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## Business Intelligence and Analytics in Small and Medium-sized Enterprises: A Systematic Literature Review

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### Abstract

Despite much interest in business intelligence and analytics (BI&A), empirical research shows that small and medium-sized enterprises (SMEs) are still lagging behind in the proliferation of BI&A. However, there are no studies found on literature reviewing research on BI&A in SMEs. This paper collects, categorizes, synthesizes, and analyzes 62 articles related to BI&A in SMEs. The identified research topics being addressed in BI&A include: BI&A components, BI&A solutions, Mobile BI&A, Cloud BI&A, BI&A application, BI&A adoption, BI&A implementation, and BI&A benefits. Further, research gaps and directions for future research are presented to facilitate the progression of BI&A in SMEs research.

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*Keywords:* Business intelligence and analytics; SMEs; BI&A review; BI&A solutions; BI&A adoption; BI&A implementation; BI&A benefits.

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## 1. Introduction

“Small and medium-sized enterprises (SMEs) account for about 90 percent of businesses and more than 50 percent of employment worldwide according to the International Finance Corporation”<sup>1</sup> (p.1). They play a major economic and social role, and therefore, they have become a source of economic development<sup>2</sup>. Thus, the need to improve SMEs’ competitiveness worldwide is crucial. However, SMEs are typically vulnerable and not robust enough to withstand the onslaught of economic and global competition<sup>3</sup>. In order to survive, they must be able to monitor their business and use all their resources efficiently, especially information resources<sup>4</sup>.

“Business intelligence (BI) is a set of methodologies, processes, architectures, and technologies that transform the raw data into meaningful and useful information which allows users to make informed business decisions with real-time data”<sup>5</sup>. According to Yeoh<sup>6</sup> the term “business intelligence” was first coined by Luhn in 1958<sup>7</sup>. However, as Burstein and Holsapple<sup>8</sup> recalled, the term “business intelligence” was reintroduced by Howard Dresner when he defined BI as “a broad category of software and solutions for gathering, consolidating and analyzing, and providing access to data in a way that let enterprise users make better business decisions”<sup>9</sup>.

The new term business analytics (BA) emerged in the late 2000s and focused on the analytical component of BI<sup>10</sup>. Thus, business intelligence and analytics (BI&A) was used as a unified term to describe information-intensive concepts and methods for improving business decision making<sup>11</sup>. According to Gartner’s survey, BI&A appears to be the top CIO’s technological choice for increasing competitiveness in the past few years<sup>12, 13</sup>. Therefore, Chaudhuri et al stated that “Today, it is difficult to find a successful enterprise that has not leveraged BI&A technology for their business”<sup>14</sup> (p.91). Moreover, for the rest of the paper, the term BI&A is used.

Notwithstanding its importance, there is a dearth of literature on BI&A in SMEs<sup>15</sup>, as the majority of the BI&A systems are mainly adopted in large, multinational, and international enterprises and thus, the research work on BI&A has largely been focused on them<sup>16, 17</sup>. Jourdan et al<sup>18</sup> conducted a literature review on BI&A research. They collected and analyzed articles related to BI&A published from 1997 to 2006 in ten leading Information Systems (IS) journals. However, their study focused mostly on BI&A in general and not on BI&A in SMEs. An extensive literature search yielded no extant literature reviewing research on BI&A in SMEs. Therefore, the objective of this paper is to provide a comprehensive review of the literature on BI&A in SMEs. By collecting, analyzing, and synthesizing all extant literature within this domain, this review presents the current state of research topics on BI&A and reveals prospective gaps that require further research. More specifically, the following research question guides this review:

RQ: What are the research topics of BI&A in SMEs that have been addressed?

Kitchenham’s guidelines for a systematic literature review (SLR) will be applied to allow the completeness of the search to be assessed, achieve effective results, and explain them in a more intelligible manner<sup>19</sup>. This means that the research procedures of this review follow a strict sequence and well-defined methodological steps that include (1) illuminate the search strategy process, (2) identify the inclusion and exclusion criteria, (3) study the selection process, (4) study the quality assessment, and (5) use data extraction and synthesis. Subsequently, 62 articles that focus on BI&A in SMEs were selected and reviewed.

The remainder of this work is structured as follows. Section 2 outlines the research methodology procedures used to conduct this research study. Section 3 reports the SLR results, and the research question results from the reviewed articles are presented in section 4. Section 5 presents the discussion and directions for future research. Finally, section 6 concludes this research.

## 2. Research Methodology

This research comprises an SLR that was undertaken based on the guidelines proposed by Kitchenham<sup>19</sup>. The Kitchenham’s guidelines were applied due to its more structured method in informing the status of the literature. In the following sub-sections, the steps followed during the review are described.

### 2.1. Search Strategy

The search strategy consists of two stages: automatic and manual research. During the first stage, the following databases were queried: Scopus, Web of Science, IEEE Xplore, ScienceDirect, Tandfonline, ACM Digital Library,

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