the most important ones according to general recommendations [31]. Few research on the use of Enterprise Architecture management in Tourism shows that additional layers of abstraction fill the gap between these two areas. Tourism is well-suited for digitization due to its service-centered character. The first layer of abstraction could be the classification of Tourism models according to the model introduced by Weill and Woerner [43]. They identified four strategic alternatives for enterprises: omnichannel business, ecosystem driver, supplier and modular producer

allowing to define the strategic alternatives in Tourism. A further layer could be digital capabilities [44].

The need for a methodological enterprise architecture management becomes more urging, as a change in the value creation mechanism of the tourism industry is about to happen. In the past, many offers were designed like physical goods. Standardized services were "produced" in large quantities with only a few or no possibilities to adapt them to individual customer wishes. Nowadays, a co-creation approach [2] is used increasingly. The preferences of the customer captured by digital means are used to tailor individual experiences. On a theoretical level, the change can be described as the move from a goods-dominant to a service-dominant perspective [2]. To be more precise, this means that the customer provides individual data and helps the supplier in term of value co-creation to improve the offered service. It is enabled on a technological level by the wide diffusion of the internet, the large use of social media and e-commerce.

Future research should follow this interesting research topic in Tourism and transfer aspects and other research results from other industry sectors to Tourism. Case study research as well as other empirical studies for evaluation different aspects of EAM in Tourism could be a good opportunity for future research. Furthermore, discovering the current offerings of consultant and IT services for the tourism sector could be a good opportunity for future research. The development of a conceptional framework for EAM in Tourism as well as the use of enterprise architecture principles and capability aspects of EAM are also possible next research steps.

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