



Research Paper

Big data analytics for knowledge generation in tourism destinations – A case from Sweden

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ABSTRACT

This paper presents a knowledge infrastructure which has recently been implemented as a genuine novelty at the leading Swedish mountain tourism destination, Åre. By applying a Business Intelligence approach, the Destination Management Information System Åre (DMIS-Åre) drives knowledge creation and application as a precondition for organizational learning at tourism destinations. Schianetz, Kavanagh, and Lockington's (2007) concept of the 'Learning Tourism Destination' and the 'Knowledge Destination Framework' introduced by Höpken, Fuchs, Keil, and Lexhagen (2011) build the theoretical fundament for the technical architecture of the presented Business Intelligence application.

After having introduced the development process of indicators measuring destination performance as well as customer behaviour and experience, the paper highlights how DMIS-Åre can be used by tourism managers to gain new knowledge about customer-based destination processes focused on pre- and post-travel phases, like "Web-Navigation", "Booking" and "Feedback". After a concluding discussion about the various components building the prototypically implemented BI-based DMIS infrastructure with data from destination stakeholders, the agenda of future research is sketched. The agenda considers, for instance, the application of real-time Business Intelligence to gain real-time knowledge on tourists' on-site behaviour at tourism destinations.

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1. Introduction

Since the advent of the WWW, major parts of tourism information processes and transactions are handled electronically (Buhalis, 2006; Fuchs, Höpken, Föger, & Kunz, 2010; Fuchs, Scholochow, & Höpken, 2010). Thus, customers leave electronic traces during all travel-related activities, like searching and trip planning, reservation and booking, service consumption as well as feedback provision in community web-sites (e.g. social media platforms) or through online surveys (Fuchs & Höpken, 2011). Consequently, a huge amount of data on customer needs and behaviour as well as perception is stored in various knowledge sources at tourism destinations. For instance, web-search data is stored in web server log-files, while survey data is stored in data bases of destination suppliers (Fuchs, Höpken, & Lexhagen, 2015). However, in tourism destinations these valuable knowledge sources typically remain unused (Höpken, Fuchs, Keil, and Lexhagen, 2011; Pyo, 2005).

In order to remove this deficiency, this paper presents a knowledge infrastructure which has been prototypically implemented on the base of real data, as a genuine novelty at the leading Swedish mountain tourism destination Åre. By applying a Business Intelligence approach (Larose, 2005), the proposed Destination Management Information system Åre (DMIS-Åre) drives knowledge creation and application as a precondition for organizational learning at tourism destinations (Pyo, Uysal, & Chang, 2002). From a theoretical standpoint the paper is based on Schianetz, Kavanagh, and Lockington's (2007) concept of the 'Learning Tourism Destination'. Following these authors, through the generation, management and intelligent access of relevant information, the knowledge level of tourism stakeholders can be significantly increased. In order to foster learning processes among destination stakeholders, the 'Knowledge Destination Framework' (Höpken et al., 2011) builds the fundament for the technical architecture of the proposed DMIS infrastructure. After having discussed theoretical foundations of the 'Knowledge Destination' in Section 2, the elements of the framework architecture are described in Section 3. Subsequently, before highlighting how DMIS-Åre can be used by destination managers and suppliers, the development process of indicators measuring destination performance as well as tourist behaviour and experience is thoroughly discussed in Sections 4 and 5. The paper concludes

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by providing a summary and by outlining limitations and the agenda for future research steps.

2. The knowledge destination

Following the knowledge-based view of the firm (Grant, 1996), an organization's value is limited by the amount of knowledge within it. Thus, the sustainable development of whole industries as well as (e.g. tourism) regions and destinations is related to available (and accessible) knowledge which is needed to (re-)configure 'resources', especially knowledge-based resources, to remain competitive (Back, Enkel, & V. Krogh, 2007). Resources are defined as 'the totality of assets, capabilities, organizational processes, information, and knowledge controlled by an organization that enables it to conceive of and implement strategies that improve efficiency and effectiveness' (Barney, 1991, p. 101). However, only if these resources are perceived as valuable and scarce by customers and difficult to imitate and to substitute by competitors, will they provide competitive advantages in the long-run (Barney, 1997). If these conditions are fulfilled, the entrepreneurial activity of combining and reconfiguring resources will be based upon core competencies which, in turn, need to be validated and renewed through continuous knowledge acquisition and learning processes. This, 'dynamic capability' is described in the literature as the 'ability to integrate, build and reconfigure internal and external competences to address changing environments' (Teece, Pisano, & Shuen, 1997, p. 516). Accordingly, organizational learning is operationalized by two core capabilities: by efficiently multiplying established processes and operations (i.e. the *replication capability*), and by continuously modifying existing resource configurations through the acquisition and development of new core-competencies (i.e. the *reconfiguration capability*). Replication capabilities are typically driven by firm-internal knowledge transfer and related codification processes. By contrast, reconfiguration capabilities are predominantly determined by the capacity to absorb external knowledge and by the ability to deduce generalizable cause-effect relationships from existing knowledge applicable to a wider range of strategic options (Back et al., 2007; Tajeddini, 2010). Finally, it is empirically shown that the reconfiguration capability is positively affected by a firm's 'proximity to the customer', thus indicating the crucial relevance of customer-based knowledge for learning and innovation processes (Burman, 2002).

In the context of tourism research, the knowledge-based school of thought regards tourism as a complex social phenomenon where *knowledge* is the essential basis for tourism development and competitiveness (Jafari, 2001). This platform of thought postulates that through the generation and intelligent application of knowledge (especially on customer needs) information asymmetries between destination stakeholders can be reduced (Hallin & Marnburg, 2008; Shaw & Williams, 2009). While tourism destinations are viewed as 'value networks of competencies that coordinate complex social stakeholder constellations and resource configurations to deliver and mediate co-created tourist experiences' (Coles, Hall, & Duval, 2006), this leads to an enhanced collaboration and innovation capacity, which, in turn fosters market cultivation processes and improves service effectiveness by using destination resources in a more efficient and sustainable way (Buckley, 2012).

However, particular approaches are needed that support stakeholder collaboration and learning processes on an organizational and destination level. Schianetz, Kavanagh, and Lockington (2007) propose the concept of the *Learning Tourism Destination* and define two major areas of knowledge: (1) an area where knowledge is created and, (2) an area where knowledge is applied and learning occurs. By acknowledging that organizational, community and individual learning are highly interlinked, Schianetz et al. (2007)

suggest that 'the learning focus should be on the understanding of how a tourism destination functions, how market possibilities can be enhanced, the requirements for adaptation to changing environments, how to promote collective awareness of economic, social and environmental risks and impacts, and how risks can be minimized and/or countered' (Schianetz et al., 2007, p. 1486). Finally, Schianetz et al. (2007) argue that the implementation of a networked infrastructure that collects customer-based data and also applies and disseminates gained knowledge, is fundamental to foster knowledge exchange between different organizations and enable effective learning cycles (Fuchs, Abadzhiev, Svensson, Höpken, & Lexhagen, 2013). Thus, it is clear why information and communication technologies (ICTS) are playing such a crucial role in realizing the full potential of a knowledge destination (Buhalis, 2006). Indeed, *destination competitiveness* is affected by the extent to which knowledge creation and application is supported by ICT-based infrastructures and services (Shaw & Williams, 2009). Accordingly, the proposed *knowledge destination framework* focuses on the inclusion of the customer, and represents the framework for a prototypically implemented Web-based infrastructure that collects customer-based data and creates and disseminates knowledge among destination stakeholders (Höpken et al., 2011). Thereby, we argue that knowledge creation and acquisition processes at tourism destinations can be significantly enhanced by applying methods of *Business Intelligence (BI)*. BI is an umbrella term which comprises: (1) data identification and preparation, (2) database modelling and the population of a data warehouse, and (3) the application of Online Analytical Processing (OLAP) and data mining (DM) techniques, respectively (Hastie, Tibshirani, & Friedman, 2009; Larose, 2005). DM comprises statistical and machine learning techniques for identifying trends and patterns in huge data sources, like (a) classification (for example artificial neural networks [ANN], decision tree analysis, rule induction, K-Nearest Neighbour techniques), (b) estimation, (c) prediction (such as multivariate statistics, ANN), (d) clustering (e.g. *k*-means, hierarchical, Kohonen Networks) and (e) association rules (particularly for market basket analyses).

Literature only recently emphasizes BI and DM for knowledge creation in travel & tourism (Fuchs & Höpken, 2009; Magnini, Honeycutt, & Hodge, 2003; Min, Min, & Emam, 2002; Morales & Wang, 2008; Palmer, Montano, & Sesé, 2006; Wong, Chen, Chung, & Kao, 2006), and only few BI studies exist for tourism destinations (Cho & Leung, 2002; Fuchs et al., 2013; Höpken, Fuchs, Höll, Keil, & Lexhagen, 2013; Höpken et al., 2011; Höpken, Fuchs, & Lexhagen, 2014; Pyo et al., 2002). According to our proposed framework, knowledge activities deal with extracting information from different customer- and supplier-based sources as well as with the generation of relevant knowledge which can be applied in the form of intelligent services for customers or destination stakeholders (Fuchs et al., 2013). Thus, the *knowledge destination framework* (Höpken et al., 2011) distinguishes between a *knowledge generation* and a *knowledge application layer* (Fig. 1).

The *knowledge generation layer*, through methods of information gathering, extraction and storage, makes knowledge sources accessible to stakeholders: for instance, on the customer side, knowledge is generated through feedback mechanisms, like (e.g. online) surveys and review platforms (Gräbner, Zanker, Fliedl, & Fuchs, 2012; Sidali, Fuchs, & Spiller, 2012). Moreover, tourists' information traces (web search) are made explicit through web-mining (Liu, 2008; Pitman, Zanker, Fuchs, & Lexhagen, 2010). Furthermore, knowledge about tourists' buying behaviour is generated through mining transaction data, while tourists' mobility behaviour may be traced by GPS/WLAN-based position tracking (Zanker, Jessenitschnig, & Fuchs, 2010). On the supply side, knowledge about products can be extracted from information sources (web-sites) in the form of product profiles and availability information (Pyo, 2005).

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