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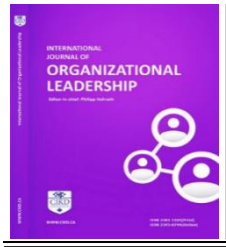

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Real-Time Data Analysis (RTDA) and Proposed Innovative Business Models: A Conceptual Study of the Tourism Industry

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ABSTRACT

The paper discusses the importance of Real-Time Data Analysis (RTDA) with innovative fluid business models for the tourism industry. The study uses a conceptual approach to identify innovative fluid tourism business models and their relationships with RTDA based on the problematisation of the crucial need for a holistic, macro understanding of the tourism ecosystem approach rather than framing the issue from a micro point of view. The paper highlights that the current digital era makes it no longer possible for the tourism ecosystem stakeholders to use static models that collect, store, analyse data and make decisions accordingly. Innovative business models should be fluid structural models that use instant data and provide continuous, multiple, and variable decisions with RTDA. The real-time analysis of macro (e.g., countries), meso (e.g., destinations), and micro (e.g., tourists) data obtained from the tourism ecosystem is vital for innovative business models which facilitate the offerings of individualised services and provide increased cooperation between stakeholders using open innovation opportunities in the ecosystem. To date, the tourism industry has not adequately grasped the outcomes and benefits of big data analytics (BDA). While a growing body of literature on big data has focused extensively on technical aspects (e.g., infrastructure, intelligence, and analytical tools), the issue of how and under what conditions BDA can generate value and impacts for various stakeholders involved in the tourism ecosystem remains largely underexplored. Thus, this paper fills this void by being among the first attempts to conceptually explain and propose unique, innovative fluid business models and RTDA in three specific areas in the tourism and hospitality context.

Given its high strategic potential, particularly in extracting business value, "big data" has become the recent focus of continuous debates among academics and practitioners (Dong & Yang, 2020; Mikalef et al., 2018; Nadkarni et al., 2019; Ogbeide et al., 2020). The big data concept leads to dramatic changes in decision-making systems and innovation-oriented business models of organizations (Duan et al., 2020; Brynjolfsson & McElheran, 2016; Vidgen et al., 2017). One of these changes has occurred in the resources and capabilities of organisations to exploit big data in the business environment since it holds great potential to achieve sustainable competitive advantage. In this regard, as McAfee and Brynjolfsson (2012, p. 61) highlighted, data-driven firms are, on average, five percent more productive and six percent more profitable compared to their competitors. Akter et al. (2016) found that despite the willingness of firms to develop the capability of big data analytics (hereafter BDA) to increase their performance, very few of them have created an impact through using big data. In addition, less than 50 percent of BDA initiatives meet their intended strategic objectives (Mithas et al., 2013). Indeed, a global survey indicates that 43 percent of organisations gain limited or no benefit from BDA (White, 2015).

Despite this growing interest and advantages, to date, the tourism and hospitality industry has not adequately grasped the outcomes and benefits to be gained from BDA (Nadkarni et al., 2019). Although there has been a growing literature on BDA in tourism, scholars by far predominantly focus on technical aspects, solutions, and issues (Baesens et al., 2014; Chen et al., 2012; Lau et al., 2016; Wang et al., 2018; Wamba et al., 2015), rather than capturing the importance of the use of BDA and its leadership challenges associated with the digital context and implications in the tourism industry. Therefore, in contrast to the studies working on infrastructure, intelligence, and analytical tools (Mikalef et al., 2018), the issue of how and under what conditions BDA can generate business value and societal impacts for various stakeholders for achieving sustainability in the times of Industry 4.0 facing the tourism and hospitality sector becomes the primary subject matter of this research. This is unlikely to happen without leaders who are digital platform creators, innovators, and pioneers and drive stakeholders toward action (AlNuaimi et al., 2022). Digital transformation brings several consequences and disruptions that (re)shape and transform the existing business models and leadership approaches in the tourism and hospitality industry (Scuotto et al., 2021). However, it should also be noted that "digital transformation is more about people than it is about digital technology" (Abbu et al., 2022, p. 39). Thus, these explorative questions form the basis of the current research. Accordingly, the paper aims to conceptually explain and demonstrate examples of Real-Time Data Analysis (RTDA) with innovative business models in the tourism ecosystem.

The remainder of this research is organised as follows: First, big data characteristics and the crucial need for BDA in the tourism and hospitality industry are highlighted. Second, the importance of RTDA in tourism is explained. Third, innovative fluid tourism business models and RTDA in three specific areas in tourism and hospitality are proposed. Finally, the study is concluded, and the implications are discussed in the last section.

Characteristics and Need for BDA in Tourism

With advanced sensing and computation capabilities, data are gathered and evaluated in real-time to extract the information, which is further converted to usable knowledge (Jin et al., 2014, p. 112). Data can be collected through cameras and sensors distributed throughout the city, communication between devices, or the interaction of humans with machines. It can be generated by meteorological observatories, financial markets, or social networks (Lavalle et al., 2020, p. 1). Analysing big data can be used to trace working conditions, working hours, living wages, social welfare, and equity, as well as to promote workplace health and safety (Chen et al., 2022, p. 8; Karaszewski et al., 2021, p. 2). In addition, big data analytics can enhance business practices' sustainability by reducing waste and carbon emissions (Rosario & Dias, 2022, p. 9).

The 'big data' concept is briefly conceptualised as 'the use of massive amounts of data to support more accurate decision making within organisations (Davenport, 2014; de Camargo Fiorini et al., 2018; Goes, 2014), which is generally associated with the so-called "3Vs". Actually, the "Vs" typically refers to 'volume' (generation and collection of a large amount of data), 'variety' (various types of data collected including structured, semi-structured, and unstructured data), and 'velocity' (timeliness and rapidity rate of data) and have been extended to include 'veracity' and 'value' as well (Fosso Wamba et al., 2015). 'Veracity' corresponds to the level of unreliability and uncertainty inherent in several data sources that need further analysis to achieve reliable predictions (Gandomi & Haider, 2015; Zikopoulos et al., 2013). Lastly, value refers to 'the extent to which big data generates worthwhile insights and benefits through data analysis' (Fosso Wamba et al., 2015; Gantz et al., 2011).

Recently, Seddon and Currie (2017) incorporated two additional dimensions in their conceptualisation of the 7V's of BDA in seeking to explain the strategies and practices of high-frequency trading in financial markets: 'variability' and 'visualization'. 'Variability' represents the dynamic opportunities available for the interpretation of unstructured data in particular (Seddon & Currie, 2017, p. 302), while 'visualization' refers to the interpretation of the trends and patterns available in the data by utilising specific tools such as artificial intelligence to generate models (Seddon & Currie, 2017, p. 305). Having stated all these characteristics, big data can be seen as a combination of volume, variety, velocity, veracity, value, variability, and visualization that paves the way for organisations to gain competitive advantage.

In a similar vein, Lamba and Dubey (2015, p. 5) noted that BDA could be described as the "application of multiple analytic methods that address the diversity of big data to provide actionable, descriptive, predictive, and prescriptive results". As a summary of existing definitions, BDA facilitates and guides managerial decision-making processes by examining a large number of varied data sets to form new patterns of knowledge (Abell et al., 2017) and, thereby, contributes to sustainability and enables a transition towards the circular economy.

Although BDA is favourable for achieving sustainability-focused purposes and putting the circular economy understanding into practice, there is a need for a holistic approach to be implemented by organisations with their organisational culture. That is to say, transforming an organisation into a fully data-driven business is not only a technical issue but also a real leadership challenge for managers. Vidgen et al. (2017) highlighted several challenges faced by managers in extracting or creating value from BDA. In a similar vein, Sivarajah et al. (2017) also highlighted various challenges that should be addressed carefully in order to exploit the

high potential of big data. Some of these challenges can be divided into three major categories (Akerkar, 2014; Sivarajah et al., 2017; Zicari, 2014): data challenges (related to the data characteristics), process (challenges faced while processing and analysing the data), and management challenges (how to deal with issues such as privacy, security, data governance, data and information sharing, data ownership and ethics).

To overcome the aforementioned challenges, organisations should initially recognise the BDA landscape before making huge investments in big data tools (Sivarajah et al., 2017) and then analyse which classified generation (i.e., business intelligence, social media analytics, and mobile analytics) can become more value-adding for the targeted context. In fact, from the academic perspective, these generations of BDA significantly contribute to value creation processes in several ways; however, the differences in such underlying value creation mechanisms have not been extensively subject to scholarly inquiry.

More specifically, in the tourism and hospitality context, there is relatively limited research on the use of BDA with its links to certain outcomes, such as guest experience and satisfaction (Inanc-Demir & Kozak, 2019). Among these studies, Fuchs et al. (2014) concentrated on the ways in which BDA has an impact on knowledge generation for tourist destinations. Xiang et al. (2015) examined the meaning of BDA and text analytics in enhancing the guest experience and satisfaction with hospitality firms. Höpken et al. (2015) investigated a large set of data on reservations and guest feedback to support decision-makers in their decisions. By using the sentiment analysis technique, Menner et al. (2016) explored the impact of consumers' insights regarding services and destinations on their decisions to make their bookings. Qin et al. (2019) monitored the tourist flow and analysed the travel behaviour of tourists in scenic areas by adopting big data technology and Call Detail Record (CDR) data with cell phone real-time location information.

Overall, as can be seen from these studies, the empirical evidence on BDA in the tourism ecosystem mostly focuses on tourist or consumer behaviour aspects. More particularly, these discussed studies were predominantly conducted for marketing purposes in several sub-areas of the hospitality sector. Yet, what is lacking in the literature is the problematisation of the crucial need, to a great extent, for a holistic tourism ecosystem approach rather than framing the issue from a micro point of view. Thus, the current study sets out to fill this void.

Importance of RTDA for Tourism

Given the changing conditions in today's business environment, the decision-makers in a tourism ecosystem need a progressive picture of what previously happened, what is currently happening, and what will happen in the future. Since traditional data warehouses provide a historical picture with a lack of fresh data, managers seek real-time data, especially to analyse their current status and make predictions about future trends. As a concept, RTDA refers to research for which data revisions matter or for which the timing of the data releases is important in some ways (Rudebusch, 2002). Diebold and Rudebusch (1991) defined real-time analysis as the use of sequential information sets that were actually available as history unfolded. Before the developments in data collection and processing, experts assumed that data revisions did not affect structural modelling, policy analysis, or forecasting due to being small and random. Real-time analysis has shown that this assumption is inaccurate in dealing with this shortcoming, and data revisions matter in many unexpected ways (Croushore, 2011).

One of the prominent characteristics of an RTDA system is that it usually meets numerous demands within a limited time (Jamei et al., 2017, p. 2). In this sense, the structural characteristics of demand or the time limit that may be appropriate for the response impact the system's characteristics. Accessing real-time data at different points positively affects strategy, finance, and process design (Nagy et al., 2018, p. 6). In addition, streaming data analysis in real-time is becoming the fastest and most efficient way to obtain useful knowledge from what happens now, allowing organisations to react quickly when problems appear or to detect new trends that help improve their performance.

Relying on these characteristics, the importance of RTDA and real-time insights is increasing day by day due to high-volume data obtained from various types of resources. Indeed, mobile devices, customers, and social media users are constantly creating live content. Businesses are now seeking ways to respond to those requests in real time, manage their assets instantly, and inform employees when necessary. Organisations have so far used historical data to analyse trends and make strategic decisions. Yet, we have recently been able to simultaneously use instant data to make decisions through RTDA. In this respect, what distinguishes current datasets from earlier ones is automatic data feeds. There are now applications in which data are better modelled not as persistent tables but rather as transient data streams. Examples of such applications include network monitoring, web mining, sensor networks, telecommunications data management, and financial applications.

Innovative Business Models in the Tourism Ecosystem with Real-Time Insights

Innovative Business Models and Big Data

In the age of Industry 4.0, digitalisation is revolutionising the way business is conducted within industrial value chains through the use of big data-oriented notions, such as the Internet of Things (IoT) technologies, intensive data exchange, and predictive analytics. Exploiting digitalisation through business model innovation becomes a critical issue for making such a transition to advanced service business models (Parida et al., 2019).

Fundamentally, a business model describes the rationale of how an organisation creates, delivers, and captures value. Zott and Amit (2010, p. 216) conceptualised a firm's business model as a system of interdependent activities that transcends the focal firm and spans its boundaries. More comprehensively, business model innovation is defined as a change in a company's business model that is new to the firm and results in observable changes in its practices toward customers and partners (Bouwman et al., 2018, p. 105). Geissdoerfer et al. (2018, p. 405) defined business model innovation as the conceptualisation and implementation, acquisition of new business models, the diversification into additional business models, or the transformation from one business model to another. The transformation can affect the entire business model, the interrelations between the elements, and the value network.

In the course of new developments caused by digital technologies, business models and processes have changed tremendously, and new business models have emerged (Härting et al., 2018). For instance, new technology-oriented business models focus on big data, cloud computing, intelligent sensorisation, and embedded systems for innovative, smart goods and services (e.g., remote installation of maintenance or activation of product upgrades). Thus, disruptive innovation provides changes in the elements of a business model, which could also

be implemented partly in the actual business model. An organisation could test the new business model while the previous one still provides revenues (Ibarra et al., 2018, p. 9).

In the new business model structure, utilising big data increases hospitality managers' decision quality and contributes to strengthening customer-centric orientation in business models. With the exponential growth of big data, organisations need to improve the adaptability level of big data to build a business model that both includes complete customer information and meets the needs of its development (Ding, 2018, p. 171). This innovative action also increases the possibilities of utilising new skills and technologies with the big data flow. Thus, it becomes possible to benefit from the strong ecosystem impacts of innovative business models.

Big data technology creates opportunities for the travel and tourism industry to grow and invent new business models by analysing big data and spotting market opportunities (TravelCompute, 2019). Emergent business models are now shaped in the tourism field through innovation that can be referred to as innovative fluid tourism business models. Therefore, by following these advancements and transformative innovations, tourism and hospitality organisations use big data to resolve previously unanswerable questions to refine and optimise business processes and decision-making procedures in the pursuit of becoming competitive in the ecosystem.

Innovative Fluid Tourism Business Models & RTDA in Three Areas

The hospitality and travel industry generates a wealth of information about guests (Al-Gasawneh et al., 2022). Following are just some of the most well-known data the tourism sector regularly captures: country of origin, booking channel, time of booking (e.g., seasonal changes), lead time, the room rate for the booking, type of room booked, length of stay, responses to marketing campaigns and discounts, direct email marketing, competitor performance (e.g., occupancy), destination data (e.g., tourist arrivals, tourist expenditure, room nights). Recently, new data sources have come to the forefront continuously with the inclusion of social media (listen to what the market is saying about the firm and its competitors, watch for spikes in traffic and analyse this: is it the result of the firm’s marketing campaign, its competitor or destination?), review data from sources (such as Tripadvisor, Priceline or Orbitz, customer data from other sources for purchases in other sectors), search engine traffic (such as the use of google analytics to see where firm’s web traffic is coming from (Eye for Travel, 2015).

Big data, advanced analytics, and artificial intelligence solutions are now diffusing across industries (Fielt et al., 2018, p. 1). Large IT companies such as Google, Amazon, Facebook, and Apple offer communication solutions in almost all areas - including tourism. Google, for example, provides the application of Google trips, where the user exploits the extensive database of the search engine giant. With the users' consent to access their personal data combined with existing data obtained by Google, the application analyses the mail traffic and the Google calendar so that flight data and destinations are available and additional journeys and offers can be suggested (European Open Data Portal, 2019).

However, recent tourism research has mainly focused on technological development and relatively less on the new business models emerging through integrating those technological innovations (Ibarra et al., 2018, p.5). The increasing availability of data and the growing capability to exploit them with analytics has sparked a new set of discussions, though: it is

claimed that data and analytics bring to bear entirely new "data-based" or "data-driven" business models. However, there is neither a common understanding of these business models nor how existing business models are transformed into those (Schüritz & Satzger, 2016, p. 1).

The growing importance of data and analytics in a broad range of industries has led to increased attention to business model literature. The question of how to capture the business potential associated with data drives scholars to explore the impact of data and analytics on the business model concept. However, little research has been conducted on how an organisation should enrich its existing business model with data or develop an entirely new, data-driven business model (Hunke et al., 2017, p.1).

Tourism companies now have the opportunity to promote new business models related to tourism based on the data economy (TravelCompute, 2019). Exploiting digitalisation goes hand-in-hand with business model innovation, which requires novel offerings and processes that define how value is created, delivered, and captured between providers, guests, and other value chain actors (Parida et al., 2019, p.2). Machine learning, the IoT, and similar developments require developing new capabilities to succeed in data management. Tourism businesses that cannot capture and analyse the data in real time will likely fall behind the competition. Therefore, they should renew their business models towards the dynamic models that successfully conduct RTDA.

The opportunities in data analytics revolve around issues using real-time data for real-time decision-making. The value of data does not come from collecting it but from contextualising it and understanding what is most relevant to the tourism business (Amadeus, 2019). It is unlikely to incorporate the huge amount of (real-time) data generated by business processes, social, mobile, or sensor data via the traditional information technology architecture (Naous et al., 2017, p. 489). While RTDA offers invaluable opportunities for flexible production, efficiency, and cost savings, it will also ensure high guest satisfaction with customised services in the tourism and hospitality industry.

RTDA forces the structure of business models to change significantly. Visionary business models should benefit from RTDA since they will help to overcome the weaknesses in the decision-making process. Real-time data enable business models to respond to current developments. The impact of data processing speed on decision quality may create competitive and dynamic business models. Such models can refer to structures, operations, and results as fluid business models.

Fluid operating models using real-time data will be the business models of the future of tourism. This fluidity is also reflected in the business model structure, which is more dynamic and flexible with the support of RTDA and can be called a new fluid state in which data formation is synchronous with the model's response. These fluid business models that are strong in value creation and other business model elements are destructive. They can facilitate the creation of more beneficial relationships with stakeholders in the tourism ecosystem. The tourism businesses applying a fluid business model will improve their ability to propose new values and increase the competence of the business model to generate revenue and arrange the key resources to create more added value. As a result, destructive fluid business models can achieve high customer and guest benefits through increased stakeholder collaboration.

One of the most important principles in data management is accuracy and timeliness. Delayed analysis damage the accuracy of the data. When businesses analyse the data in real

time, they can determine the situation closest to reality. The rapid growth and diversification of data sources, and the insignificant dimensions of the amount of data, are now among the weakest data storage points. A large amount and variety of stored data that the tourism business model cannot analyse in time will lose its value after a while. Therefore, tourism business models should have a philosophy based on RTDA.

RTDA does not use data based on past activities and events. Instead, it uses data describing what's happening right now. Thus, it supports the fluid structure of business models and increases the chance of success. This success is related to the real-time analysis of big data. Fluid business models can perform real-time big data analysis in two ways: first, by analysing the flowing data simultaneously and in large quantities; second, it can do this by querying the changes in the flow stream.

RTDA varies in terms of the sectoral characteristics and the analysis time according to the nature of the products. For example, autonomous cars analyse a wide variety of data in milliseconds. The use of RTDA in tourism businesses can vary. Yet, by adopting the position-based approach, three categories can be noted: Indoor Area, Near and Wide Area, and Remote Area. In this respect, this paper highlights the importance of these positions for using RTDA and discusses these concepts with their distinctive features.

Indoor Area (Plant Context / Instant Response)

RTDA on consumer mobility and service preferences is positioned within tourism facilities. These analyses relate to predicting service preferences and concentration in physical areas. For example, consider the data flowing from sensors at various points in a five-star resort. First, the guests' location information is obtained without privacy violation and identification. On the other hand, this location data provides information depending on the time, activities, and special preferences about the concentrations within the facility. The management can perform different activities by evaluating instant and fluid data at the appropriate time. For example, when the density at the beach turns towards the hotel building, a contest can be organised at the bar on this route. Or, if guests are returning from the wine house event, head towards the lobby bar, and an instant late-night outdoor party can be arranged. It is important to note that the facility management has a dynamic infrastructure and operating speed that can quickly offer alternatives. For this purpose, appropriate packages should be prepared for these cases. These applications improve agile operation habits through RTDA.

Near and Wide Area (Close Context / Short Range of Interest- Reaction in Appropriate Range of Interest)

RTDA on consumer mobility and service preferences is positioned outside and close to the facility. For example, a restaurant business uses IBeacon or similar passive digital detection technology to communicate between smart devices. The restaurant can identify potential guests nearby by utilising this technology. In this way, it can offer surprise offers based on instant data. This method applied on a consumer basis can be enhanced by the RTDA of a large number of guests. Suppose this restaurant also uses data from intelligent city-based sensors. Sensitive data flow is provided by the sensors and smart devices in the destination. With RTDA, information such as weather, traffic, noise, and heat maps of regional concentration is accessible.

The restaurant can offer guests new, personalised, and surprise products and services with RTDA, digital channels, and smart device support. Assume that traffic density and weather cause drivers to change directions, and most choose the route close to the restaurant. This change can offer an opportunity for the restaurant. The change of direction can help many potential guests get closer to the restaurant. The restaurant can evaluate this instant data quickly and deliver its offers to the guests in close and wide areas. Besides, the agile activity structure for the restaurant business can be improved with this new understanding of the management of the restaurant menu, staff, and stocks.

Remote Area (Beyond Destination / Wide Range of Interest-Optimal Time Response)

RTDA on consumer mobility and service preferences is positioned as the whole area beyond the destination boundaries. The flow of these data to tourism enterprises can be seen by two methods. First, is the flow of data in the network structure of global-scale tourism enterprises? The second is acquiring services from information companies that provide RTDA services.

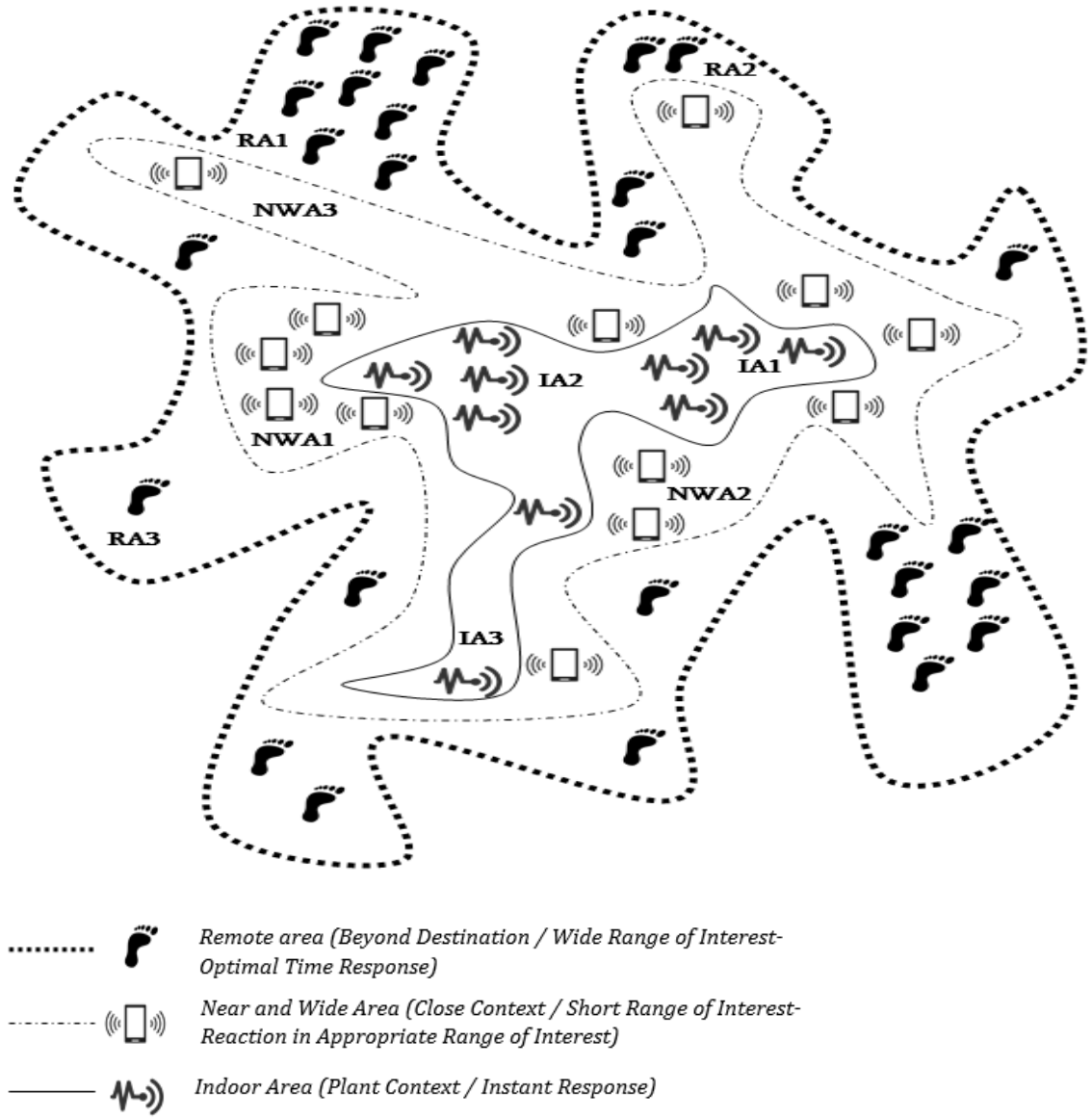
Remote area RTDA is wider than the first two analyses as the range of interest. Monitoring tourist data on a global scale makes this range even more comprehensive. In this context, social media, climate, community, and urban data are analysed globally. Indeed, this analysis follows the digital footprints of tourists travelling worldwide. Tracking digital footprints can provide quick and critical information on trends that facilitates agile responses from tourism enterprises. For example, airline companies can benefit from RTDA demographic-based tourist movements. These data vary from travel location selection to flight hours, from airport densities to airport service points.

The use of heat maps that show tourists' real-time mobility at airports and tourist destinations can be given as an example. Another example is social media listening, which uses the power of crowdsourcing. RTDA, including social media listening, facilitates airline companies to monitor and respond to developments globally. Especially open data movement creates a suitable source for this kind of analysis. Initiatives and approaches to standardise real-time data flow in tourism exist at the European level (European Data Portal, 2019).

Figure 1 represents three areas for an exemplary international large-scale hotel business; Remote area (RA-Beyond Destination / Wide Range of Interest-Optimal Time Response), Near and Wide Area (NWA-Close Context / Short Range of Interest-Reaction in Appropriate Range of Interest), and Indoor Area (IA-Plant Context / Instant response). The purpose of drawing the fields in a wavy form rather than a straight line is to show the dispersion of the fields (especially in terms of digital data), flexibility, and interaction density differences. Three different points are specified for each area (e.g., RA1, RA2, and RA3).

Figure 1

Response Based Area Conceptualization for Fluid Business Model



Remote area (RA-Beyond Destination / Wide Range of Interest-Optimal Time Response), expressed in bold and dotted on the outermost area, refers to where the hotel follows customer digital footprints. RA refers to the global tourism ecosystem outside the destination's borders where the hotel business operates. The hotel business monitors its digital footprints in real-time from many different channels that make up the new media within RA. RA1 marks the peak of interaction for the customer's digital footprint. RA1 includes footprints left by many customers during digital interactions with the hotel and data that require action within the optimal response time in real-time data (booking.com). On the contrary, RA3 refers to an area where interaction occurs much less frequently (for example, the hotel's web page).

Near and Wide Area (NWA-Close Context / Short Range of Interest-Reaction in Appropriate Range of Interest) refers to where the hotel monitors and evaluates real-time data on a destination basis. NWA1 regionally refers to channels where real-time data generation and sharing is intense and indicates high interaction (for example, digital channels where local public administration units share regional data). NWA3 shows interaction relatively less

frequently than other points (for example, digital channels where non-governmental organisations share data infrequently). NWA1 area will be of great importance for the hotel business to continue its activities competitively and in real-time tracking opportunities or threats. It is critical to evaluate the data shared by the local public administration in real-time and react within an appropriate time frame on local daily regional data sharing, decisions affecting tourist movements, regional tourist regulations, or similar issues.

When the point where RA1 is located in Figure 1 is analysed, the interaction density and the value of the transitions between the field layers can be seen better. The RA1 region exhibits a density indicating that some important developments will be closely related to the hotel business. At this point, the interaction seems extremely strong. This intensity may herald a development based on the preference for sustainability-themed hotel businesses in the tourism ecosystem. However, when the NWA3 region is examined, there is no interaction regarding this real-time data density in the global tourism ecosystem of the destination. When evaluated in terms of transitions between areas, it seems that the local authority and the destination management stakeholders will not successfully react to real-time data at an appropriate time. As the response time increases in the interaction of RA1 and NWA3, it seems likely that both the destination and the hotel business will lose their competitiveness in the global tourism ecosystem.

Considering RA3 and NWA1 in terms of the interactions in question, it can be interpreted that there is another striking improvement. It can be stated that this is an important touristic development that will probably gain value in terms of the global tourism ecosystem in the near future. This development may be related to a local and sustainable-based touristic structure that is very valuable today. The intensity experienced in NWA1 indicates a development in the NWA where the hotel business must respond appropriately regarding real-time data response time.

The interaction seen in the IA2 and NWA1 domains can be an example of responding to destination-based real-time data in a timely manner. For an event organised in the destination, the sample hotel business should develop a response in an appropriate time period for both its existing guests and the guests who are likely to request the services of the hotel business within the scope of this event.

The IA field in the centre indicates the situation related to immediate reaction (sensors, etc.) by monitoring the customers within the hotel business (within legal conditions). In the example hotel, customers are concentrated in IA1 and IA2 areas. Suppose the concentration in the IA1 area does not create added value for the extra sales of the hotel. In that case, the hotel can make an instant and attractive service announcement and presentation by giving an immediate reaction (their setup and basic needs have been completed beforehand) to direct the guests to the IA3 area. It should be noted that such services planned and announced to the guests will not have a satisfactory effect on controlling the said distribution.

It will be of great importance for hotel businesses to meticulously analyse the interactions between the RA, NWA, and IA domains based on real-time data analysis and reveal actions based on the results of this analysis and taken within appropriate reaction times. The integration of real-time data obtained globally (macro-RA), destination-based (me-so-NWA), and in-hotel (micro-IA) will be critical in this respect.

Conclusion

Given the dynamic or instantaneous structure of the tourism ecosystem that requires the same qualifications of innovative business models, we argue that it is no longer possible for the stakeholders of the tourism ecosystem to use static models that collect, store, analyse data and make decisions accordingly. In fact, today's recent challenges brought by emerging concepts (e.g., circular economy) compel organisations to move beyond a linear mindset by offering technological and innovative solutions in practice (Mahroof et al., 2022). In this respect, especially in the tourism ecosystem, innovative business models that use instant data offer a fluid structure that provides continuous, multiple, and variable decisions with RTDA. For this reason, these business models can be called instant (snap) or fluid (hot) business models.

In the tourism ecosystem, learning from the tourist experience has enriched the literature and increased the diversity of stakeholders. One of the driving forces of this enrichment is the impact of technology and innovation on the tourist experience. The data provided by tourists reach a huge amount with the frequent use of information and technology. In addition to smart systems and social media channels, the open data movement also affects the amount and quality of data collected. However, all these developments create two important problems regarding the data collected in the tourism ecosystem. First, the data stored in large proportions cannot be used in a timely manner, and the importance of its availability is lost to a considerable extent. Second, the extraction and analysis of large amounts of non-specific data cause the loss of time and money.

This paper highlights that the real-time analysis of macro (e.g., countries), meso (e.g., destinations), and micro (e.g., tourists) data obtained from the tourism ecosystem is vital for the development of innovative business models. Analysing instant data within time periods ranging from milliseconds to hours and converting it into a structured database suitable for decision-making form the basis of a fluid business model. These innovative business models facilitate the offerings of individualised services and provide increased cooperation between stakeholders using open innovation opportunities in the ecosystem.

Moving from the macro-level to the micro-level in the tourism field, designing a business model only for a specific destination is inadequate. Instead, it should be adapted to the global changes in the tourism ecosystem. This is an area where it is challenging for businesses to achieve success alone. To overcome this challenge, we strongly argue that businesses should develop a relationship per the open innovation strategy to include the interests of diverse stakeholders in their business environment.

Conceptually, open innovation is a system that promotes collaboration with people and organisations where inflows and outflows of knowledge can be included to enrich the business environment. In this model, for achieving success, the necessity for management to adapt competencies to digital transformations in this era is a requisite, as Petry (2018) pointed out. In this respect, since digital leadership is regarded as a mixture of the transformational leadership type and digital technology (De Waal et al., 2016), digital leaders of innovative organisations need primarily to possess digital transformation mindsets (AlNuaimi et al., 2022). By doing so, digital leaders can pave the way for inspiring and empowering people working in their organisations and establishing successful business models.

Despite the fact that digital leadership is advantageous as it enables access to available resources and generates techniques for equal access with the respective stakeholder groups

(Aldawood et al., 2019), it also faces critical challenges in organisations. For instance, with the Industry 4.0 developments, identifying digital skills and determining whether white or blue collar employees should still be recruited for several tasks have become more challenging for digital leaders, especially when there is a lack of skilled workforce but a need for a specialised management in some contexts (Kucukaltan et al., 2022). In a similar vein, more recently, during the Covid-19 pandemic, leading teams remotely has become another challenging task for such decision-makers in organisations. Accordingly, given the fact that tourism is a service and labour-intensive field, there are still some blurry points for leaders, especially digital leaders, to disambiguate. Nevertheless, they can achieve their desired success by using a business model that exploits RTDA in the tourism ecosystem. Since it inevitably requires an innovative business model, the further research question to be responded to is: How and under what conditions can a fluid business model be structured based on RTDA?

The following critical issue for this innovative model is the timing and the scope of data. Indeed, the model to be formed as a result of innovation should consider the needs of various stakeholders and ensure the flow of real-time data. In creating fluid business models based on RTDA, cloud computing service models, such as IaaS, SaaS, or PaaS, come into play. Working with relevant businesses for services as the key partners of the model, such as data from the open information movement, social media listening, and heat maps is critical. The fluidity of the business model can be ensured by RTDA results obtained from these organisations.

In the fluid business model, classifying key partners such as data flow, operations, support services, and creative services is paramount. Fluid business models add digital stakeholders to the tourism ecosystem, and a real-time database becomes one of the most critical sources. An instant changing resource definition replaces the classic source definition. Therefore, this fluidity becomes an image of RTDA instantly. The operating model should be able to adapt these snapshots quickly (at varying speeds). Thus, these developments tend to positively affect other key internal resources (e.g., employees, equipment, and finance) and human resource planning and management of tourism businesses for a sustainable workplace using Industry 4.0 drivers (Farooq et al., 2021).

The value proposition of the business model, characterised by speed, customisation, and surprise, is also fluid. In reality, the fluid business model primarily emphasises the ability to react quickly to consumers' immediate demands. Another significant change in the fluid business model based on RTDA can be experienced in customer segments. Using a fluid business model, tourism organisations keep existing customer segments that may change depending on the data flow (month, week, day, or even hours). Therefore, the customer segment of the fluid business model is divided into two parts: the "medium and long" term and the "short and very short" term. As a result, fluid business models based on RTDA are the future business model for tourism and hospitality institutions.

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References

Abell, J. A., Chakraborty, D., Escobar, C. A., Im, K. H., Wegner, D. M., & Wincek, M. A. (2017). Big data-driven manufacturing—Process-monitoring-for-quality philosophy. *Journal of Manufacturing Science and Engineering*, *139*(10), 1–12.

Abbu, H., Mugge, P., Gudergan, G., Hoeborn, G., & Kwiatkowski, A. (2022). Measuring the Human Dimensions of Digital Leadership for Successful Digital Transformation: Digital leaders can use the authors' Digital Leadership Scale to assess their own readiness and ability to accelerate digital transformation. *Research-Technology Management, 65*(3), 39–49.

Akerkar, R. (2014). *Big data computing*. Florida, USA: CRC Press, Taylor & Francis Group.

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment?. *International Journal of Production* Economics, *182*, 113–131.

Al-Gasawneh, J. A., AlZubi, K. N., Anuar, M. M., Padlee, S. F., ul-Haque, A., & Saputra, J. (2022). Marketing performance sustainability in the Jordanian hospitality industry: The roles of customer relationship management and service quality. *Sustainability*, *14*, 1–25.

Aldawood, H., Alhejaili, A., Alabadi, M., Alharbi, O., & Skinner, G. (2019, July). Integrating digital leadership in an educational supervision context: A critical appraisal. *International Conference in Engineering Applications (ICEA)*, 1–7. IEEE.

AlNuaimi, B. K., Singh, S. K., Ren, S., Budhwar, P., & Vorobyev, D. (2022). Mastering digital transformation: The nexus between leadership, agility, and digital strategy. *Journal of Business Research*, *145*, 636–648.

Amadeus (2019). *Defining the future of travel through intelligence.* https://amadeus.com/documents/en/travel-industry/white-paper/defining-the-future-of-travel-through-intelligence1.pdf (accessed: 14 April 2019).

Baesens, B., Bapna, R., Marsden, J. R., Vanthienen, J., & Zhao, J. L. (2014) Transformational issues of big data and analytics in networked business. *MIS Quarterly*, *38*(2), 629–631.

Bouwman, H., Nikou, S., Castillo, F. J. M., & Reuver, M. (2018). The impact of digitalization on business models. *Digital Policy, Regulation and Governance*, *20*(2), 105–124.

Brynjolfsson, E., & McElheran, K. (2016). The rapid adoption of data-driven decision-making. *American Economic Review*, *106*(5), 133–39.

Chen, C., Feng, Y., & Shen, B. (2022). Managing labor sustainability in digitalized supply chains: A systematic literature review. *Sustainability*, *14*(7), 1–19. https://doi.org/10.3390/su14073895

Chen, H., Chiang, R. H. L., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly*, *36*(4), 1165–1188.

Croushore, D. (2011). Frontiers of real-time data analysis. *Journal of Economic Literature*, *49*(1), 72–100.

Davenport, T. H. (2014). How strategists use "big data" to support internal business decisions, discovery and production. *Strategy and Leadership*, *42*(4), 45–50.

de Camargo Fiorini, P., Seles, B. M. R. P., Jabbour, C. J. C., Mariano, E. B., & de Sousa Jabbour, A. B. L. (2018). Management theory and big data literature: From a review to a research agenda. *International Journal of Information Management*, *43*, 112–129.

De Waal, B., van Outvorst, F., & Ravesteyn, P. (2016). Digital leadership: The objective-subjective dichotomy of technology revisited [Paper presentation]. The *12 th European Conference on Management, Leadership and Governance ECMLG 2016* (p. 52).

Diebold, F. X., & Rudebusch, G. D. (1991). Forecasting output with the composite leading index: A real-time analysis. *Journal of the American Statistical Association*, *86*(415), 603–610.

Ding, R. (2018). Study on Business Model Innovation Based on Big Data. *2018 International Conference on Education, Management and Social Science (EMSS 2018)*, China, 170–173.

Dong, J. Q., & Yang, C. H. (2020). Business value of big data analytics: A systems-theoretic approach and empirical test. *Information & Management*, *57*(1), 103–124.

Duan, Y., Cao, G., & Edwards, C. S. (2020). Understanding the impact of business analytics on innovation. *European Journal of Operational Research*, *28*(3), 1–14.

European Open Data Portal (2019). *How Open Data can sustainably improve the cooperation in tourism sector*. https://www.europeandataportal.eu/ en/highlights/open-data-tourism (accessed 10 April 2019).

Eye for Travel (2015). *Bringing predictive analytics to the hotel industry*. https://www.eyefortravel.com/sites/default/files/1613_eft_predictive_analysis_report_v3.pdf (accessed: 12 April 2019).

Farooq, K., Yusliza, M. Y., Wahyuningtyas, R., Haque, A. U., Muhammad, Z., & Saputra, J. (2021). Exploring challenges and solutions in performing employee ecological behaviour for a sustainable workplace. *Sustainability*, *13*, 1–19.

Fielt, E., Westerveld, P., Desouza, K., & Gable, G. (2018). Business model innovation and strategic transformation when confronting digital disruption: The case of data-driven business models for professional services. *Australasian Conference on Information Systems*, Australia, 1–7.

Fosso Wamba, S., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, *165*, 234–246.

Fuchs, M., Höpken, W., & Lexhagen, M. (2014). Big data analytics for knowledge generation in tourism destinations: A case from Sweden. *Journal of Destination Marketing & Management*, *3*(4), 198–209.

Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management*, *35*(2), 137–144.

Gantz, J., Reinsel, D., & Gantz, B.J. (2011). Extracting value from chaos. *IDC Review*, *1142*, 1–12.

Geissdoerfer, M., Vladimirova, M., & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of Cleaner Production*, *198*, 401–416.

Goes, P. B. (2014). Big data and IS research. *MIS Quarterly*, *38*, 3–8.

Härting, R. C., Reichstein, C., & Schad, M. (2018). Potentials of digital business models – Empirical investigation of data driven impacts in industry. *Procedia Computer Science*, *126*, 1495–1506.

Höpken, W., Fuchs, M., Keil, D., & Lexhagen, M. (2015). Business intelligence for cross–process knowledge extraction at tourism destinations. *Information Technology & Tourism*, *15*(2), 101–130.

Hunke, F., Seebacher, S., Schüritz, R., & Illi, A. (2017). Towards a process model for data-driven business model innovation [Paper presentation]. The *19th IEEE Conference on Business Informatics*, Greece, 150–157.

Ibarra, D., Ganzarain, C., & Igartua, J. I. (2018). Business model innovation through industry 4.0: A review. *Procedia Manufacturing*, *22*, 4–10.

Inanc-Demir, M., & Kozak, M. (2019). Big data and its supporting elements: Implications for tourism and hospitality marketing. In M. Sigala, R. Rahimi, & M. Thelwall (Eds.), *Big data and innovation in tourism, travel, and hospitality: Managerial approaches, techniques, and applications* (pp. 213–223). Chalm: Springer.

Jamei, E., Mortimer, M., Seyedmahmoudian, M., Horan, B., & Stojcevski, A. (2017). Investigating the role of virtual reality in planning for sustainable smart cities. *Sustainability*, *9*(11), 1–16. https://doi.org/10.3390/su9112006

Jin, J., Gubbi, J., Marusic, S., & Palaniswami, M. (2014). An information framework for creating a smart city through internet of things. *IEEE Internet Things Journal*, *1*(2), 112–121. https://doi.org/10.1109/JIOT.2013.2296516

Karaszewski, R., Modrzynski, P., & Modrzynska, J. (2021). The use of blockchain technology in public sector entities management: An example of security and energy efficiency in cloud computing data processing. *Energies*, *14*(7), 1–19. https://doi.org/10.3390/en14071873

Kucukaltan, B., Saatcioglu, O.Y., Irani, Z., & Tuna, O. (2022). Gaining strategic insights into Logistics 4.0: Expectations and impacts. *Production Planning & Control*, *33* (2-3), 211–227.

Lamba, H. S., & Dubey, S. K. (2015). Analysis of requirements for big data adoption to maximize IT business value in reliability [Paper presentation]. The *4th International Conference on Infocom Technologies and Optimization (ICRITO)*, India, 1–6.

Lau, R. Y., Zhao, J. L., Chen, G., & Guo, X. (2016). Big data commerce. *Information and Management*, *53*(8), 929–933.

Lavalle, A., Teruel, M.A., Maté A., & Trujillo, J. (2020). Improving sustainability of smart cities through visualization techniques for big data from IoT devices. *Sustainability*, *12*(14), 1–17. https://doi.org/10.3390/su12145595

Mahroof, K., Omar, A., & Kucukaltan, B. (2022). Sustainable food supply chains: Overcoming the challenges with digital technologies. *International Journal of Productivity and Performance Management*, *71*(3), 981–1003.

McAfee, A., & Brynjolfsson, E. (2012). Big data: The management revolution. *Harvard Business Review*, *90*(10), 60–68.

Menner, T., Höpken, W., Fuchs, M., & Lexhagen, M. (2016). Topic detection: Identifying relevant topics in tourism reviews. *Proceedings of the International Conference of Information and communication technologies in tourism* (pp. 411–423). Spain.

Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: a systematic literature review and research agenda. *Information Systems and e-Business Management*, *16*(3), 547–578.

Mithas, S., Lee, M. R., Earley, S., Murugesan, S., & Djavanshir, R. (2013). Leveraging bigdata and business analytics [guest editors' introduction]. *IT Professional Magazine*, *15*(6), 18–20.

Nadkarni, S., Kriechbaumer, F., Rothenberger, M., & Christodoulidou, N. (2019). The path to the Hotel of Things: Internet of Things and Big Data converging in hospitality. *Journal of Hospitality and Tourism Technology*, *11*(1), 93–107. https://doi.org/10.1108/JHTT-12-2018-0120

Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of Industry 4.0 and the Internet of Things on the business strategy of the value chain - The case of Hungary. *Sustainability*, *10*(10), 1–25. https://doi.org/10.3390/su10103491

Naous, N., Schwarz, J., & Legner, C. (2017). Analytics as a service: Cloud computing and the transformation of business analytics business models and ecosystems [Paper presentation]. *25th European Conference on Information Systems (ECIS)*, Portugal, 1–16.

Ogbeide, G. C., Fu, Y. Y., & Cecil, A. K. (2020). Are hospitality/tourism curricula ready for big data? *Journal of Hospitality and Tourism Technology*, *12*(1), 112–123. https://doi.org/10.1108/JHTT-09-2017-0081

Qin, S., Man, J., Wang, X., Li, C., Dong, H., & Ge, X. (2019). Applying big data analytics to monitor tourist flow for the scenic area operation management. *Discrete Dynamics in Nature and Society*, Special Issue, 1–11.

Parida, V., Sjödin, D., & Reim, W. (2019). Reviewing Literature on Digitalization, Business Model Innovation, and Sustainable Industry: Past Achievements and Future Promises. *Sustainability*, *11*, 2–8.

Petry, T. (2018). Digital leadership. In K. North, R. Maier, & O. Haas (Eds.), *Knowledge management in digital change* (pp. 209–218). Springer: Cham, Switzerland, ISBN 9783319735467.

Rosario, A. T., & Dias, J. C. (2022). Sustainability and the digital transition: A literature review. *Sustainability*, *14*(7), 1–18. https://doi.org/10.3390/su14074072

Rudebusch, G. D. (2002). Assessing nominal income rules for monetary policy with model and data uncertainty. *Economic Journal*, *112*, 402–32.

Schüritz, R., & Satzger, G. (2016). Patterns of data-infused business model innovation. *IEEE Conference on Business Informatics (CBI)* (pp.1–10). https://doi.org/10.1109/CBI.2016.23

Scuotto, V., Nicotra, M., Del Giudice, M., Krueger, N., & Gregori, G. L. (2021). A microfoundational perspective on SMEs' growth in the digital transformation era. *Journal of Business Research*, *129*, 382–392.

Seddon, J. J., & Currie, W. L. (2017). A model for unpacking big data analytics in high-frequency trading, *Journal of Business Research*, *70*, 300–307.

Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, *70*, 263–286.

TravelCompute. (2019). *Big Data for travel & tourism*. https://travelcompute.com/big-data-for-travel-tourism/ (accessed 10 April 2019).

Vidgen, R., Shaw, S., & Grant, D. B. (2017). Management challenges in creating value from business analytics. *European Journal of Operational Research*, *261*(2), 626–639.

Wamba, S.F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. I*nternational Journal of Production Economics*, *165*, 234–246.

Wang, Y., Kung, L., & Byrd, T. A. (2018). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. *Technological Forecasting and Social Change*, *126*, 3–13.

White, S. (2015). "Study reveals that most companies are failing at big data.CIO.com", https://www.cio.com/article/242623/study-reveals-that-most-companies-are-failing-at-big-data.html (accessed 29 August 2022).

Xiang, Z., Schwartz, Z., Gerdes, J., & Uysal, M. (2015). What can big data and text analytics tell us about hotel guest experience and satisfaction? *International Journal of Hospitality Management*, *44*, 120–130.

Zicari, R. V. (2014). Big Data: Challenges and opportunities. in R. Akerkar (Ed.), *Big data computing* (pp. 103–128). Taylor & Francis Group, CRC Press, Florida, USA.

Zikopoulos, P., DeRoos, D., Parasuraman, K., Deutsch, T., Corrigan, D., & Giles, J. (2013). *Harness the power of Big Data: the IBM Big Data Platform*. McGraw Hill Professional. https://doi.org/10.1007/s13398-014-0173-7.2

Zott, C., & Amit, R. (2010). Business model design: an activity system perspective. *Long Range Planning*, *43*(2-3), 216–226.