

# A Review of Business Intelligence and Analytics in Small and Medium-sized Enterprises

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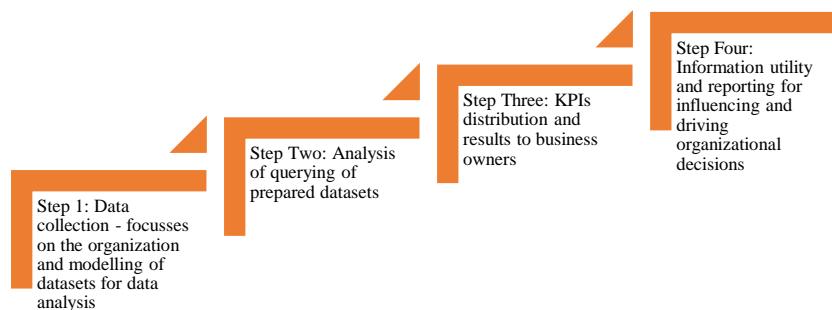
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**Abstract** – This paper provides a critical review of the adoption of Business Intelligence and Business Analytics (BI&BA) in SMEs. Business Intelligence (BI), Business Analytics (BA), Small and Medium-sized Enterprises (SMEs), and their respective combinations were among the keywords searched to find as many relevant articles as possible for this review. Business Analytics (BA) relies heavily on predictive and explanatory modeling, fact-based management, numerical analytic and analytical modeling to guide decision-making. Business intelligence (BI), on the other hand, help entrepreneurs manage their budgets and allocate resources more effectively. In this paper, BI&BA (Business Intelligence and Business Analytics) has been utilized to cover these data-centric criteria to enhancing corporate decision-making process within SMEs. BI&BA seems to be a top technical option for enhancing competitive advantage in SMEs, which have not embraced the BI&BA technology in their business activities. This paper further reviews the assumptions from various aspects such as BI&BA elements, BI&BA solution, BI&BA implementation, BI&BA benefits, BI&BA applications, BI&BA adoption, cloud BI&BA, and mobile BI&BA.

**Keywords** – Business Intelligence (BI), Small and Medium-Sized Enterprises (SMEs), Business Analytics (BA).

## I. INTRODUCTION

Directors, managers, and employees may benefit from Business Intelligence (BI) since it is a system, which is driven by technological advancement in order to analyze and provide actional data used for business decision-making processes. To provide analytics results to business users for conceptual planning and operational decision-making, businesses engage in the BI process in **Fig 1**, which involves collecting information from both internal IT networks and external sources, cleaning the data, running queries against the datasets, and developing BI dashboards, reports as well as data visualizations. Better business choices are what BI projects are all about since they lead to more profits, more streamlined operations, and enhance competition. In order to do this, BI makes use of a wide variety of data management and analysis techniques, as well as analytics and reporting technologies.



**Fig 1.** BI Process for Conceptual Planning and Operational Decision-Making

Data for business intelligence purposes may be kept in either a centralized company data warehouse or in decentralized departmental data marts that store relevant subsets of corporate data. Data files, radar data, texts, and other unstructured or semi-structured forms of data are rapidly arriving in data lakes developed on Hadoop clusters or other platforms of big data

for business intelligence and analytics. Decision-making, both strategic and tactical, may benefit from the use of BI tools, since the data used in these applications can comprise both historic data and real-time data acquired from data sources as it is created. In order to guarantee that BI teams and enterprise customers are evaluating correct and consistent information, raw data from various systems should often be aggregated, connected, and cleaned utilizing interoperability and data quality control solutions.

Business Intelligence (BI) tools [1] were originally used by BI and IT experts who conducted queries and generated dashboards and data for business users. However, with the rise of self-service BI and data exploration tools, business analysts, executives, and employees are increasingly adopting BI systems independently. Business users may perform BI data queries, graphical representations, and dashboard designs in a self-service BI setting. To sum up, the purpose of business intelligence is to enhance corporate operations by making better use of appropriate data. When properly implemented, BI tools and methodologies allow businesses to transform raw data into actionable intelligence about their operations and plans. Better business choices that boost productivity and revenue may speed up a company's development and raise its profitability when such insights have been gleaned. It is difficult for businesses to reap the benefits of data-driven decision making without Business Intelligence (BI). Rather, executives and employees must rely on their own expertise, experience, intuition, and gut instincts to make crucial business choices. Even while these approaches have the potential to lead to sound judgments, they are also vulnerable to the pitfalls of erroneous reasoning due to a lack of supporting evidence.

The term "Business Intelligence" refers to a suite of programs used for data analysis that may be tailored to various inquiries. Most may be used with either self-service BI applications or more conventional BI systems. The following, in **Table 1**, are examples of BI technologies, which might be utilized by businesses today:

**Table 1.** Business Intelligence (BI) Technologies for Modern Businesses

Business Intelligence (BI) technologies	Details
Ad-hoc analysis	One of the cornerstones of contemporary BI solutions, ad hoc querying is also an important part of self-service BI software. Querying is the practice of creating and executing queries in order to investigate certain business problems. Ad hoc queries may be conceived on the fly, but their analytics findings are so valuable that they are often executed and included into reports and dashboards.
Online Analytical Processing (OLAP)	OLAP tools, which are inclusive of the first BI technologies permit users to assess data along various dimensions, making them effective for complex computations and queries. OLAP analyses may now be done directly against columnar datasets, while in the past they had to be run against multivariate OLAP cubes containing data from a data center.
Mobile BI	With the help of mobile BI, BI tools and dashboards can be accessed from anywhere, even on mobile devices. Mobile BI solutions are usually created with a focus on simplicity of use since they are utilized more for viewing data than for analysis. So that they may be quickly seen on a mobile device's screen, mobile dashboards, for instance, may simply provide two or three graphical representations and KPIs.
Real-time BI	By analyzing data as it is being produced, gathered, and processed, real-time BI systems provide users with a current picture of company processes, consumer actions, financial markets, and other relevant areas. Decision analytics applications like credit scoring, stock trading, and personalized marketing all rely on real-time analytics and their utilization of data streams.
Operational intelligence (OI)	Real-time analytics, often known as operational BI, provide data to corporate leaders and frontline employees as they happen. OI apps are created to support in operational decision-making and allow for quicker action on issues, such as assisting contact center operators in resolving customer concerns and logistics managers in reducing distribution constraints.
Software-as-a-Service (SaaS) BI	SaaS BI solutions are hosted by providers in the cloud and provide customers with data analysis techniques as a subscription-based service. The multi-cloud support offered by the software as a service (SaaS) framework permits businesses to run business intelligence (BI) applications on many cloud platforms, tailoring their BI offerings to individual users while avoiding vendor lock-in.
Open-source BI (OSBI)	The two most common forms of open-source BI software are the free community editions and the corporate versions with technical assistance provided by the vendor. Access to the code base is also available for development purposes for BI teams. In addition, various proprietary BI instruments manufacturers provide free updates, majorly for particular users.
Integrated BI	The data visualization and BI capabilities of enterprise applications may now be integrated with the help of BI tools. This allows business users to do data analysis from inside their preferred software. While commercial ASVs are the most prevalent adopters of embedded analytics capabilities, in-house IT departments are increasingly adding such tools to internal projects.
Collaborative BI	This is more of a method than a concrete technological solution. Data analysis and sharing may be accomplished by several people at once via the integration of Business Intelligence (BI) software

	and collaboration platforms. Users may add comments, questions, and highlights to BI analytics and data findings using, say, online chat and forum platforms.
Location intelligence (LI)	This subset of business intelligence includes map-based data visualization tools that facilitate the examination of geographic and spatial information. Geographical context may be added to corporate data and processes with the help of location intelligence. Site selection for shops and headquarters, as well as location-based advertising and supply chain management, are just a few examples of possible applications.

According to this paper, the keywords utilized in the search integrated BI, BA (Business Analytics), and SMEs were utilized to identify as many related literature texts as possible. Section I focused mostly on introducing the concept of BI and BA. BA alludes to the practices, technologies and skills for progressive iterative investigation and exploration of the previous business performance to achieve insights and enhance business planning. BI on the other hand, alludes to the technologies and strategies employed by the business for the analysis of data and management of enterprise data. Common functionalities of BI technologies integrate predictive analytics, predictive analytics, text mining, benchmarking, business performance management, complex event processing, process mining, data mining, dashboard development, data analytics digital analytical processing, and data reporting. Business Intelligence and Business Analytics (BI&BA) was utilized as a joined term to define data-intensive methods and concepts for enhancing enterprise decision-making in this paper. The remaining sections of the paper are organized as follows: Section II presents a background analysis of the research. Section III focusses on defining the methodology employed in this paper to draw the required conclusions. Section IV focusses on a systematic literature review of the study to define BI&BA in SMEs for the purpose of enhancing business decision-making process. Section V presents the results of the systematic literature review, while Section VI focusses on a discussion of BI, BA, and results. Section VII draws final remarks to the general research.

## II. BACKGROUND ANALYSIS

The International Finance Corporation reports that "Small and Medium-sized Enterprises (SMEs) account for over 90% of businesses and more than 50% of employment globally." Because of the significant part they play in the economy and society, they've become a motor for growth. Therefore, it is critical to increase the competitiveness of SMEs across the globe. But SMEs are notoriously weak and seldom able to endure the economic and global competition that they face. They need to be able to keep tabs on their operations and make good use of all of their resources, particularly the information resources, if they want to stay in business. To paraphrase the definition of BI given by IBM: "Business Intelligence (BI) is a combination of techniques, processes, structures, and technologies that turn the raw data into meaningful and valuable information that enables users to make educated business choices using real-time data."

Richard Millar reportedly came up with the phrase "business intelligence" in 1865, according Richard [2]. Poblano-Ojinaga [3] noted that the terminology "business intelligence" was reintroduced by Papachristodoulou, Koutsaki, and Kirkos [4], who described 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." When the analytical side of business intelligence (BI) was finally given its own name in the late 00s, it was called Business Analytics (BA). Thus, the umbrella phrase "Business Intelligence and Analytics" (BI&BA) was coined to cover these data-heavy approaches to bettering corporate decision making. BI&BA seems to be the top technical option of CIOs for enhancing competitiveness in the previous few years, according to a poll conducted by Gartner. As a result, "Today, it is impossible to identify a successful organization that has not embraced BI&BA technology for their business," as stated by Su and Cardoso [5]. Additionally, BI&BA is utilized throughout the remainder of the article.

Despite its significance, the study on BI&BA in SMEs is significantly scarce. Since the majority of BI&BA frameworks are employed by multinational, and large operation, most of the BI&BA literature has concentrated on these types of organizations. A literature analysis of BI&BA studies was completed by Jourdan et al. They collected and examined 10 of the most prestigious IS journals to publish studies on BI&BA between 1997 and 2006. Their research, meanwhile, didn't pay much attention to BI&BA in SMEs in particular. Following a comprehensive search of the available literature, we were unable to locate any reviews of studies conducted on BI&BA in various types of SMEs. The principal aim of this study is to provide an evaluation of the literatures surrounding BI and BA in SMEs. This analysis provides a summary of the present condition of research challenges on BI&BA by gathering, evaluating, and synthesizing all available literature in this area, therefore revealing probable gaps that need additional investigation.

This paper seeks to provide answers to this research question: What areas of research have been explored in the field of BI and BA as they pertain to SMEs? To evaluate the thoroughness of the search, provide useful findings, and provide clearer explanations of those results, we will use Kitchenham's recommendations for a SLR (Systematic Literature Review) [6]. This means that (i) the search strategy process is illuminated, (ii) the inclusion and exclusion criteria are identified, (iii) the selection process is studied, (iv) the quality assessment is studied, and (v) data extraction and synthesis are used in a specific order and according to a predetermined methodology. Then, 62 papers specifically about BI&BA in SMEs were chosen for evaluation.

### III. RESEARCH METHODOLOGY

An SLR was conducted for this study following Kitchenham's suggestions. Because of its more organized approach, Kitchenham's recommendations were used to determine the current state of the literature. Details of the review process are laid forth below.

#### *Search Strategy*

Two distinct phases make up the search strategy: automated and human-led investigation. Scopus, IEEE Xplore, Web of Science, ScienceDirect, ACM Digital Library, Tandfonline, and Emerald Insight were searched in the first step. These online resources were chosen because they are the most comprehensive and provide access to the most influential publications and conference papers in the subject of business intelligence and analytics. Knobbut and Van der Stappen [7] provided empirical support for the idea that it is more productive to do research using online databases than a predetermined list of publications and conferences. BI, BA, SMEs, and their respective combinations were among the keywords searched to find as many relevant articles as possible. The articles were then examined in light of the predetermined goals after the first data had been collected. Thus, EndNote was utilized to keep track of the findings of the inquiries for every database and to avoid doing duplicate research by compiling and organizing all citations in a single place. To make sure no studies were overlooked during the automated search, a human search was also conducted. As a result, we went through the references of all the main research and removed the ones that did not meet our standards. After compiling the results of this manual search, the main studies were uploaded to EndNote.

#### *Inclusion and Exclusion*

The criteria for exclusion and inclusion were established to guarantee that on essential researches would be used in this review. Literature papers from workshops, journals, conferences, and books were taken into account. Articles were omitted if their abstracts did not specifically address the research topic, their full texts were unavailable, or they did not clearly connect to business intelligence and analytics. The same goes for removing duplicates of the same research that were reported. In cases where several editions of an article are available, only the most comprehensive version was included. Please take into account that the selected literatures should meet all the inclusion methodology and fail to meet any criteria of inclusion.

#### *Quality Assessment*

Evaluation of main study quality was also seen as important, alongside exclusion and inclusion criteria. The primary goal of this analysis was to evaluate how well the chosen studies performed. The quality assessment questions (i) and (ii) were asked to help guide the interpretations of results and measure the strength of conclusions drawn from the selected studies: (i) Are the themes of the study addressed in this paper directly connected to BI&BA; and (ii) Does the context of this research clearly link up to SMEs?

#### *Study Selection Procedure*

The research turned up a total of 306 articles. Using EndNote, we found that 127 of these 306 items were redundant and took them out. As a result of reviewing the remaining 179 articles against the inclusion and exclusion criteria, 115 were deemed ineligible, leaving just 64. As soon as the first phase of investigation was over, the second could begin. The goal of this labor-intensive process was to give us more faith in the relevant and severity of results. Therefore, references of the 54 literatures are studied while employing exclusion approaches, leading to the discovery of 17 more publications. Bhogal, Montagnese, and Mani [8] propose a term for this strategy of following leads from previously established references: snowballing. After that, the 17 publications were obtained from Google Scholar and imported into EndNote to form the preliminary collection of primary studies. There were 81 articles altogether. Subsequently, 19 articles were omitted after being subjected to the quality evaluation criteria. In the end, 62 publications were selected as the key research that would serve as the foundation for the rest of this review.

#### *Data Extraction and Synthesis*

Extraction and synthesis of the gathered data included reading every article and retrieving essential data using Microsoft Excel, and EndNote. The main aim of this process was to formulate data extraction forms for effective documentation of data gleaned from the principal research. Therefore, the study's context was determined using Webster and Watson's concept-centric approach. The evaluation also took into account the columns labeled "title," "date," "research technique," "citations," and "publication."

### IV. SYSTEMATIC LITERATURE REVIEW

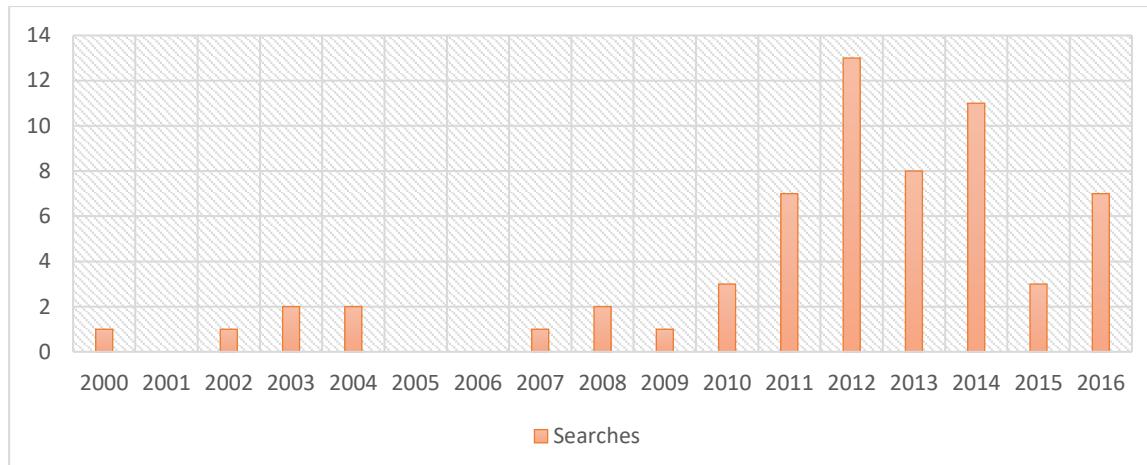
Before a discussion of data analysis for SLR, this section presents critical statistical results based on the selected study. Thus, we will review the relevant research methodology, temporal reviews, citation status, and publication sources.

#### *Publication Sources*

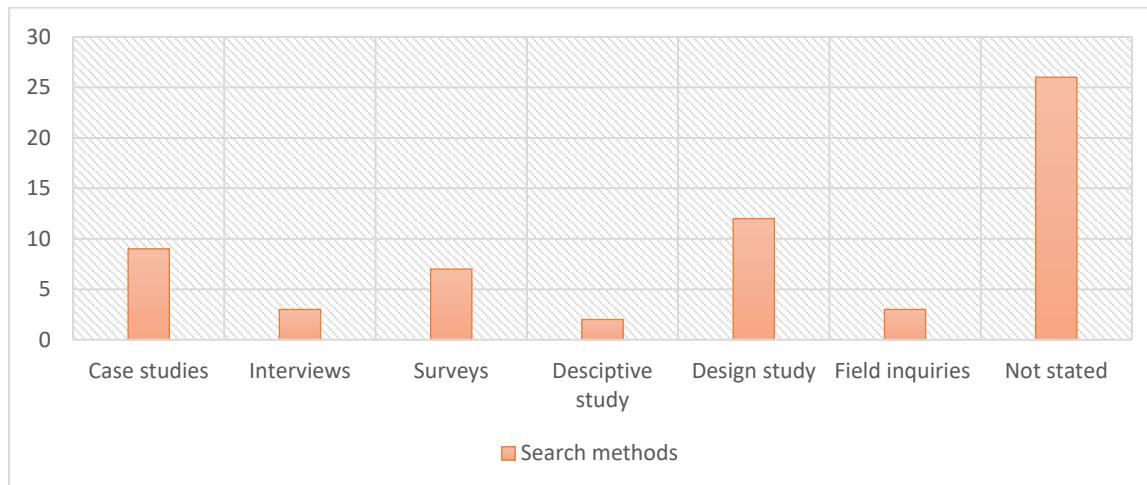
Most of the first-hand accounts of research were presented at meetings or published in academic publications. There were not many investigations presented at conferences or published as workshop papers or book chapters. **Fig 2** displays the dispersion of main research according to the locations of their original publications.

#### *Citation Status*

The aggregate citation counts for the included studies are shown in **Fig 3**. Searches on Scopus and Google Scholar were used to compile the citation data. Taking a glance at the information in **Fig 3**, we can see that 49 of the research were mentioned by other publications. Some of these papers had more than 30 citations, while the vast majority had either a few or none at all. Since most of the chosen studies have just been published in the past several years, an uptick in citation rates is to be anticipated.



**Fig 2.** Distributions Of the Major Researches Throughout the Years



**Fig 3.** Distributions According to The Research Methodology

#### *Temporal Review*

In **Fig 2**, we can see how the years covered by the research that were ultimately chosen for inclusion changed over time. Interest in BI&BA seems to have skyrocketed between 2010 and 2012. However, the number of research conducted in 2014 dropped to three the following year. Overall, there are not a lot of research presented.

#### *Research Methodology*

**Fig 3** displays the categorization of the included literature as per the study strategies used by each. In the main studies, design research was the most common approach used, followed by descriptive research, field inquiries, interviews, surveys and case studies (as shown in **Fig 3**). But 42% of the literature reviews did not specify the methodologies used, either directly or indirectly. This shows that academic study is still in its infancy.

## V. RESULTS

The study's research question was developed from the 62 publications evaluated after the main studies were chosen and extracted. During the process of gathering and synthesizing information, we used a strategy based on the centrality of concepts. Following is an in-depth examination of the selected study subjects, which integrate BI&BA elements, BI&BA solution, mobile BI&BA, BI&BA applications, cloud BI&BA, BI&BA adoption, BI&BA benefits, and BI&BA implementation.

### *BI&BA Elements*

Determination of KPIs, data mining, data warehousing, OLAP (Online Analytical Processing), data interfacing, and reporting through data visualization are all the elements of atypical BI&BA models. The literature integrates different researches on dashboards, data gathering, OLAP, KPIs and data warehousing. To take BI&BA to the next level, [9] recommended Database as a Service (DaaS). While [10] conducted research of the actual application of data warehousing frameworks in 45 SMEs in Italy. Several web-based data warehouse systems were proposed, and the significance of data management for SMEs was stated by Huang, Chen, and Frolick in [11]. Companies that use a combined company structure might gain an edge in the marketplace by using collaborative business solutions.

Despite this, conventional BI&BA is not built for teamwork. To address this issue, Banek, Vrdoljak, Tjoa, and Skocir in [12] developed a criterion for heterogeneous data warehousing. According to [13], reference models help Small and Medium-Sized Enterprises (SMEs) get through the challenges they face when attempting to implement BI&BA remedies. To assist minimize the barriers, which prevent SMEs from employing BI&BA technologies, Romero and Abelló in [14] established a four-layered referencing framework for data warehouses. Explicitly, the problems of report construction using explicit modeling, derived KPIs, and data marts were discussed. Additionally, Glancy and Yadav in [15] introduced the concept of BI&BA reference modelling for data analysis approach as a follow-up to study that concentrated on explicit modeling of KPIs.

OLAP is another segment of BI&BA. Knowledge is mined from a data warehouse or data marts and then OLAP is used to help laypeople find their way around the information. Despite the fact that conventional OLAP technology is difficult to use and requires expensive storage, Taniar and Rahayu in [16] published a comparison of various OLAP advancements, which operate in major memory and interface interfaces. Data mining-based business intelligence and analysis has become a vital tool for many companies, particularly when looking to expand their customer base or introduce new items to the market. Results from the implementation of a BI&BA prototype developed by Alawin and Al-ma'aitah in [17] and dubbed the CCSDMS (Correlation Coefficient Sales Data Mining System) demonstrated that the proposed solution improves upon the state-of-the-art on the basis of accuracy, computational efficiency, and predictive ability. However, Varde [18] highlighted the use of data mining strategies grounded in customer profile information to Japan's power energy sector. A dashboard is a visual representation of data analytics for quick review. InKoM, developed by Wendt, Werner, Adam, and Benlian in [19], is an intelligent dashboard for managers. In order to assess the usefulness of the InKoM project's decision support system, Lin in [20] proposed a scorecard-based assessment technique tailored specifically to BI&BA projects and systems.

### *BI&BA Solutions*

Commonplace employment of open-source BI and BA throughout industry. Prasai in [21] cite many web-centric open-source remedies, which are appropriate for SMEs, including Talend OpenStudio, Pa-Lo and Mondrian Pentaho. Brandão et al. in [22] did a similar analysis, this time evaluating seven of the most famous open-source BI&BA instruments. While Wangoo in [23] did a comparison of BI&BA tools to help with platform selection, they zeroed in on the best options for SMEs. Alternative BI&BA instruments for SMEs were seldom mentioned in the literature. Kollwitz, Dinter, and Krawatzeck in [24] conducted research that cataloged the BI&BA tools available to SMEs in both international and domestic markets. García and Pinzón in [25], on the other hand, classified the present BI&BA remedies in the Polish market. Additionally, various issues with BI&BA remedies have been presented. With reference to the case studies of 8 SMEs in Sweden, Authors established a typical methodology for assessing BI&BA success. Authors in [26] investigated the reasons why BI&BA applications are not more commonplace in small businesses. This research also included a table that mapped out Mallach's 2000 categorization of BI&BA systems. In addition, Custis in [27] provided a comparison of the leading BI&BA suppliers and technologies.

### *Cloud BI&BA*

It is possible to replicate the features of desktop BI&BA systems in mobile apps. One of the most talked-about issues in this area is the mobile system, yet there has been surprisingly little conceptual work done in this area so far. Rabuzin and Škvorc in [28] conducted research in Croatia to examine the use of mobile BI&BA in 83 SMEs. According to the findings, financial restrictions are a major obstacle to wider use of mobile BI&BA. The literature on mobile BI&BA also addressed other related topics. To that end, Brodzinski in [29] developed a paradigm for mobile BI&BA, while authors in [30] suggested a low-cost network topology for cellular BI&BA in SMEs. Both studies were conducted with the overarching goal of developing a system based on inexpensive open-source technology that could be tailored to the specific needs of SMEs and used to provide such organizations with the same advantages that BI&BA provides to larger corporations. Another author, Ilmudeen in [31]

provided a mobile BI&BA infrastructure for SMEs in undeveloped nations and highlighted problems with mobile BI&BA's application.

#### *Cloud BI&BA*

Gaining and keeping a competitive advantage 46 is becoming more dependent on cloud computing and business intelligence and analytics. Many literature reviews have addressed the employment of cloud BI&BA, as identified as SaaS BI, by SMEs, and have proposed various frameworks for the study of this topic. For their part, Giannoulis, Zdravkovic, and Petit, in [32] presented a unified five-layer architecture consisting of the following parts: operative service layer, user interface service, business service, data service, and infrastructure. To remedy the issues with conventional BI&BA, some writers have offered a cloud-based BI&BA model and developed an application infrastructure for BI&BA. Further research was conducted by Figalist, Elsner, Bosch, and Olsson in [33] using a business intelligence and analytics software as a service platform. To further address the security concerns in cloud BI&BA, Verma and Shri in [34] offered a unique technique by using tokenization as a security measure.

Based on their findings, tokenization may be used instead of complex encryption protocols to keep BI&BA data safe in the cloud. There are a number of other concerns with BI&BA in the cloud that have been addressed in the research. The variables that make cloud-based BI&BA successful have been found by Ploder, Bernsteiner, and Dilger in [35] also outlined the most crucial CSFs and issued a CSF framework for the BI&BA application in the cloud system, authors in [36] published research that presented the cloud BI&BA idea and reviewed the advantages, disadvantages, and difficulties associated with it. To make cloud-based analytics more attractive to SMEs in emerging markets, authors in [37] developed a pre-packaged customizable process for BI&BA. Ferrari, Rossignoli, and Zardini in [38] also looked into how well the BI&BA SaaS framework would operate for the Czech SMEs market.

#### *BI&BA Application*

Manufacturing, telecommunications, securities, finances, banking, insurance and retail are just some of the 60 sectors that have incorporated BI&BA into their operations. However, research on the potential of BI&BA in other sectors is scant. According to a study conducted by authors in [39], the usage of BI&BA among the nation's 135 agricultural enterprises was analyzed to determine the nature of the relationship between the two. Despite the study showing a higher probability for the possibilities for the probable application of BI&BA among the participants, only a small percentage of respondents actually utilize any BI&BA application. Ratia, Myllärniemi, and Helander in [40] also assessed the potential of business intelligence and analytics (BI&BA) to help agricultural businesses increase their output and technical efficiency.

#### *BI&BA Adoption*

Some researchers have provided models, adoption theories, and maturing levels to assist with BI&BA adoption comprehension. The elements and causes that affect BI&BA adoption within SMEs have been discovered by numerous research. The present situation of BI&BA implementation in Thailand was provided by Vajirakachorn and Chongwatpol in [41], who also offered a study methodology to investigate the enabling variables that effect the implementation of BI&BA in SMEs. Further work by the same authors proposed BI&BA maturity levels and found characteristics that affected BI&BA adoption among Thai SMEs. The characteristics that influence small enterprises' adoption of business intelligence and analytics were modeled and tabulated in research by Wee, Scheepers, and Tian in [42]. To aid in the creation and validation of BI&BA adoption frameworks, Authors in [43] investigated the factors of BI&BA acceptance. In a similar aspect, the authors analyzed the relationship between SMEs and public firms in Tunisia to see what factors influence the adoption of BI&BA.

Using the TOE (Technology-Organization-Environment) model and the DOI (Diffusion-Of-Innovation) theory, Nazri and Iskandar in [44] presents a BI&BA technology acceptance framework for SMEs Malaysia. Concerns with BI&BA adoption were hardly addressed in the published literature. Chaudhry and Dhingra [45], who performed qualitative research with 11 NI-based SMEs, offered several suggestions for facilitating the implementation of BI&BA. While Pimperl, Schulte, and Hildebrandt in [46] conducted an exploratory investigation of BI&BA application in German SMEs in order to identify underlying elements linked to the ideology of BI&BA's organizational determinants, obstacles, and advantages, their research did not find any significant differences between the two groups. Gauzelin and Bentz in [47] found seven NACs of a BI&BA frameworks through empirical research with twenty French firms. The authors recommended using the framework to facilitate the establishment of a SME-specific contextual intelligence platform.

#### *BI&BA Implementation*

There were a number of articles that presented various CSFs, frameworks, development cycles, and models discussing BI&BA deployment. After interviewing 20 SMEs in Upper Silesia, Olszak and Ziembra in [48] identified three aspects of CSFs in BI&BA application: technology, process, and organization. The paradigm given by the authors shows how BI&BA may be used to motivate small and medium-sized enterprises. Similarly, the authors presented a system that offers user-friendly automation of data mapping, loading, and validation from user application. An SME-centric conceptual and operational paradigm was presented by the authors, while Vahadane and Clarke in [49] outlined a BI&BA development

cycle and implemented a practical example to show how the ideas worked in practice. In addition, the authors presented a business intelligence and analysis model predicated on the use of a company's undocumented expertise and data.

Multiple writers have implemented BI&BA methods that have been previously described in the academic literature. Chemlal in [50] developed a multi-agent system for cutting-edge BI&BA resources on the web. The authors used an expert system approach to create a prototype that was tailored to the needs of Indonesian SMEs. In addition, the authors detailed the BI&BA system's Eagle's architecture and programming. The authors discovered the bilişimBI and described its useful properties. According to a recent report written by the authors, open-source technologies were used to create a business intelligence and analytics solution for Industries and Wire Products in Sriram. The authors adopted a cutting-edge BI&BA system technique developed for SMEs in the machine-instrument industry. The ease of use and significant cost reductions of a web-based BI&BA support system were also proved by the authors.

There were many other implementation-related concerns that were highlighted in the literature. How BI&BA may be established in a small business was shown by Peng, Tuan, and Liu in [51]. While the authors went the extra mile and researched the implementation of BI&BA in SMEs, major corporations, and the cultural sector to support his claim that BI&BA necessitates an integrative strategy. The difficulties of implementing BI&BA in a SME in the United Kingdom were analyzed by the authors and solutions were offered. In addition, the authors created a strategy for a fruitful BI&BA deployment by using indicators of performance derived from company operations.

#### *BI&BA Benefits*

There are several studies that detail the many advantages of business intelligence, such as reduced wait times for information retrieval, reduced costs associated with maintaining an IT architecture, and enhanced customer satisfaction. Nonetheless, just 3 literature papers have covered the advantages of BI&BA for SMEs. To begin, Rahchamani, Rashidi Ashtiani, and Vahedi in [52] analyzed Melamin, a SME, to determine BI&BA's potential advantages. A primary goal of benefits assessment, they said, is to prove that BI&BA is money well spent. Second, the authors showed how standardized BI&BA solutions may assist SMEs in reducing budgeting times while maintaining accuracy. To illustrate the most serious issues in budgeting efficiency, they conducted a case study at a Danish SME and presented a model for further study. Finally, the authors outlined significant advantages of BI&BA for SMEs. Here in **Table 2** are the most compelling arguments for why small or medium-sized business should use a business intelligence system.

**Table 2.** Reasons Why Firms Should Use BI

Argument	Details on the usage of BI in SMEs
BI software presents solutions to major business questions promptly.	Small and medium-sized company owners (SMEs) may utilize business intelligence (BI) tools to extract useful information from large stores of unstructured data, process it using analytical programs, and then base their choices on the outcomes. Additionally, business owners may simply and rapidly get lists of customers and contacts, sales information, and other BI material whenever it's needed.
BI empowers team members.	As a result of the accessibility of BI tools, any member of the team may participate in making decisions, which is very helpful for lean operations.
BI solutions save time.	Because BI software makes automation possible, small and medium-sized enterprises (SMEs) no longer need to waste time on labor-intensive, error-prone manual processes like data input. With the help of BI technologies, workers may devote less time to menial activities and more time to those that need original thought and analysis.
BI software presents SMEs with more precise customer profiles.	Due to the advancement of BI technologies, SMEs will have an easier time narrowing down on their ideal clientele. By collecting client information from a variety of internet sources, business intelligence software helps companies zero in on their ideal customers and deliver their goods and services to that market in the most effective and profitable manner possible.
BI tools help SMEs identify where they can cut costs.	Understanding where you may cut expenditures without resorting to drastic austerity measures is crucial when working with a small budget (e.g., laying off people). Business intelligence (BI) technologies help entrepreneurs manage their budgets and allocate resources more effectively.
BI solutions provide insights into trends.	SMEs may achieve a competitive edge by anticipating market trends with the aid of BI tools.
BI presents entrepreneurs with insights on actual-time business performances.	SMEs owners may monitor KPIs like client retention, profit, and sales using BI software. Users may immediately see whether a commodity or campaign works as planned, rather than having to wait until the conclusions of the promotions of reporting periods, and then take steps to correct any problems that may be reducing profits.
BI software provide data in formats, which are understandable.	BI tools are useful since not all business owners have a background in accounting or are good at quickly assessing data from a table. Advanced visual capabilities in BI software provide analytical findings and other BI materials in the form of infographics, comprehensible charts, graphics, as well as other visualizations. BI software also facilitates

	company owners' comprehension of business data by displaying it graphically rather than in blocks of plain text.
BI software provides easier collaboration and cooperation.	By using BI tools, information can be exported and shared more efficiently across members of a SME team. For a small or medium-sized firm (SME), where open lines of communication, teamwork, and collaboration are essential to success, it is crucial that all team members have instantaneous access to accurate, up-to-date data.

## VI. DISCUSSION

### *Overview of Business Intelligence*

The term "business intelligence" (BI) refers to the methods and systems that companies use to analyze and manage their internal business data. Benchmarking, text mining, predictive analytics, prescriptive analytics, complex event processing, data analytics, dashboard creation, data mining, process mining, and online analytical processing are all typically applications of BI technology. Corporate intelligence (BI) systems are able to process massive volumes of data, both structured and unstructured, which may be used to discover and cultivate novel avenues for strategic business growth. They hope that this will make it simpler to comprehend these massive datasets. It is possible for organizations to attain a competitive edge and long-term stability by determining novel possibilities and implementing effective plans based on the available insights.

There is a broad spectrum of business choices that may be supported by business information, from the tactical to the strategic. Decisions like product positioning and price are the building blocks of every business. Making broad-scale choices about priorities, objectives, and orientations is what we call "strategic decision making" in business. Effective Business Intelligence (BI) always involves a combination of external data gathered from the industry where the firm works (external dataset) and internal dataset gleaned from the organization's own financials and activities (internal data). When internal and external data are merged, a more comprehensive picture emerges, yielding "intelligence" that cannot be obtained from either source alone. Business intelligence technologies have several applications, including helping companies expand into new markets, analyze the demand for their goods and services, and determine the efficacy of their advertising campaigns. The terms "Business Intelligence" (BI) and "Data Warehouse" (DW) are sometimes used interchangeably, and "BI/DW" and "BIDW" refer to the combination of these two ideas. BI applications apply data retrieved from DW or data marts. One of the functions of a data warehouse is to store copies of analytical data for use in making decisions.

### *Overview of Business Analytics*

The term "Business Analytics" (BA) is used to describe the body of information, resources, and methods that are used to analyze and investigate past company performance in order to develop knowledge and guide future business strategy. The field of business analytics applies statistical and data-driven methods to the study of business with the goal of gaining new insights into organizational processes. When it comes to assessing past performance and guiding strategic planning, however, business intelligence has often centered on using a uniform set of metrics. Contrast this with business intelligence, which focuses on describing existing conditions, and you'll see that business analytics is all about making predictions and offering suggestions. Business analytics relies heavily on predictive and explanatory modeling, fact-based management, numerical analytic and analytical modeling to guide decision-making.

As a result, it has a tight relationship to knowledge management. Analytics may drive completely automated judgments or be utilized as input for human decision-making. Online analytical processing (OLAP), reporting, and "alerts" are all components of business intelligence. In other words, searching, reporting, as well as OLAP are alert systems that may provide information on what occurred, how often it occurred, how many times, where the issue is, and what has to be done. Why is this occurring, what if these patterns continue, what will occur next (forecast), and what is the best conclusion that can occur are all queries that business analytics can respond to (optimize).

### *Discussion of Results*

Through a thorough literature analysis of papers published between 2000 and 2016, this study provided a summary of the research on BI&BA in SMEs. Despite the fact that 62 publications were included because they matched the inclusion criteria, the research methodologies used in another 26 were not well described. The need for greater empirical study on BI&BA is highlighted, indicating the immaturity of the area. Future research areas and gaps are presented in the discussion that follows. The offered pieces of BI&BA may be combined in many ways to create new kinds of BI&BA software and systems. A thorough familiarity with these parts is necessary for establishing a BI&BA system's architecture and designing for its effective deployment.

Many SMEs not decisive enough to employ BI&BA technology, but reference frameworks help them get through the challenges they have when introducing BI&BA solutions, as stated by Antwi in [53]. More study is needed to provide supplementary reference models for BI&BA parts. This research presents a mature collection of BI&BA open-source solutions that cover a wide range of BI&BA needs. As a result, these solutions developed into a reliable choice for any business, particularly SMEs, to meet and even exceed its BI&BA requirements. Future study might benefit from investigating the advantages of open-source BI&BA for SMEs.

Due to their versatility in communication and computing, mobile phones have quickly become indispensable to businesses, particularly SMEs. It's incredible how convenient it is to have constant, mobile access to all of your favorite

services. The deployment techniques, information presentation and interaction, context awareness, data exploration, rich programming functionality, multiple device compatibility, and offline model exploration are all areas that might need further work. In addition, it is crucial that BI&BA developers place a strong emphasis on exploiting mobile security features, including secure authentication, VPN and HTTPS support, and application sandboxing. Because of this, greater research into this area could assist alleviate the annoyance of users and enhance BI&BA application.

Cloud-based BI&BA was also touted as an affordable licensed alternative to open-source solutions for SMEs. Although the research presents criteria, frameworks, and models for effective deployment of cloud BI&BA, no practical studies demonstrate its advantages. While cloud computing has many advantages, many SMEs are still hesitant to make the move owing to concerns about data security and management, especially ownership. Therefore, these concerns need to be the focus of future research. Knowledge, efficiency, improved decision-making in a timely manner, and financial gain are just few of the benefits that a well-implemented BI&BA system can provide to any business. When looking at case studies of businesses using BI&BA, it is common to find ones that focus on more conventional manufacturers. More research on the use of BI&BA in non-financial sectors is required. The results of these kinds of studies might shed new light on the topic of BI&BA and help bring it into the mainstream of SMEs.

Adopting BI&BA throughout the company requires a thorough understanding of what it is, why it will be used, and the advantages that come along with it. Not enough research has been done to further our understanding of whether or not SMEs are prepared to implement BI&BA. Owner managers or top-level management may find this information helpful in their efforts to boost BI&BA. Furthermore, there is a need for further empirical research on the inhibitors and drivers of BI&BA adoption. In order to help businesses, determine what it takes to execute BI&BA successfully, a number of frameworks and models have been developed. However, success was not defined in any concrete way. There has also been a lack of research on how the advantages of BI&BA systems are really employed. More importantly, the requirement to provide a high return on investment (ROI) and the means by which this may be accomplished, as well as the means by which this can be combined with other measures to reduce the overall cost of ownership.

The advantages of BI&BA typically extend beyond what is first apparent. According to Agostino, Solberg Søilen, and Gerritsen, in [54], the greatest desired result of BI&BA in SMEs is improved decision-making, just as it is in big businesses. Intriguingly, just single research examined the positive effects of BI&BA on SMEs. Benefits assessment of BI&BA has received little attention in the academic community, according to the authors' claims. Therefore, it is crucial to do more research into the advantages of BI&BA. The importance of BI&BA and the systems that use it to generate intelligence will only be better understood with further research in this area. SME's need to go beyond the technical feasibility in order to fully capture BI&BA's value, which may lead to new insights. The use of BI&BA tools and techniques in fields outside of business is in its early stages. Establishing protocols and governance, ensuring privacy, protecting security, adaptability, usability, and constantly developing technologies are all areas that require greater attention if BI&BA is to become more popular for SMEs. The aforementioned problems are just the beginning. Last but not least, it would be significant to present empirical reports to effectively understand the varied capacities of BI&BA, to enable SMEs mitigate typical challenges during the application stages, and to provide support for the procurement of BI&BA solutions.

## VII. CONCLUSION

This paper presents a systemic review of the relevant literature concerning BI&BA for SMEs. The majority of research has focused on the elements that influence the spread of BI&BA, such as the models, critical success factors, architectures, problems, and determinants. Having this proof of the contribution's potential might help practitioners make better decisions when planning future work. Business intelligence and analysis providers may benefit from this in a number of ways, including enhanced BI&BA product usability, system integration, and implementation simplicity. This analysis helped academics by pointing them in the right direction by highlighting existing research gaps and promising new avenues to explore. Research into (a) the creation of reference frameworks; (b) the realization, assessment, and evaluation of benefits; (c) the factors affecting the implementation and adoption (e.g., overall ownership cost, security concerns, and return on investment); and (d) various applications of BI&BA in various enterprise industries and fields are all areas that could benefit from further investigation. Additionally, mobile and cloud-based BI&BA solutions provide interesting use cases for SMEs. There are a few problems with this research. Despite the paper's extensive literature study, I should point out that I make no claims to have covered everything relevant to the topic here.

### **Data Availability**

No data was used to support this study.

### **Conflicts of Interests**

The author(s) declare(s) that they have no conflicts of interest.

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### **Competing Interests**

There are no competing interests

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