A SYSTEMATIC LITERATURE REVIEW OF BUSINESS INTELLIGENCE FRAMEWORK FOR TOURISM ORGANIZATIONS: FUNCTIONS AND ISSUES

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ABSTRACT

Aim/Purpose	The main goal of this systematic literature review was to look for studies that provide information relevant to business intelligence's (BI) framework development and implementation in the tourism sector. This paper tries to classify the tourism sectors where BI is implemented, group various BI functionalities, and identify common problems encountered by previous research.
Background	There has been an increased need for BI implementation to support decision-making in the tourism sector. Tourism stakeholders such as management of destination, accommodation, transportation, and public administration need a guideline to understand functional requirements before implementation. This paper addresses the problem by comprehensively reviewing the functionalities and issues that need to be considered based on previous business intelligence framework development and implementation in tourism sectors.
Methodology	We have conducted a systematic literature review using the Preferred Reporting Items for Systematic Reviews and Guidelines for Meta-Analysis (PRISMA) method. The search is conducted using online academic database platforms, resulting in 543 initial articles published from 2002 to 2022.
Contribution	The paper could be of interest to relevant stakeholders in the tourism industry because it provides an overview of the capabilities and limitations of business intelligence for tourism. To our knowledge, this is the first study to identify and classify the BI functionalities needed for tourism sectors and implementation issues related to organizations, people, and technologies that need to be considered.

Findings	BI functionalities identified in this study include basic functions such as data analysis, reports, dashboards, data visualization, performance metrics, and key performance indicator, and advanced functions such as predictive analytics, trend indicators, strategic planning tools, profitability analysis, benchmarking, budgeting, and forecasting. When implementing BI, the issues that need to be considered include organizational, people and process, and technological issues.
Recommendations for Practitioners	As data is a major issue in BI implementation, tourism stakeholders, especially in developing countries, may need to build a tourism data center or centralized coordination regulated by the government. They can implement basic functions first before implementing more advanced features later.
Recommendations for Researchers	We recommend further studying the BI implementation barriers by employing a perspective of an adoption framework such as the technology, organization, and environment (TOE) framework.
Impact on Society	This research has a potential impact on improving the tourism industry's performance by providing insight to stakeholders about what is needed to help them make more accurate decisions using business intelligence.
Future Research	Future research may involve collaboration between practitioners and academics in developing various BI architectures specific to each tourism industry, such as destination management, hospitality, or transportation.
Keywords	business intelligence, framework, functionalities, literature review, tourism

INTRODUCTION

Tourism combines goods and service products, making it a unique activity. Tourism services and products result from collaboration between various organizations, so they need good supply coordination and management (SCM) to increase competitiveness in the tourism industry (Zhang et al., 2009). In general, tourism has the following problems: needs intense coordination with numerous other products/services, is perishable, is very reliant on the product's presentation and perception consists of several different components of the service (such as lodging, transport, food, food, and shopping), frequently faces high uncertainty of demand and more complex dynamics from partners due to intense competition among service providers (Zhang et al., 2009). The tourism industry is somewhat more complicated than other industries (such as manufacturing) attributed to the characteristics of its supply chain, such as information & coordination intensive (Zhang et al., 2009), in which the product and service are made up of a mixture of various products from different suppliers. These characteristics' implication remains a challenge to research and implement innovative business intelligence (BI) solutions for tourism sectors and expand knowledge in this field. Tourism is also a complex phenomenon where information and knowledge are essential to destinations' growth and competitiveness (Del Vecchio et al., 2018). Data and information are valuable resources for data-driven management in tourism and hospitality business units and organizations (Fuchs et al., 2013; Marine-Roig & Clavé, 2015). The data may relate to tourism organizations' inputs, outputs, and key performance indicators (Buhalis & Foerste, 2015; Tsaih & Hsu, 2018). However, the results provided by historically applied statistical surveys do not accurately reflect and acknowledge trends or perspectives for stakeholders in the tourism supply chain. Fortunately, business intelligence applications can be implemented to support business decisions as they can navigate complex data (structured or unstructured) from various data sources (survey or operational). They utilize the analytical method to convert data into executable actions to support better business strategy (Phillips-Wren & Hoskisson, 2014; Vajirakachorn & Chongwatpol, 2017).

The interest in reviewing business intelligence in the tourism sector is increasing. An example of these reviews is the one by Mariani et al. (2018). The authors systematically discuss to what degree hospitality and tourism academics are conscious of and are deliberately working on business intelligence and big data. They deeply explore the articles based on the following characteristics: the research subject, conceptual and theoretical characterization, data sources, data type and size, data collection methods, data analysis techniques, and data reporting and visualization (Mariani et al., 2018). Nyanga et al. (2020) presented a narrative analysis showing the importance of business intelligence (BI), particularly in tourism firms. It concludes that tourism is one sector that continues to benefit from implementing a BI system (Nyanga et al., 2020). Finally, a systematic literature review by Rodrigues et al. (2020) discusses business analytics usage in hospitality management. They found that significant business analytics trends are related to investigating the link between the success of BI implementation, organizational culture, and decision-making.

This paper aims to comprehensively review previous BI framework's development and implementation, focusing on the functionalities or features in the frameworks and issues related to organizations, people, and technologies that need to be considered. We found that with the increasing importance of using BI in the tourism industry, guidelines or recommendations based on previous studies are needed to provide an overview of the functions/features that must be implemented by tourism professionals, BI engineers, policymakers, or other related stakeholders. In addition, the issues commonly encountered in the implementation process also need to be understood so stakeholders can implement them successfully. Understanding the required features and possible issues is essential before successfully developing BI solutions for stakeholders in the tourism sector. Thus, the following research question is discussed in this study: what are the main functions to be included and issues that need to be addressed in BI implementation for tourism?

We conducted the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines for this systematic review. By completing the PRISMA checklists, we would like to let reviewers and readers know what we did and found to optimize the quality of reporting (Liberati et al., 2009). The rest of this paper is arranged as follows. Section 2 explains the overview of tourism, the BI system's overview, and its implementation in tourism. Section 3 addresses the methods for carrying out a literature review. Then, in Section 4, the literature review findings are clarified, accompanied by discussions in Section 5. Last, Section 6 addresses the conclusions of this study, including lessons learned, limitations, and future work.

THEORETICAL BACKGROUND
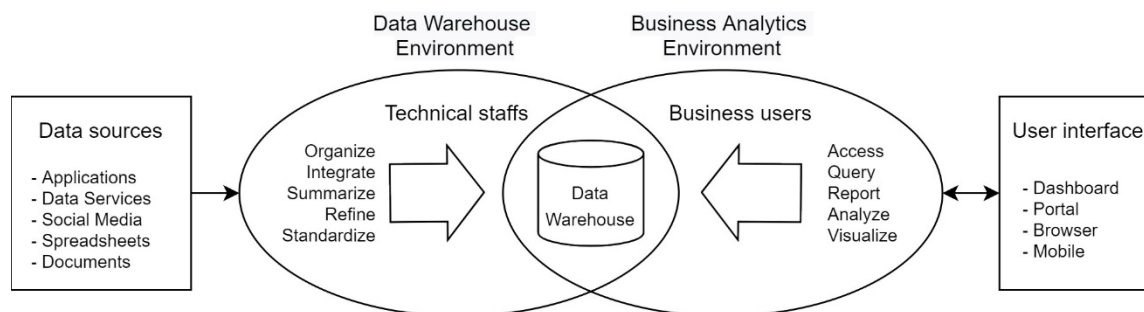
TOURISM

Tourism is characterized by the word "non-resident travel and stay". It is one of the most influential, rapidly expanding, and diverse economic sectors attracting external economic activity and overtaking other foreign trade categories. Tourism has proved to be an essential business sector globally, creating employment in formal and informal areas, improving the quality of life, and attracting foreign exchange (Meyer & Meyer, 2015). There are three critical components of tourism: 1) attraction/destination, i.e., natural or non-natural tourist sites, 2) lodging services, and 3) transport/travel services (Sinha et al., 2017). All components of tourism include a vast and complicated amount of information and knowledge essential for its growth and competitiveness (Vajirakachorn & Chongwatpol, 2017).

A tourism value chain from both physical and online providers is included in the tourism ecosystem. Tour operators, travel agents, airlines, transport operators, hotels, attractions, historic landscape excursions, and activity/shopping/entertainment operators are included in the physical provider (Piboonrungroj & Disney, 2015). Besides, many online service providers also play an essential role, such as online services (e.g., TripAdvisor, Google Map), transportation, online travel agents (e.g., Airbnb, Expedia, Booking), online payments, and social media platforms (Tsaih & Hsu, 2018).

BUSINESS INTELLIGENCE IMPLEMENTATION IN TOURISM

BI is a technology, tool, and software system that helps an organization collect data, automate, and produce information transformed into knowledge to make quality decisions (Nyanga et al., 2020). The business intelligence architecture typically consists of four main elements: data warehouse, business analytics, business performance management (BPM), and user interface (Sharda et al., 2018). As depicted in Figure 1, in typical BI implementation, technical staffs are responsible for preparing and managing data to become actionable information for business users.


Figure 1: Business intelligence implementation environment

This section provides some research on applying BI and analytics in tourism. One of the critical areas in BI research for tourism is functionality, such as data analysis, visualization, and forecasting, supported by the availability of data ready for use (Mariani et al., 2018). However, unfortunately, most research still occurs in developed countries such as the US, China, and European countries. Some of the reasons are the number of open data sites, the quality of data, and their usage are still minimal in developing countries (Schwegmann, 2012). However, some countries have already started developing, such as India (Sinha et al., 2017) and Thailand (Nanthaamornphong et al., 2020; Vajirakachorn & Chongwatpol, 2017). Some BI frameworks also do not explain the issues during implementation (Hlee et al., 2019; Marine-Roig & Clavé, 2015; Stylos & Zwiegelaar, 2019). Some others do not explain the privacy issue when retrieving data from other parties using web crawling techniques (Ramos et al., 2015, 2017), except for one study that mentions using data provided for academic purposes (Jimenez-Marquez et al., 2019). Also, some BI frameworks are not equipped with visualization front ends and only emphasize the data processing side (Malthouse et al., 2019; Ramos et al., 2015, 2017).

Several BI Frameworks are also still in a conceptual stage, so they still need to be further developed regarding the details of the realization of their implementation (Stylos & Zwiegelaar, 2019; Yan-Li & He-feng, 2016). Several studies also have explained detailed steps to implement the BI framework, from setting up business goals to creating actionable plans, but have only been implemented in a small scope for specific destinations such as festivals and amusement parks (Hlee et al., 2019; Vajirakachorn & Chongwatpol, 2017) and do not involve external data (Sinha et al., 2017).

METHODOLOGY

PRISMA was chosen in this study because it uses specific and accurate parameters that are key to mitigating unconscious prejudices and researchers' biases (Sharif et al., 2019). Figure 2 shows the flow diagram for the search result using PRISMA.
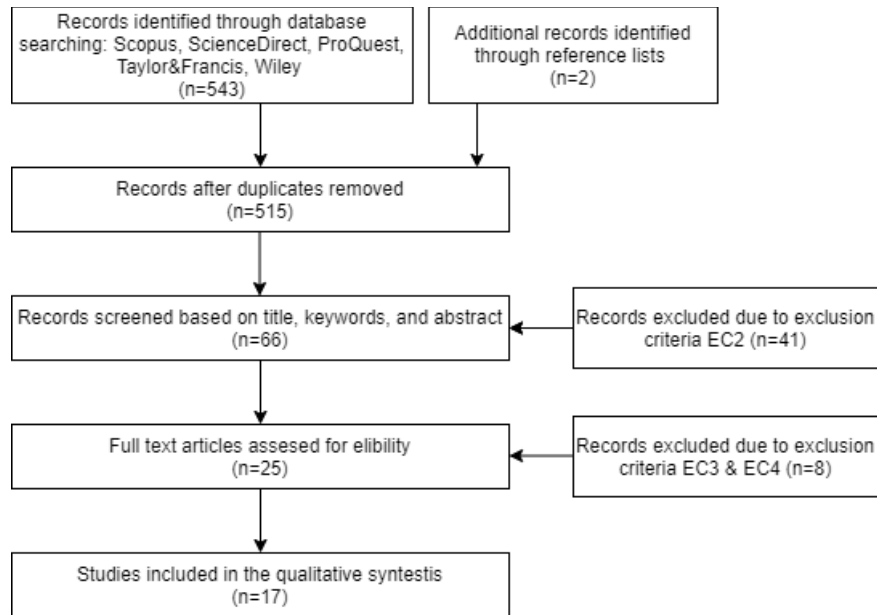
Figure 2: Flow diagram for search results

The result based on the inclusion of the time criteria from January 2002 until January 2022 and "Scientific Reviews" was 543 articles. Next, duplicated records were removed, resulting in 513 studies. These studies were screened based on the title, abstract, and keywords, resulting in 66 papers. Based on mutually agreed criteria by both authors, the first author eliminated one article that could not be fully accessible (EC1), 41 articles that are review articles, or articles that are not original research articles as they do not explain the methodology or do not explain the results of the study (EC2). The first author also removed eight articles that do not discuss functionalities or issues related to BI implementation or framework development (EC3). Finally, in this study, a total of 17 articles were chosen. The following section describes the eligibility criteria, search strategy, study selection, and data items.

ELIGIBILITY CRITERIA

Both authors defined the inclusion and exclusion criteria as the review guidelines for study selection. The inclusion criteria for this study are:

- IC1. The full-text article was available and written in English.
- IC2. Original research article.
- IC3. Published from January 2002 until January 2022
- IC4. The article discussed functionalities or issues in the business intelligence implementation or framework development for the tourism or hospitality industry.

Both authors defined the exclusion criteria for this study as follows:

- EC1. The full-text article was not available or not written in English.
- EC2. Review article or not original research article.
- EC3. Not relevant context: business intelligence implementation or framework development for tourism or hospitality.
- EC4. Not discussed functionalities or issues in the business intelligence implementation or framework development for the tourism or hospitality industry.

SEARCH STRATEGY

A systematic search of online scientific databases in ScienceDirect, Scopus, Taylor & Francis, ProQuest, and Wiley web platforms was conducted in January 2022. The search was made using several queries containing the keywords ("business intelligence" OR "big data" OR analytics) AND (tourism OR hospitality) AND (framework OR implementation OR functionality OR issue).

STUDY SELECTION

The selection of the study was carried out in the following stages:

1. A keyword search or search string was searched in each online database based on the search strategy section. Then, duplicated records were checked and removed.
2. The title and abstract of selected articles were selected based on eligibility criteria. Articles that did not comply with inclusion criteria were eliminated.
3. Articles not removed in the previous process were read in full to decide if they could be included in the analysis based on the eligibility criteria.

DATA ITEMS

Data collection was performed manually using a data extraction form. Information extracted from each article consists of:

1. Demography of papers chosen, including:
   - Countries involved in the study.
   - Purpose of the BI implementation or framework development.
   - Methods of the study.
   - Sources of the selected study.
2. Functionalities and issues in the BI implementation or framework development

Data item number 1 is intended to provide researchers or tourism organizations with details about where the BI framework has been developed or implemented in developed or developing countries and current research trends in this field. Data item number 2 aims to explain the BI's functionalities and issues that need to be considered in the framework development and implementation that might affect users' adoption.

RESULT

STUDY CHARACTERISTICS

Demographic data of previous research

This section explains the demographic data for the selected papers. This country's classification was based on the United Nations World Economic Situation and Prospects 2020. The selected articles showed that research on the BI framework for tourism was done in developed and developing countries, as shown in Figure 3. However, BI frameworks are implemented primarily in developed countries. Much research came from European countries, such as the UK, that proposes an intelligent hospitality ecosystem framework, a big data implementation framework, and a data value creation framework. Besides, studies from Portugal, Sweden, Spain, Greece, and Italy also made a significant impact in this area, such as proposing a Destination Management Information System (DMIS) (Fuchs et al., 2013), Hospitality Big Data Warehouse (HBDW) (Ramos et al., 2017), Data Analytics Framework (DAF) (Michele et al., 2019), UGC data mining and analytics (Marine-Roig & Clavé, 2015), and a framework for smart tourism on transportation (Moustaka et al., 2019). In Asian countries, we found research from China that proposes a framework for competitive intelligence in the hotel industry (Yan-Li & He-feng, 2016) and artificial intelligence in smart tourism (Tsaih & Hsu,

2018). In Thailand, we also noted some exciting research that proposes a Business Intelligence framework for festival tourism (Vajirakachorn & Chongwatpol, 2017) and the architecture of a smart city data platform in Phuket (Nanthaamornphong et al., 2020).
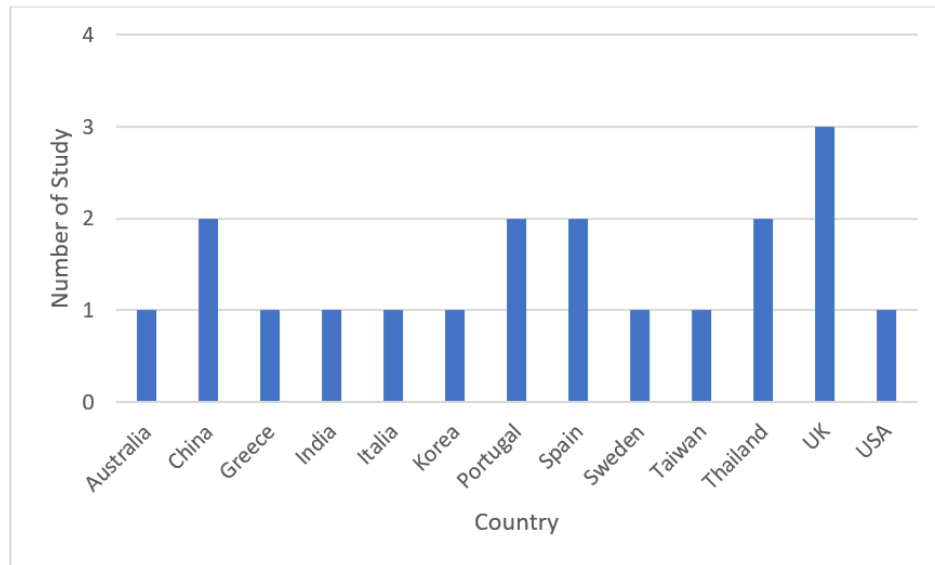
Figure 3: Implementing countries and amount of studies

Research methods of previous research

According to Table 1, the researcher's study methods include qualitative, a proposed design, and mixed methods.

Table 1: Methods of study

NO	METHOD OF STUDY	STAKEHOLDERS	PAPERS
1	Qualitative (i.e., interviews, case studies, and observations)	Tourism Destination Supplier, Tourist, Restaurant, Tour Operator, Hotelier, OTA, Government, Festival Tourism Organization, Road Passenger Transport Operators (RPTOs)	(Fuchs et al., 2013; Hlee et al., 2019; Michele et al., 2019; Moustaka et al., 2019; Sinha et al., 2017; Tsaih & Hsu, 2018; Vajirakachorn & Chongwatpol, 2017)
2	Quantitative (i.e., questionnaire surveys)	Destination management	(Marine-Roig & Clavé, 2015)
3	Proposed Design	Tour Operator, Transport Operator, Hotelier, OTA, Service Provider Platforms, Data Providers, DMO, Tourism Association	(Buhalis & Leung, 2018; Hamilton & Selen, 2008; Jimenez-Marquez et al., 2019; Malthouse et al., 2019; Ramos et al., 2015, 2017; Stylos & Zwiegelaar, 2019; Yan-Li & He-feng, 2016)
4	Mixed-Method	The tourism industry, Private organizations, Public organization	(Nanthaamornphong et al., 2020)

Table 2 shows the selected study source, including the conference sources and textbooks.

Table 2: Source of the selected study

NO	SOURCES (JOURNAL/CONFERENCE/BOOK)	PUBLISHER
1	Journal of Service Management	Emerald
2	Tourism Management Perspectives	Elsevier Ltd
3	Journal of Destination Marketing and Management	Elsevier Ltd
4	International Journal of Information Management	Elsevier Ltd
5	International Journal of Hospitality Management	Elsevier Ltd
6	International Journal of Information Systems in the Service Sector	IGI Global
7	International Journal of Grid and High-Performance Computing	IGI Global
8	e-Review of Tourism Research	Texas A and M University
9	Advances in Environmental Science and Energy Planning	CAB International
10	Tourism: An International Interdisciplinary Journal	SRCE
11	The Web Conference 2019	ACM
12	International Conference on Computer and Communications	IEEE
13	International Conference on Electrical Engineering/Electronics, Computer, Telecommunications, and Information Technology (ECTI-CON)	IEEE
14	International Conference on Electronic Business	AISNET
15	Communications in Computer and Information Science	Springer
16	Big Data and Innovation in Tourism, Travel, and Hospitality: Managerial Approaches, Techniques, and Applications	Springer

THE INTENDED ORGANIZATION OF BI FRAMEWORK DEVELOPMENT AND IMPLEMENTATION

Table 3 shows that most BI frameworks are developed and implemented to support destination management (6), tourism organization in general (5), and hotel management improvement (4). Only one implementation aims for the public sector (government) and transportation management.

Table 3: Intended organization of BI framework

CATEGORY SECTOR	DEFINITION	NUMBER OF STUDIES
Destination management	Management that includes organized actions to regulate a particular tourism territory's economic, socio-cultural, and environmental aspects.	6 (Fuchs et al., 2013; Hlee et al., 2019; Marine-Roig & Clavé, 2015; Nanthaamornphong et al., 2020; Tsaih & Hsu, 2018; Vajirakachorn & Chongwatpol, 2017)

CATEGORY SECTOR	DEFINITION	NUMBER OF STUDIES
Tourism organizations in general (unspecified)	Management that seeks to enhance operational efficiency and effectiveness in order to improve the organization's ability to deliver products and services	5 (Hamilton & Selen, 2008; Jimenez-Marquez et al., 2019; Malthouse et al., 2019; Sinha et al., 2017; Stylos & Zwiegelaar, 2019)
Hotel management	Management in the areas of lodging, dining, and general guest facilities to strengthen operations such as revenue management and formal leadership	4 (Buhalis & Leung, 2018; Ivanov, 2014; Ramos et al., 2015, 2017; Yan-Li & He-feng, 2016)
Public sector management	Management that plays a key role in strategic advice, creating opportunities to consult and cooperate with a dispersed private sector. It is tied to the federal, state, and local governments.	1 (Michele et al., 2019)
Transport management	Management that involves the movement of people to the places of tourist attractions from their places of residence	1 (Moustaka et al., 2019)

Destination management

Most BI Framework is developed for organizational learning at tourism destinations (Fuchs et al., 2013). The data can be collected from clients/tourists during their visits to a particular tourist destination as follows:

- Web-based data such as Structured and Unstructured Web Navigation, Booking, and Feedback (Fuchs et al., 2013).
- A questionnaire asks for demographic data, push & pull factors, perceived values & quality, and satisfaction (Vajirakachorn & Chongwatpol, 2017).
- Visitor's mobile application data: visitor's profile, visitor's co-creation process (physical evidence, review frequency), GPS-based visitor's mobile information (e.g., park entry, distance, visiting facilities), staying time at each facility (Hlee et al., 2019)
- Cash flow and logistics data (Tsaih & Hsu, 2018)
- User-generated content from user reviews/blogs (Marine-Roig & Clavé, 2015)
- BI framework can be helpful in the development of tourist destinations such as monitoring (Fuchs et al., 2013; Marine-Roig & Clavé, 2015; Vajirakachorn & Chongwatpol, 2017), knowledge exchange (Fuchs et al., 2013), learning process (Fuchs et al., 2013), market & issue insights (Hlee et al., 2019; Marine-Roig & Clavé, 2015; Nanthaamornphong et al., 2020), operation improvement (Tsaih & Hsu, 2018; Hlee et al., 2019), and optimizing tourism resources (Tsaih & Hsu, 2018).

Tourism organization in general

Some BI Frameworks are developed and can be implemented by companies in the tourism-related sector. The data is collected from multi-agents such as consumers (Hamilton & Selen, 2008; Jimenez-Marquez et al., 2019; Malthouse et al., 2019; Sinha et al., 2017), hotels (Hamilton & Selen, 2008;

Malthouse et al., 2019; Sinha et al., 2017), restaurants (Hamilton & Selen, 2008; Malthouse et al., 2019), tour operators (Hamilton & Selen, 2008; Malthouse et al., 2019), transport operator (Hamilton & Selen, 2008; Malthouse et al., 2019), associations (Stylos & Zwiegelaar, 2019), government (Stylos & Zwiegelaar, 2019), social network (Sinha et al., 2017), blogger (Sinha et al., 2017), reviewer (Jimenez-Marquez et al., 2019; Sinha et al., 2017), as well as third party data providers (Malthouse et al., 2019).

The BI framework can be helpful for organizational improvements, such as:

- Creation of high service offerings with higher customer customization based on their previous visit behavior (Hamilton & Selen, 2008; Malthouse et al., 2019; Stylos & Zwiegelaar, 2019)
- Increasing productivity in the tourism sector (Sinha et al., 2017)
- Providing global knowledge for the benefit of the industry about patterns and data trends (Stylos & Zwiegelaar, 2019)
- Capturing the overall impression of a business unit to recognize the company's current image according to the desires of its clients (Jimenez-Marquez et al., 2019)

Hotel management

Hotel management involves the management of anything related to the hotel industry. The BI framework is designed to help hoteliers make wiser choices by using logical, general, and timely data (Yan-Li & He-feng, 2016); such as understanding the consumer's behavior (Ramos et al., 2015, 2017), maximizing the revenue (Ramos et al., 2015, 2017), and anticipating competitor's behavior (Buhalis & Leung, 2018; Ramos et al., 2015), and improving strategies performance (Buhalis & Leung, 2018; Ivanov, 2014).

The data source can be obtained from:

- Internal data include rooms, feedback, review score, channel, section, guest origin, customer satisfaction, distinctive products and services, and marketing strategies (Buhalis & Leung, 2018; Ramos et al., 2015, 2017). Hotels can also implement an intelligent system to obtain data from sensors, content extractors, and beacons (Buhalis & Leung, 2018)
- External data in the form of opponents' data and environmental data
- Examples of information from opponents include presence, location, opening days, room types and prices, restaurant scales and numbers inside, bars, conference rooms, meeting facilities, network information, potential marketing tactics, financial results, specific sales networks, and staff changes (Ramos et al., 2015). Environmental data include politics, economy, law, the advancement of science and technology, and cultures (Yan-Li & He-feng, 2016).

Interestingly, research in the BI frameworks development or implementation aimed at hotel management is still rare despite their importance. There are numerous direct and indirect business associates and collaborators in the management of hotels. Every network member has comprehensive and detailed data to enrich their business research. However, no value can be generated without such data being available, evaluated, and supporting decision-making (Buhalis & Leung, 2018) that one can obtain in a business intelligence implementation.

Public sector management

The BI framework is introduced to enhance and simplify the interoperability and sharing of data between public administrations for government purposes and address the difficulties of channeling data stored in local public administrations into a single container (data lake) (Michele et al., 2019). Examples of data such as arrivals (number of hosted customers) and the visit duration (number of nights spent) can help the government have capacity measures regarding the number of accommodation facilities and related beds and rooms.

Transport management

Transport management in tourism includes the processes and structures used to handle tourist physical transportation needs and requirements. Data from vehicles, travelers, and social networks help transport operators arrange attractive and efficient packages, adjust demand-based service rates, and manage their resources effectively (Moustaka et al., 2019). Travelers would also profit from affordable pricing and the quality of services customized to their needs and desires by using tour data analytics. The tourist destination (such as a town) would benefit from a more comprehensive viewpoint, as its sights and culture will be advertised, attracting new tourists. New business activities will also be developed, and competitive advantages will be obtained, making it a popular tourist destination.

MAIN FUNCTIONS IN BI FRAMEWORKS FOR TOURISM

Based on the purposes identified in the previous section, we present functionalities found in the previous BI framework in Table 4. The table lists features from the simplest to the most complex but does not suggest a sequence of implementation.

Table 4: Basic functionalities in BI framework for tourism

FUNCTION	DESCRIPTION	IDENTIFIED IMPLEMENTATION
Data analysis	A data review, cleaning, transformation, and modeling method aimed at discovering valuable data, informing conclusions, and fostering decision-making	• Hotel (Buhalis & Leung, 2018; Ramos et al., 2017; Yan-Li & He-feng, 2016) • Destination (Fuchs et al., 2013; Hlee et al., 2019; Tsaih & Hsu, 2018; Vajirakachorn & Chongwatpol, 2017) • Travel and transport operator (Hamilton & Selen, 2008; Moustaka et al., 2019) • Tourism regulator (Malthouse et al., 2019; Marine-Roig & Clavé, 2015; Michele et al., 2019; Nanthaamornphong et al., 2020) • Tourism firms in general (Jimenez-Marquez et al., 2019; Sinha et al., 2017)
Reports and Dashboard	A visual display of key metrics and trends for records in an organization	• Destination (Fuchs et al., 2013; Hlee et al., 2019; Vajirakachorn & Chongwatpol, 2017) • Travel and transport operator (Hamilton & Selen, 2008); • Tourism regulator (Michele et al., 2019; Nanthaamornphong et al., 2020) • Tourism firms in general (Sinha et al., 2017)

FUNCTION	DESCRIPTION	IDENTIFIED IMPLEMENTATION
Data visualization	A graphical representation of data offers an interactive way to see and interpret trends, outliers, and patterns in data using visual components, such as charts, graphs, and maps.	- Destination (Fuchs et al., 2013; Hlee et al., 2019; Vajirakachorn & Chongwatpol, 2017) - Tourism firms in general (Jimenez-Marquez et al., 2019; Sinha et al., 2017) - Tourism regulator (Michele et al., 2019; Nanthaamornphong et al., 2020) - Transportation (Moustaka et al., 2019)
Performance metrics	Figures and data that reflect the behavior, expertise, and overall efficiency of an organization	- Hotel (Ramos et al., 2017; Yan-Li & He-feng, 2016) - Destination (Hlee et al., 2019; Vajirakachorn & Chongwatpol, 2017) - Tourism firms in general (Sinha et al., 2017)
Key Performance Indicator	Corporate executives use these metrics to monitor and evaluate critical variables to an organization's success. There are four main categories of KPIs that are primarily measured in the tourism sector: economic, product/service, customer, and brand	- Hotel (Ramos et al., 2017; Stylos & Zwiegelaar, 2019) - Tourism firms in general (Sinha et al., 2017) - Destination (Vajirakachorn & Chongwatpol, 2017)

Most BI solutions include simple (standard) features that more users need. These most common features are very important or necessary, and on which more advanced features depend. Such basic features are data analysis, reports, dashboards, data visualization, performance metrics, query, analysis, and key performance indicators (KPIs) (Badawy et al., 2016). However, as the business requirement grows, advanced BI solutions also need to be developed for the organization's needs on top of the basic ones, as shown in Table 5. Unlike the more common features that all team members can use daily, niche features are usually only used by selected teams or individuals.

Table 5: Advanced functionalities in BI framework for tourism

FUNCTION	DESCRIPTION	IDENTIFIED IMPLEMENTATION
Predictive analytics	Using modeling, statistics, machine learning, and data mining techniques, users can predict consumer behavior, forecast demand, and prepare strategies	• Hotel (Buhalis & Leung, 2018; Ramos et al., 2017; Stylos & Zwiegelaar, 2019) • Destination (Fuchs et al., 2013; Hlee et al., 2019; Vajirakachorn & Chongwatpol, 2017; Tsaih & Hsu, 2018) • Tourism firms in general (Jimenez-Marquez et al., 2019; Sinha et al., 2017) • Tourism regulator (Nanthaamornphong et al., 2020)
Trend indicators	Help users identify trends and identify irregularities in production, sales, and distribution lines	• Destination (Hlee et al., 2019) • Hotel (Stylos & Zwiegelaar, 2019)
Strategic planning tools	Enable users to develop high-level financial and organizational strategies based on past results and prospective objectives	• Destination (Vajirakachorn & Chongwatpol, 2017) • Hotel (Buhalis & Leung, 2018)
Profitability analysis	Help users to analyze the performance of an organization. The output can be divided into goods, clients, places, networks, and transactions.	• Destination (Vajirakachorn & Chongwatpol, 2017) • Hotel (Ramos et al., 2017)
Benchmarking	The method of contrasting company processes and efficiency indicators with other organizations' best and best practices in the field. Quality, time, and cost dimensions usually are calculated	• Destination (Hlee et al., 2019) • Hotel (Yan-Li & He-feng, 2016)
Budgeting and forecasting	Budgeting quantifies the probability of sales for a future timeframe that an organization wishes to reach. The financial forecast, on the other hand, predicts the number of sales or revenue that will be generated in the coming year	• Hotel (Buhalis & Leung, 2018)

It is necessary to decide which features are required and which are not necessary for the organization's needs. There are no precise rules about what features a company may want or need to implement, as it will depend on how far the company may handle the issues. Organizations may also be associated with more advanced features such as predictive analytics, trend indicators, strategic planning tools, profitability analysis, benchmarking, budgeting, and forecasting (Pribisalić et al., 2019).

ISSUES IN IMPLEMENTATION OF BI FOR TOURISM

In addition to the functionality and features described, some critical issues must be considered in implementing BI that might affect the adoption. The implementer must concentrate on three dimensions: organizational, people and process, and technology dimensions that have performed well for organizations or industries to achieve efficient BI implementations (Yeoh et al., 2008). Figure 4 shows the critical issues of BI implementation where some of these issues can relate and affect across dimensions.
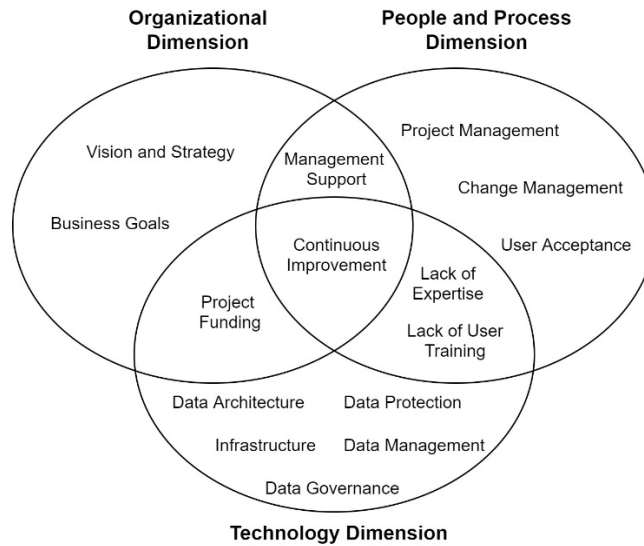
Figure 4: Critical issues of BI implementation in the tourism sector

One of the identified issues in implementing BI for the tourism domain is organizational-related issues. Organizational issues are related to organizational decisions supporting the implementation to be successful (Buhalis & Leung, 2018; Jimenez-Marquez et al., 2019; Nanthaamornphong et al., 2020; Vajirakachorn & Chongwatpol, 2017). As the BI team viewed organizational aspects as outside their direct control, they were regarded as more critical than technological considerations (Yeoh et al., 2008). For example, organizations need to define the vision and business goals in the first place (Vajirakachorn & Chongwatpol, 2017). Organizations also must specify the project schedule within the budget (Vajirakachorn & Chongwatpol, 2017).

Another issue of BI implementation for the tourism domain is related to people and processes. The people and process issues related to management's tasks and conditions to facilitate BI executions (Malthouse et al., 2019; Michele et al., 2019; Sinha et al., 2017; Vajirakachorn & Chongwatpol, 2017). The issues related to teamwork and individual members that can hinder work toward accomplishing the BI implementation and execution, for example, lack of expertise and proper project management to maintain the project continuously, could affect the success of BI implementation (Malthouse et al., 2019). The BI project should come from top management who understand what BI can do because the acceptance toward adopting such advanced technology and concepts is still not optimistic, and not all associates participate entirely in BI project experiments (Malthouse et al., 2019; Vajirakachorn & Chongwatpol, 2017). Thus, change management and user training should also be a concern of top management (Malthouse et al., 2019; Vajirakachorn & Chongwatpol, 2017).

Lastly, the technological dimension includes the practical fundamentals of the BI (Fuchs et al., 2013; Hamilton et al., 2008; Moustaka et al., 2019; Ramos et al., 2015, 2017; Sinha et al., 2017; Tsaih & Hsu, 2018; Vajirakachorn & Chongwatpol, 2017; Yan-Li & He-feng, 2016). Technology-related issues are the most common problems found in BI implementations. Around 60 percent of the project

time is allocated to data management, including planning, integrating, and cleaning data to ensure accuracy before implementing data analytics (Hamilton & Selen, 2008; Malthouse et al., 2019; Nanthaamornphong et al., 2020; Ramos et al., 2015, 2017; Sinha et al., 2017; Vajirakachorn & Chongwatpol, 2017). For example, it will take more time and effort when data comes from multiple sources with different formats. Moreover, processes specific to the tourism domain often have additional issues, such as the requirement of specific data types, data integration, and interoperability of external data (Rahman et al., 2016). Data protection is also a significant concern to ensure organizations avoid data breaches, primarily when data repositories are maintained on the cloud (Malthouse et al., 2019; Sinha et al., 2017). Another issue related to data governance comprises regulation and ethical usage of collected data. There have always been many challenges to knowledge sharing across organizations, including intra-organizational, inter-organizational, technological, and political problems. Inter-organizational problems such as lack of confidence in competitors' exposure to new system business data will delay the industry's adoption of big data hospitality (Buhalis & Leung, 2018; Sinha et al., 2017). The data collection often poses ethical concerns regarding the use, possession, and distribution of that, whether collected directly from companies or publicly available information (web scrapping) (Jimenez-Marquez et al., 2019). A set of ethical principles on the use of data is needed in order to protect individual rights. The European Union has recently enacted, for example, the General Data Protection Regulation (GDPR) (Malthouse et al., 2019; Tsaih & Hsu, 2018).

Figure 4 also demonstrates that some issues span multiple dimensions. First, project funding is a matter of technology and organization (Vajirakachorn & Chongwatpol, 2017). Organizations must ensure that the return on investment from their BI technology implementation has the most significant possible impact according to their capabilities and needs. In addition, a lack of expertise and user training is a human resource issue in managing and employing technology (Malthouse et al., 2019). The developed BI technology will not optimally address the company's needs if the appropriate personnel does not handle it. Top management must also provide maximum support for those who implement and operate BI from the beginning to their daily use to ensure everyone moves in the same direction (Malthouse et al., 2019; Vajirakachorn & Chongwatpol, 2017). Lastly, each dimension faces the same challenge regarding continuous improvement to ensure that all BI implementation efforts and investments contribute to the company's sustainable growth.

CONCLUSION, CONTRIBUTION, LIMITATION, AND FUTURE RESEARCH

This study aims to comprehensively review the previous BI framework's development and implementation in tourism sectors, focusing on the purposes, functionalities, and issues that need to be considered. We found that the main stakeholders of the BI system in the tourism domain are tourists, restaurants, hoteliers, service providers (tour, transport, OTA), destination management/suppliers, tourism associations, governments, and data providers. We learned that tourism stakeholders should at least implement the following basic functions in the BI system to assist them in their day-to-day decision-making, such as data analysis, data reports and dashboards, data visualization, performance metrics, and key performance indicator. After these functions are correctly implemented, they can improve their analytical and decision-making abilities by adding advanced functions such as trend indicators, predictive analytics, strategic planning tools, profitability analysis, benchmarking, budgeting, and forecasting. In addition, we also found that in contrast to developed countries, which primarily have regulated data & analytic frameworks (Michele et al., 2019), developing countries might need to build a tourism data center or centralized coordination regulated by the government or a consortium (Viglia et al., 2021). Such movement might foster data sharing and collaboration in which each stakeholder is responsible for providing, sharing, and using data according to established standards. With such collaboration, every participant in the tourism supply chain can make better strategic decisions based on more complete shared data.

We also learned that several issues could hinder the BI system implementation process. These three issues should concern anyone who implements: organizational, people and processes, and technological issues. We also found that the main drive depends on whether and to what extent the stakeholders view BI as a means of organizational transformation, as it will determine the strategy, support, improvement, and funding of BI implementation (Nyanga et al., 2020). If the organization already commits, this needs to be communicated to each related party to prepare human resources who have adequate skills and knowledge to ensure project implementation, changes in working methods, user training, and user acceptance can run well. Adequate and competent human resources will prepare technology and data regarding availability, preparation, completeness, security, and governance (Rahman et al., 2016).

Practically, this study gives researchers and practitioners valuable contributions to understanding the concepts of business intelligence and functional requirements for the tourism domain and raises awareness of implementation issues. Theoretically, this study contributes to the knowledge in the tourism field by presenting the necessary BI functionalities and visualizing the various issues across all dimensions encountered in the literature. Compared to the extant literature, which identifies five issues (Rahman et al., 2016), this study enriches our understanding by identifying 15 issues found using the PRISMA method.

However, this study is not without limitations. While we minimize the risk and promote transparency by publishing the protocol before starting the review and adhering to the PRISMA statements, there is a risk of bias in the resulting articles as the keywords chosen during the search are subjective. For instance, we do not include the keywords "adoption" or "acceptance" in the search because the related research explains the circumstances under which organizations have used BI, whereas our study focuses more on understanding prior to implementation. The exclusion of content in languages other than English was another limitation. For future research recommendations, we may further study the BI implementation barriers by employing a perspective of an adoption framework such as the technology, organization, and environment (TOE) framework. Future research can also develop a complete BI model comprised of architecture, dashboards, and data visualization design for a specific sector, such as the hospitality or transportation industry, based on data collaboration between stakeholders. Examples of practical implementations needed by the hospitality industry include how they can estimate the occupancy rate, determine the most optimal pricing, and measure competitiveness with surrounding competitors based on aggregated shared data so that they can carry out their business optimally.

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REFERENCES

Badawy, M., Abd El-Aziz, A. A., Idress, A. M., Hefny, H., & Hossam, S. (2016). A survey on exploring key performance indicators. *Future Computing and Informatics Journal*, *1*(1–2), 47–52. https://doi.org/10.1016/j.fcij.2016.04.001

Buhalis, D., & Foerste, M. (2015). SoCoMo marketing for travel and tourism: Empowering co-creation of value. *Journal of Destination Marketing and Management*, *4*(3), 151–161. https://doi.org/10.1016/j.jdmm.2015.04.001

Buhalis, D., & Leung, R. (2018). Smart hospitality – Interconnectivity and interoperability towards an ecosystem. *International Journal of Hospitality Management*, *71*, 41–50. https://doi.org/10.1016/j.ijhm.2017.11.011

Del Vecchio, P., Secundo, G., & Passiante, G. (2018). Analyzing big data through the lens of customer knowledge management: Evidence from a set of regional tourism experiences. *Kybernetes*, *47*(7), 1348–1362. https://doi.org/10.1108/K-07-2017-0273

Fuchs, M., Abadzhiev, A., Svensson, B., Höpken, W., & Lexhagen, M. (2013). A knowledge destination framework for tourism sustainability: A business intelligence application from Sweden. *Tourism: An International Interdisciplinary Journal*, *61*(2), 121-148. https://hrcak.srce.hr/file/157542

Hamilton, J. R., & Selen, W. (2008, September). A multi-agent business intelligence framework for the travel sector. *Proceedings of the International Conference on Electronic Business (ICEB)* (pp. 36–42). Hawaii, Waikoloa, Big Island: Association for Information Systems (AIS). https://aisel.aisnet.org/iceb2008/14/

Hlee, S., Yhee, Y., Chung, N., & Koo, C. (2019). Service innovation by design thinking methods: A case of Seoul children's grand park (SCGP). *E-Review of Tourism Research*, *17*(2), 271–291. https://ertr-ojs-tamu.tdl.org/ertr/article/view/511

Ivanov, S. H. (2014). *Hotel revenue management: From theory to practice* (1st ed.). Zangador. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2447337

Jimenez-Marquez, J. L., Gonzalez-Carrasco, I., Lopez-Cuadrado, J. L., & Ruiz-Mezcua, B. (2019). Towards a big data framework for analyzing social media content. *International Journal of Information Management*, *44*, 1–12. https://doi.org/10.1016/j.ijinfomgt.2018.09.003

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *Journal of Cinical Epidemiology*, *62*(10), e1-e34. https://doi.org/10.1016/j.jclinepi.2009.06.006

Malthouse, E. C., Buoye, A., Line, N., El-Manstrly, D., Dogru, T., & Kandampully, J. (2019). Beyond reciprocal: The role of platforms in diffusing data value across multiple stakeholders. *Journal of Service Management*, *30*(4), 507–518. https://doi.org/10.1108/JOSM-12-2018-0381

Mariani, M., Baggio, R., Fuchs, M., & Höepken, W. (2018). Business intelligence and big data in hospitality and tourism: A systematic literature review. *International Journal of Contemporary Hospitality Management*, *30*(12), 3514–3554. https://doi.org/10.1108/IJCHM-07-2017-0461

Marine-Roig, E., & Clavé, S. A. (2015). Tourism analytics with massive user-generated content: A case study of Barcelona. *Journal of Destination Marketing and Management*, *4*(3), 162–172. https://doi.org/10.1016/j.jdmm.2015.06.004

Meyer, D. F., & Meyer, N. (2015). The role and impact of tourism on local economic development: A comparative study and leisure. *African Journal for Physical Health Education, Recreation and Dance*, *21*(1.1), 197–214. https://hdl.handle.net/10520/EJC172415

Michele, P., Fallucchi, F., & De Luca, E. W. (2019, October). Create dashboards and data story with the data & analytics frameworks. In E. Garoufallou, F. Fallucchi, & E. W. De Luca (Eds.), *Proceedings of the 13th International Conference on Metadata and Semantic Research (MTSR 2019)* (pp. 272–283). Rome, Italy: Springer. https://doi.org/10.1007/978-3-030-36599-8_24

Moustaka, V., Vakali, A., Zikos, N., Tsirakidis, T., & Anthopoulos, L. G. (2019, May). TOMI: A framework for smart tourism on the move innovation. In L. Liu & R. White (Eds.), *WWW '19: Companion Proceedings of the 2019 World Wide Web Conference* (pp. 123–129). San Francisco, USA: ACM. https://doi.org/10.1145/3308560.3317051

Nanthaamornphong, A., Holmes, J., & Asawateera, P. (2020, June). A case study: Phuket City Data Platform. *Proceedings of the 17th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON)* (pp. 717–722). Phuket, Thailand: IEEE. https://doi.org/10.1109/ecti-con49241.2020.9158101

Nyanga, C., Pansiri, J., & Chatibura, D. (2020). Enhancing competitiveness in the tourism industry through the use of business intelligence: A literature review. *Journal of Tourism Futures*, *6*(2), 139–151. https://doi.org/10.1108/JTF-11-2018-0069

Phillips-Wren, G., & Hoskisson, A. (2014). Decision support with big data: A case study in the hospitality industry. *Frontiers in Artificial Intelligence and Applications*, *261*, 401–413. https://doi.org/10.3233/978-1-61499-399-5-401

Piboonrungroj, P., & Disney, S. M. (2015). Supply chain collaboration in tourism: A transaction cost economics analysis. *International Journal of Supply Chain Management*, *4*(3), 25–31. http://ojs.excelingtech.co.uk/index.php/IJSCM/article/view/1073

Pribisalić, M., Jugo, I., & Martinčić-Ipšić, S. (2019, June). Selecting a business intelligence solution that is fit for business requirements. *Proceedings of the 32nd Bled eConference* (pp. 443–465). University of Maribor, University Press. https://doi.org/10.18690/978-961-286-280-0.24

Rahman, A. A., Hasan, N. A., & Lahad, N. A. (2016). Issues and challenges in business intelligence case studies. *Jurnal Teknologi*, *78*(8–2), 171–178. https://doi.org/10.11113/jt.v78.9554

Ramos, C. M. Q., Correia, M. B., Rodrigues, J. M. F., Martins, D. J., & Serra, F. (2015). Big data warehouse framework for smart revenue management. In *Advances in Environmental Science and Energy Planning* (pp. 13–22). WSEAS Press. http://hdl.handle.net/10400.1/6906

Ramos, C. M. Q., Martins, D. J., Serra, F., Lam, R., Cardoso, P. J. S., Correia, M. B., & Rodrigues, J. M. F. (2017). Framework for a hospitality big data warehouse: The implementation of an efficient hospitality business intelligence system. *International Journal of Information Systems in the Service Sector*, *9*(2), 27–45. https://doi.org/10.4018/IJISSS.2017040102

Rodrigues, J. P., Sousa, M. J., & Brochado, A. (2020). A systematic literature review on hospitality analytics. *International Journal of Business Intelligence Research*, *11*(2), 20–28. https://doi.org/10.4018/ijbir.20200701.oa2

Schwegmann, C. (2012, February). Open data in developing countries. In *European Public Sector Information Platform Topic Report No. 2013 / 02*. https://data.europa.eu/sites/default/files/report/2013_open_data_in_developing_countries.pdf

Sharda, R., Delen, D., & Turban, E. (2018). *Business intelligence, analytics, and data science: A managerial perspective* (4th ed.). Pearson.

Sharif, S. P., Mura, P., & Wijesinghe, S. N. R. (2019). Systematic reviews in Asia: Introducing the "PRISMA" protocol to tourism and hospitality scholars. In S. Rezaei (Ed.), *Quantitative tourism research in Asia* (pp. 13–33). Springer. https://doi.org/10.1007/978-981-13-2463-5_2

Sinha, S., Bhatnagar, V., & Bansal, A. (2017). A framework for effective data analytics for tourism sector: Big data approach. *International Journal of Grid and High Performance Computing*, *9*(4), 92–104. https://doi.org/10.4018/IJGHPC.2017100106

Stylos, N., & Zwiegelaar, J. (2019). Big data as a game changer: How does it shape business intelligence within a tourism and hospitality industry context? In S. Marianna, R. Roya, & T. Mike (Eds.), *Big data and innovation in tourism, travel, and hospitality: Managerial approaches, techniques, and applications* (pp. 163–181). Springer. https://doi.org/10.1007/978-981-13-6339-9_11

Tsaih, R. H., & Hsu, C. C. (2018, December). Artificial intelligence in smart tourism: A conceptual framework. *Proceedings of the International Conference on Electronic Business (ICEB)* (pp. 124–133). Guilin, China: Association for Information Systems (AIS). https://aisel.aisnet.org/iceb2018/89

Vajirakachorn, T., & Chongwatpol, J. (2017). Application of business intelligence in the tourism industry: A case study of a local food festival in Thailand. *Tourism Management Perspectives*, *23*, 75–86. https://doi.org/10.1016/j.tmp.2017.05.003

Viglia, G., De Canio, F., Stoppani, A., Invernizzi, A. C., & Cerutti, S. (2021). Adopting revenue management strategies and data sharing to cope with crises. *Journal of Business Research*, *137*, 336–344. https://doi.org/10.1016/j.jbusres.2021.08.049

Yan-Li, B., & He-feng, H. (2016, October). Framework and management of competitive intelligence system for tourist hotels in the era of big data. *Proceedings of the 2nd IEEE International Conference on Computer and Communications (ICCC)* (pp. 60–64). Chengdu, China: IEEE. https://doi.org/10.1109/CompComm.2016.7924665

Yeoh, W., Koronios, A., & Gao, J. (2008). Managing the implementation of business intelligence systems: A critical success factors framework. *International Journal of Enterprise Information Systems*, *4*(3), 79–94. https://doi.org/10.4018/jeis.2008070106

Zhang, X., Song, H., & Huang, G. Q. (2009). Tourism supply chain management: A new research agenda. *Tourism Management*, *30*(3), 345–358. https://doi.org/10.1016/j.tourman.2008.12.010

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