

Article

Leveraging Business Intelligence Systems for Enhanced Corporate Competitiveness: Strategy and Evolution

Montserrat Jiménez-Partearroyo ¹ and Ana Medina-López ^{2,*} 

¹ Economía Aplicada II y Fundamentos Análisis Económico Department, Economía de la Empresa (ADO), Universidad Rey Juan Carlos, 28032 Madrid, Spain; montserrat.jimenez@urjc.es

² Economía Financiera y Contabilidad Department, Universidad Rey Juan Carlos, 28032 Madrid, Spain

* Correspondence: ana.medina@urjc.es

Abstract: This study contextualizes the transformative role of Business Intelligence (BI) over the past two decades, emphasizing its impact on business strategy and competitive advantage. Employing a dual-method approach, it integrates a bibliometric analysis using SciMAT with a qualitative examination of six key articles from the Web of Science (WoS), analyzed through the Gioia methodology, focusing on BI and competitiveness. The aim is to examine the metamorphosis of Business Intelligence (BI) and how it has evolved from a traditionally supporting role to a central strategic player in shaping corporate strategy and business competitive advantage over the past two decades. It discusses the overall transformation of BI and provides an in-depth examination of the specific ways in which Business Intelligence tools have redefined the landscape in contemporary business practices. Key findings reveal BI's pivotal role in enhancing knowledge management, innovation, and marketing capabilities. Challenges in BI implementation, such as the necessity for skilled personnel and adaptability to swift technological shifts, are also highlighted. Results advocate for a dynamic BI approach, adaptable to market trends and technological evolutions. The research demonstrates that BI tools, especially when integrated with technologies like AI, IoT, and machine learning, significantly enhances decision making and efficiency in socio-technical and management systems, leading to a paradigm shift in handling complex systems and adapting to changing environments.

Keywords: business intelligence; competitiveness; Gioia; SciMAT; data-driven; decision support systems



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1. Introduction

In an era in which data and information are one of the most important assets of any organization [1], Business Intelligence (BI) tools have become the axis of corporate competitiveness [1,2]. Once relegated to the back offices of IT departments, these tools are now at the forefront of strategic business operations, catalyzing profound transformations across the corporate landscape. This article aims to highlight the path taken by BI tools from mere data processors to strategic assets for forecasting and corporate decision making.

This exploration is set against the backdrop of a rapidly evolving digital economy, where agility and informed decision making are paramount. This study meticulously analyzes the qualitative insights gained from the Gioia methodology [3] with a bibliometric analysis to chart the thematic evolution of BI tools. In doing so, it sheds light on the fundamental role of BI in strengthening knowledge management, fostering innovation, and amplifying marketing capabilities, with the objective of overcoming the obstacles that organizations encounter in the wheel of corporate competitiveness.

As we read through the annals of the literature on BI and its impact on enterprise competitiveness, spanning from 2002 to 2023, this article posits that the true value of BI lies in its technological excellence and in its strategic utilization [4]. This metamorphosis of BI from a supporting role to becoming a leading strategic player leads us to consider the following research question: How have Business Intelligence tools transformed the fabric of corporate strategy and competitive advantage over the last two decades?

Our findings highlight the transformation of BI from a technological aid to a strategic oracle [5]. They reveal that BI's influence enhances knowledge management, driving innovation and reinforcing marketing strategies. Yet, the full potential of BI tools emerges only when companies overcome the challenges of implementation, such as the need for skilled personnel and adaptability to rapid technological changes. These technologies can be used in conjunction with conceptual models of business objectives, processes, and situations (business structures) to drive strategic decision making about opportunities and threats [6].

To explore this transformative role of BI tools in corporate strategy and their influence on competitive advantage, this study applies a dual approach that combines a bibliometric analysis with the SciMAT bibliometric tool and a detailed review of six key articles using the qualitative Gioia methodology to complement this study and formulate a grounded theory that answers the research question. This approach emphasizes the importance of BI in knowledge management, innovation, and marketing capabilities, also identifying challenges and the need for adaptability to rapid technological changes. Furthermore, this study highlights how BI, in conjunction with technologies such as artificial intelligence (AI), the Internet of Things (IoT), and machine learning, represents a paradigm shift for maintaining a competitive edge in the current market. In this way, this study not only provides relevant practical and theoretical contributions but also fills a critical gap in the existing literature by illuminating the systemic and interconnected nature of business intelligence in the context of complex and adaptive systems, systems engineering and artificial intelligence, and by offering both a panoramic view and a granular analysis of how BI tools have reshaped competitive dynamics within the business environment.

2. Theoretical Framework

Although the term Business Intelligence is relatively new, it has been 60 years since we discovered computer-based business intelligence systems called decision support systems (DSS). The history of Business Intelligence (BI) dates to these systems that appeared in the 1960s; initially, they were computer-assisted models created to support decision making and planning [7]. However, they laid the foundation for what would become BI by emphasizing the use of data to assist in management decisions and increasing competitiveness.

2.1. Business Intelligence: Increasing Competitiveness

The earliest definitions provided descriptions, which defined BI mainly as a technological tool or information system that appeared during the mid-1980s [8]. In the late 1980s, the concept of BI began to take a more defined shape with the development of data warehouses, executive information systems, and online analytical processing (OLAP). These advancements allowed for the aggregation of large volumes of data from various sources and the ability to perform complex analyses, which were crucial steps in the evolution towards today's BI systems. Howard Dresner [9], later associated with Gartner, was instrumental in popularizing the term "Business Intelligence" in 1989. He described BI as encompassing concepts and methods to improve business decision making by using fact-based support systems, a definition that highlighted the strategic role of BI tools beyond simple data processing.

By the 1990s, the costs associated with data warehousing began to decline, making BI tools more accessible to a broader range of business professionals and not just top management [10]. This period, often referred to as "Business Intelligence 1.0", saw BI becoming an integral part of the business decision-making process, supported with tools like ETL (extract, transform, and load) and OLAP. Business Intelligence 1.0 was defined by Vercellis [10] as a comprehensive knowledge of all factors affecting a business, enabling optimal decisions.

Entering the new millennium, the abundance of data and the need for real-time processing led to the integration of BI with cloud computing and big data analytics, marking a significant milestone in BI's history. BI combines operational data with analytical tools

to present complex and important information to decision makers, business managers, and planners; in fact, the technologies associated with BI have been growing and gaining improved positioning in certain techniques such as Data Mining [11]. The main goal of BI is to improve the timeliness and quality of inputs to the decision process [12]. As we move through the 21st century, BI continues to evolve, incorporating advanced analytics, machine learning, and artificial intelligence to provide more predictive and prescriptive insights. The current landscape of BI is characterized by a focus on real-time analytics, the Internet of Things (IoT), and an ever-increasing integration with cloud computing, setting the stage for further innovations in how businesses leverage data for strategic advantage.

The integration of machine learning and artificial intelligence with business intelligence has been a game-changer for companies, enabling improved operational processes, better customer service, and real-time data analysis [13,14]. Machine learning, a subset of AI, is a type of artificial intelligence (AI) that allows software applications to become more accurate in predicting outcomes without being explicitly programmed; it is particularly effective in uncovering patterns in large datasets, making it ideal for exploiting the opportunities hidden in big data [15]. The transition from traditional BI to AI-driven BI is driven by the need for real-time processing and decision making in the face of growing data volumes [16]. This shift also represents a move from descriptive analytics to predictive analytics [17]. However, the adoption of AI and ML in information systems research remains a challenge relative to preparation, preprocessing, and processing data, as well as expertise, among others, with potential causes and solutions [18].

BI is all about gathering data in a business from numerous sources in the business environment and from within the business itself and then using technology to store, process, and retrieve that data for use by decision makers within the business as and when they need to do so. This will then help assist them in understanding how the business is doing, where weaknesses exist, and what opportunities and threats there are in the business environment or within the business that decision makers can set their eyes on and take appropriate steps [19].

Since we now live in a world where all businesses are information driven, BI systems fulfill the conditions to succeed, but, for this to happen, they should have the potential to transform the information into knowledge within the organization [20]. BI serves as one of the ways to obtain complete information about the state of the organization, as well as the company's competitors in the market and the level of interaction with customers. BI is the process for increasing the competitive advantage of a company by intelligent use of available data in decision making [21]. The functionality of BI extends to the collection, purification, and integration of data from disparate sources, thereby facilitating enhanced decision-making processes and improving overall business performance [22]. Furthermore, BI is particularly important for knowledge management and innovation, both of which contribute to competitiveness [23]. In essence, BI is a strategic tool for improving competitiveness in organizations.

Figure 1 shows the evolution of BI tools from 1990 to the present.

As can be observed in Figure 1, before 1995, the initial and basic use of BI tools consisted of simple reporting and basic data analysis. The period of 1995–2001 marks a growth in the adoption of BI, with the development of more sophisticated tools for analysis and reporting, beginning the stage of Business Intelligence 1.0 with the use of tools such as OLAP and ETL. During the period of 2002–2010, BI was consolidated and expanded significantly, starting the integration of BI with cloud computing and big data analytics, becoming an essential part of business strategy. This integration evolves deeper in the period of 2011–2019, advancing with the use of data mining, big data, and social networks and incorporating advanced analytics.

From 2020 onwards, artificial intelligence and machine learning emerged, taking BI to a higher level of sophistication and automation, which was more valued due to the challenges and adaptation needs caused by the COVID-19 pandemic.

BI Development Periods

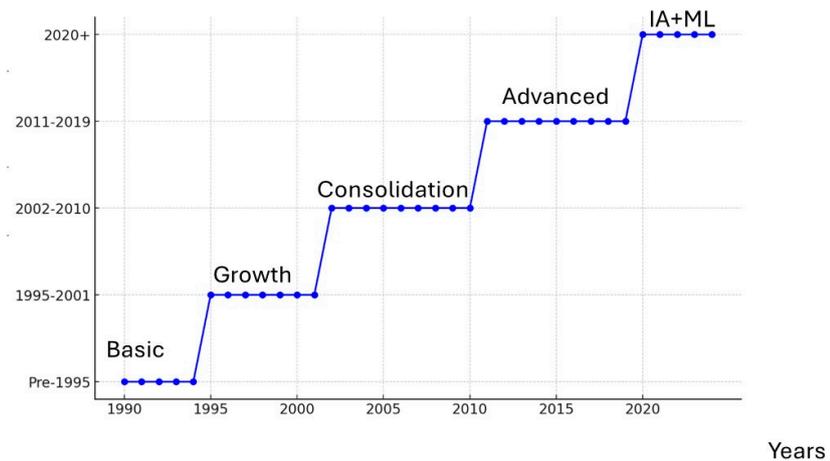


Figure 1. Evolution of Business Intelligence Tools. Own Elaboration.

2.2. Business Intelligence Tools

According to Shende and Panneerselvam [24], Business Intelligence refers to the application of technologies and practices for collecting, integrating, analyzing, and presenting business information. Six major components of BI are identified:

- **OLAP (On-line Analytical Processing):** It pertains to the methods business users employ to analyze data using advanced tools, facilitating the exploration of dimensions like time or hierarchies;
- **Advanced Analytics:** This involves data mining, forecasting, or predictive analytics, utilizing statistical analysis techniques to predict or provide certainty measures on facts;
- **Corporate Performance Management (Portals, Scorecards, Dashboards):** Typically provides a framework for various components to integrate and collectively narrate a story;
- **Real-time BI:** Enables the real-time distribution of metrics through emails, messaging systems, and interactive displays;
- **Data Warehouse and Data Marts:** The data warehouse acts as a centralized repository where large amounts of data from multiple sources within an organization are stored. It is a strategic component that facilitates the collection, storage, and processing of large volumes of data, which in turn allows for detailed analysis and more informed decision making in organizations, essential for BI, aiding in the physical transmission of data for integration, cleansing, aggregation, and query tasks. Data marts store historical operational data for trend analysis and strategy formulation;
- **Data Sources:** These may include diverse data types like operational, historical, and external data from market research or existing data warehouse environments.

To these components, we should incorporate other elements within the BI strategy that can significantly enhance its capabilities, making it more adaptable, predictive, and integrated into the daily workflow of an organization [25–28]:

- **AI and Machine Learning in BI** can significantly improve the predictive capabilities of BI systems by learning from historical data to forecast future trends, customer behaviors, and market dynamics. AI can automate complex data analysis tasks. Integrating Natural Language Processing (NLP) allows users to interact with BI systems using natural language, making the systems more accessible and intuitive. Machine learning models can adapt and improve over time, continually refining their analysis and predictions based on new data, leading to progressively more accurate and insightful BI outputs [15];

- Cloud Computing offers BI systems scalability and flexibility, allowing businesses to access and analyze vast datasets without the need for extensive on-premises infrastructure;
- IoT devices provide a continuous stream of real-time data, which can be used for more dynamic and immediate BI insights. Integrating IoT with BI can enhance operational efficiency by enabling predictive maintenance, optimizing supply chains, and improving customer experiences;
- Collaborative BI tools allow for better teamwork and communication around data, leading to more informed decision making;
- Mobile BI ensures that business users have access to data and insights on the go, increasing the reach and impact of BI. It enables real-time alerts and reporting, allowing decision makers to stay informed no matter where they are;
- Embedded Analytics integrate BI capabilities directly into business applications, providing analytics in the context of the user's workflow. This leads to a more intuitive user experience and can increase the adoption and effectiveness of BI tools.

As BI continues to evolve, it is likely that these components will become even more central to how businesses leverage data for strategic advantage.

3. Methodology

This section explores, on the one hand, a bibliometric analysis, focusing on the interplay between Business Intelligence (BI) and competitiveness. Building upon the foundational understanding of BI's evolution and its integration with cutting-edge technologies, this analysis aims to uncover the empirical trends, thematic developments, and scholarly discourse surrounding BI as a strategic tool in enhancing corporate competitiveness. On the other hand, in this research paper, we employ the Gioia methodology, a renowned qualitative approach in organizational research devised by Dennis A. Gioia [3]. This method is characterized by its systematic approach to theory building from empirical data, which is particularly relevant for deeply exploring phenomena within specific contexts, such as the intersection of Business Intelligence (BI) and competitiveness.

3.1. Business Intelligence and Competitiveness: A Bibliometric Analysis

In the context of an increasingly data-driven business world, understanding the role of BI in shaping competitive dynamics is the tool for companies to better understand the market, optimize their operations, personalize their offerings, and ultimately maintain and enhance their competitive position. This bibliometric study, employing the robust capabilities of SciMAT, systematically examines the academic landscape as captured in the Web of Science (WoS). It explores how the discourse on BI and competitiveness has evolved, identifying key themes, influential works, and emergent patterns in the literature. This instrument, as characterized by Cobo et al. [29], excels in executing science mapping analyses over extended time periods. Its methodology goes beyond simply cataloguing established knowledge. It probes further by combining performance analysis with science mapping. This dual approach is instrumental in detecting and visualizing conceptual subdomains within the research field, whether they be specific themes or broader thematic areas.

The Web of Science (WoS) Core Collection is selected as the primary database for this bibliometric analysis. This collection stands out as a comprehensive assembly of high-quality scientific journals, incorporating a variety of publication databases. It provides the necessary data, such as keywords and abstracts, for effective analysis using SciMAT. As emphasized by Shu et al. [30], WoS is recognized globally as one of the most influential databases. This recognition is often attributed to the correlation observed between top-tier research and the publications it houses, prevalent in numerous countries. The decision to utilize WoS is further supported by its extensive coverage and efficiency in delivering wide-ranging results across diverse disciplines, a perspective supported by the findings of other authors [31,32]

The search within WoS was guided by specific criteria, with the terms "business intelligence" (Topic) and competitiveness (Topic) and Article or Proceeding Paper (Doc-

ument Types) forming the core of the search and selection process. A total of 174 articles remained as the primary subject of analysis. The articles identified in this study span the years 2002 to 2023, offering a comprehensive view of the field's evolution. To conduct a nuanced evolutionary analysis, this study divides this timeline into three distinct periods, the choice of these periods was not based on the number of articles published (as may be the criterion followed by other bibliographic research), but on key events that have marked the development and evolution of the field of Business Intelligence (BI): (2002–2010) with 27 papers found, (2011–2019) with 100 documents found, and post-pandemic (2020–2023) with 47 articles. The first article identified within the chosen topics of BI and competitiveness dates to 2002, the first period (2002–2010) captures the initial years of development and early adoption of BI, as well as its evolution up to the post-global financial crisis of 2008. It focuses on the initial phase where businesses began to recognize the importance of BI for competitiveness, especially in a changing economic context [33,34]. The second period (2011–2019) covers the consolidation of BI in a mature business environment and its integration with emerging technologies such as big data and social network analytics, just before the COVID-19 pandemic. Here, BI begins to take on a more strategic role, with an increasing focus on data-driven decision making and preparation for the era of AI and digital transformation. The final period (2020–2023) reflects the era of the COVID-19 pandemic and its aftermath, a time of rapid changes and significant adaptations. Here, the analysis can focus on how BI has been instrumental in businesses' responses and adaptations to the unprecedented challenges posed by the pandemic, marking a significant shift in competitiveness strategies and the acceleration of digital transformation [35,36].

Table 1 presents the journals in which two or more articles on this topic have been identified.

Table 1. Journals/Proceedings with two or more articles analyzed. Source: own elaboration.

Source	Number of Documents
Sustainability	4
Proceedings of 2021 16th Iberian Conference on Information Systems and Technologies (Cisti'2021)	3
Competitiveness Review	2
Kybernetes	2
Education Excellence and Innovation Management Through Vision 2020	2
Management-Journal of Contemporary Management Issues	2
Proceedings Of the Iti 2012 34th International Conference on Information Technology Interfaces (Iti)	2
Journal of Enterprise Information Management	2
International Journal of Hospitality Management	2
Strategic Management	2
2015 6th International Conference on Information, Intelligence, Systems and Applications (Iisa)	2

Despite the relatively modest size of the sample analyzed, a considerable array of themes and concepts has been identified, thereby facilitating a thorough analysis using the SciMAT tool. Presented below is Table 2, delineating the list of the most-cited articles, with more than 30 citations:

Table 2. List of the articles with more than 30 citations. Own Elaboration.

Article	Number of Citations	Authors
The Role and Impact of Industry 4.0 and the Internet of Things on the Business Strategy of the Value Chain-The Case of Hungary	270	Nagy et al. [37]
Smart hospitality-Interconnectivity and interoperability towards an ecosystem	162	Buhalis et al. [38]

Table 2. Cont.

Article	Number of Citations	Authors
Process-centric business intelligence	49	Bucher et al. [39]
Requirements for forming an ‘e-supply chain’	38	Akyuz et al. [40]
Fusion-Based Supply Chain Collaboration Using Machine Learning Techniques	37	Ali et al. [41]
The impact model of business intelligence on decision support and organizational benefits	37	Rouhani et al. [42]
Hotel chain affiliation as an environmental performance strategy for luxury hotels	35	Chen [43]

Continuing with the SciMAT study, upon completing the co-word or co-citation analysis using SciMAT, a series of clusters is generated, which can be interpreted as aggregates of various scientific aspects. In the context of co-word analysis, these clusters form groupings of textual content, representing semantic or conceptual collections of diverse topics addressed within the research field. Therefore, these identified clusters facilitate the quantification of the research field through performance analysis. Co-word analysis allows us to discover the main concepts treated by the field and it is a powerful technique for discovering and describing the interactions between different fields in scientific research [44].

3.2. Description of Gioia Methodology

The Gioia methodology is a distinctive qualitative research approach that effectively combines data-grounded concept development with theoretical insight. It involves a nuanced process of data analysis, starting with first-order coding that stays true to the terms and descriptions used by study participants. This stage is instrumental in capturing the authentic perspectives and experiences of the subjects. The methodology then progresses to second-order coding (secondary themes), where the researcher interprets these data points, grouping them into broader, theoretically informed categories. The Gioia methodology advances further into the aggregation of dimensions, where the secondary themes identified in the second-order coding coalesce into higher-order dimensions. These dimensions are more abstract and encompassing, serving as pillars for developing a conceptual framework that bridges the empirical findings with existing theories.

Finally, the methodology culminates in the construction of a data-driven theory. By interlinking the empirically grounded first-order concepts, second-order themes, and aggregate dimensions, a theoretical model emerges. This model not only reflects the intrinsic complexity of the qualitative data but also offers a substantive contribution to the theoretical sphere, providing a robust foundation for both scholarly discourse and practical application in the field of Business Intelligence and competitiveness.

The Gioia methodology is tailored for the analysis of rich qualitative data, such as detailed interviews, observational notes, other narrative materials, and documents; for example, the paper “Using the Gioia Methodology in International Business and Entrepreneurship” [45] summarizes about 70 papers where this methodology has also been utilized. The conclusion emphasizes the value of qualitative research in representing complex organizational phenomena and the potential of the Gioia methodology in producing meaningful research in international business and entrepreneurship.

Our study uniquely adapts the Gioia methodology to secondary data analysis, focusing on previously collected and published scientific academic articles. This approach deviates from traditional methodologies that primarily rely on primary data collection, like interviews or surveys. By leveraging secondary data, we tap into a comprehensive array of prior studies, enabling an extensive comparative analysis across various perspectives within the fields of BI and BA. This method not only enriches our database but also enhances the robustness and validity of our theoretical framework [46].

The analytical approach in qualitative research, utilizing secondary sources such as scientific articles, offers a unique method of understanding and interpreting any area of study. This approach emphasizes the importance of existing knowledge and scholarly discourse in shaping our comprehension of various phenomena. By analyzing and synthesizing information from these secondary sources, researchers can construct a comprehensive view of the subject matter, considering different perspectives and theoretical frameworks [47,48].

Selected Articles for Gioia Analysis

For this research, articles were systematically identified using the Web of Science database, employing specific keywords such as ‘Business Intelligence’ and ‘Competitiveness’. The selection was purposive, focusing on articles that directly contributed to this study’s aim of understanding the intersection of BI and competitiveness. This approach ensured a comprehensive coverage of the topic.

Six scientific articles were selected from the Web of Science (WoS) database. This selection was made randomly using specific filters: Topic: “Competitiveness” and Topic: “Business Intelligence” were applied. This was to ensure that the selected articles contained these two phrases in their title, abstract, or keywords. Articles were included based on their relevance to BI in competitiveness, publication year to ensure timeliness, and their presence in high-impact journals. Exclusion criteria included lack of direct relevance to the research theme and articles with limited methodological rigor.

This process included identifying, categorizing, and relating themes to this study’s research questions, using a systematic approach to ensure comprehensive theme extraction. Findings from the selected articles were synthesized to provide a holistic understanding of the research topic. This involved integrating insights from different studies, identifying commonalities and differences, and linking them to the overarching research question.

Once six articles from each thematic area were randomly chosen, their content was examined to determine if they could address the following research question: How have Business Intelligence tools transformed the fabric of corporate strategy and competitive advantage over the last two decades?

Through the application of the qualitative Gioia methodology, it is intended to develop a grounded theory whose objective is to build a theoretical understanding that responds to the research question, based on collected data, in this case through the analysis of the 6 articles. For this purpose, the following questionnaire was designed, to which each of the selected articles had to respond:

1. What conditions or factors are important for the successful implementation of BI tools and for improving their competitiveness in the market? Is the use of any BI tool recommended?

This question explores the relationship between implementation conditions and BI success and identifies the critical elements that influence the effectiveness of the tools;

2. What challenges and barriers or difficulties of any kind might companies encounter when adopting, implementing, integrating, or utilizing Business Intelligence solutions?

The inclusion of this question allows for a comprehensive assessment of the obstacles faced by companies, crucial for developing effective BI strategies;

3. How does Business Intelligence contribute to strategic decision making in organizations?

This question serves to understand how BI facilitates strategic decision-making processes in organizations;

4. What is the impact of Business Intelligence on the financial and operational performance of companies or how does it influence the agility of their management?

The inclusion of this question is key to understanding the tangible influence of BI on managerial efficiency and agility;

5. How has the use of Business Intelligence tools in companies evolved and what are the current and future trends?

This question is intended to explore the evolution and future trends of BI tools, a crucial aspect for foreseeing future directions and strategic planning;

6. What role do technological innovation and changes in the business environment play in the evolution of Business Intelligence strategies?

This question is based on the interaction between BI, technological innovation, and changes in the business environment. BI is influenced by and in turn influences the technological and business environment.

The methodology for article selection in this research closely follows the quality criteria for qualitative research as outlined by Laumann in 2020 [49]. Articles were systematically sourced from the Web of Science database, employing specific keywords pertinent to Business Intelligence (BI) and competitiveness. This deliberate choice focused on articles that significantly contribute to the understanding of the intersection between both concepts. Such a targeted approach ensures thorough coverage of the subject, aligning with Laumann's guideline for selecting and presenting a relevant sample.

Furthermore, the selection criteria for articles included factors like recent publication dates for timeliness, and inclusion in high-impact journals. This detailed process not only ensures the credibility and reliability of the sources but also aligns with the ethical considerations and reflexivity necessary in qualitative research. By meticulously evaluating each article's contribution to the research questions and the broader understanding of BI and competitiveness, this study upholds critical standards of background presentation, methodological rigor, and bias identification. The characteristics of the sample selection process highlight several key virtues of the sample for the integrity and validity of the research in several ways:

Mitigating Bias through Random Sampling: The initial random selection of articles from the Web of Science database was deliberately chosen to reduce selection bias. This strategy promotes a wide-ranging perspective within the dynamic realms of Business Intelligence (BI) and competitiveness. It allows for an impartial exploration of new trends and developments by sidestepping personal biases or popular trends in the literature;

Diverse Temporal Range: Including articles from 2008 to 2023 enables a longitudinal study of the evolution and transformation of BI and BA in the tourism industry. This range of years provides insights into both the historical underpinnings and the current trends of these fields. The expansive timeframe adds a layered understanding of the topic;

Criteria-Based Selection Post-Randomization: After the initial random selection, articles were further refined based on their ability to answer six pre-established questions relevant to BI and competitiveness. This selective process ensures that each article substantially contributes to the research, highlighting a focus on relevance and thematic consistency;

Adaptive and Flexible Selection Methodology: The selection process exhibits adaptability and flexibility, vital attributes in qualitative research. The willingness to exclude articles not meeting specific standards shows a commitment to preserving the analytical quality and relevance of the research material. This approach balances exploratory sampling with stringent selection, showcasing methodological strength;

Representativeness and Diversity: The random sampling from a comprehensive source like the Web of Science ensures a representative and varied set of articles. This diversity is key to gaining a comprehensive understanding of the subject areas, preventing a limited or biased view of the field. The sample's diversity and representativeness are pivotal in encompassing a range of approaches and findings within the field.

The selected articles are displayed in Table 3:

Table 3. Selected articles.

Title	Source	Abstract
Business intelligence: Strategy for competitiveness development in technology-based firms [23]	Contaduría y administración (2016)	The article discusses the importance of intangible assets in organizations and the need to strengthen knowledge through information systems, innovation, and decision-making processes. These elements contribute to the development of business intelligence, which is a key factor in enhancing competitiveness in technology-based companies. The study used a mixed-methods approach, including in-depth interviews and a questionnaire, to gather data from companies. The findings suggest that knowledge is the most valuable asset in organizations, and that the business environment plays a key role in competitiveness.
Social Media Big Data Analysis: Towards Enhancing Competitiveness of Firms in a Post-Pandemic World [50]	Journal of healthcare engineering (2022)	In this paper, an advanced business intelligence framework for firms in a post-pandemic phase is proposed to increase their performance and productivity. This document presents a study on the impact of Business Intelligence on marketing processes in telecom companies. The authors propose and statistically evaluate a causal model that connects the availability of BI and BA resources and capabilities in a company to its operational marketing capabilities. The study aims to provide insights into the business value generation process associated with the adoption of BI and BA technologies, and its implications for a firm's performance and competitiveness.
Integrated Understanding of Big Data, Big Data Analysis, and Business Intelligence: A Case Study of Logistics [51]	Sustainability (2018)	The article explores the synergy between big data, BDA, and BI, emphasizing their role in enhancing decision making and operational efficiency in businesses, particularly in the logistics sector. The authors conducted an in-depth literature review to explore the evolution and interconnectedness of big data, BDA, and BI. They argue that these components should not be viewed as separate entities but as an integrated decision support system. This integration is crucial for businesses to harness the full potential of big data and BI for effective decision making and operational efficiency.
Assessing benefits of business intelligence systems—a case study [52]	Management: journal of contemporary management issues (2008)	The study acknowledges that while the costs associated with BI systems are often significant and challenging to measure, the benefits, such as improved decision making, enhanced customer satisfaction, and increased operational efficiency, can be even more difficult to quantify due to their often intangible nature. The case study of Melamin demonstrates how OLAP technology improved the company's financial and operational performance by enabling faster and more flexible report generation, improved decision support, and enhanced analytical capabilities.
Enhancing competitiveness in the tourism industry through the use of business intelligence: a literature review [53]	Journal of tourism futures (2020)	The paper delves into the role of Business Intelligence (BI) in boosting productivity, efficiency, and competitiveness in tourism firms. It emphasizes the increasing reliance on BI systems to process and analyze vast amounts of data for improved decision making. The article reviews the literature on BI's application in tourism, highlighting its integration with environmental analysis models like Porter's Five Forces and the Resource-Based View (RBV) model. It discusses the benefits of BI, such as flexible and user-friendly data management and analytical capabilities. The paper confirms the tourism industry's early adoption of BI for competitive advantages and stresses the need for tourism firms to embrace BI for enhanced competitiveness and efficiency.

Table 3. Cont.

Title	Source	Abstract
A business intelligence approach using web search tools and online data reduction techniques to examine the value of product-enabled services [54]	Expert systems with applications (2015)	The paper explores the significance of product-enabled services in companies with substantial R&D investments. By employing web search tools and data reduction techniques, the study delves into the service value attributes of firms heavily focused on product development. The findings highlight the importance of service quality, innovation, customer relationships, and strategic advantage in the context of product–service integration. The study emphasizes the potential for businesses to enhance their competitive edge by offering modernized, innovative, and customer-centric product-enabled services. The research contributes to the development of intelligent business intelligence systems and offers insights for practitioners and researchers seeking to capitalize on the evolving landscape of product-enabled services.

3.3. From Data Collection to Theory Generation

Following with the Gioia methodology, we now progress to the subsequent step: synthesizing and transforming the ideas gathered from the selected scientific articles. This process aims to converge these ideas towards a central concept and the formation of a theory. Figure 2 illustrates this synthesis process.

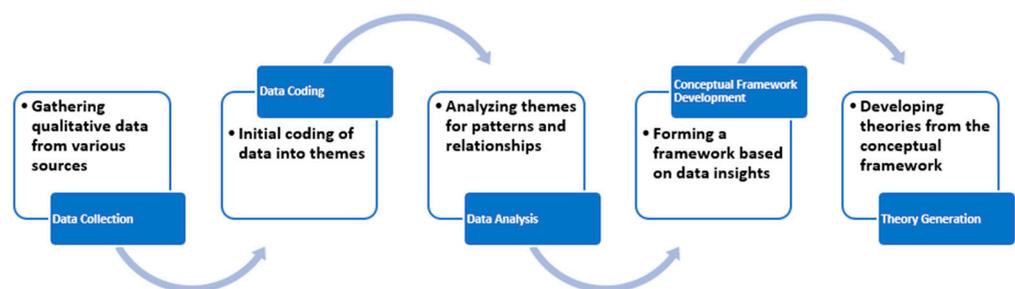


Figure 2. Stages of the Gioia methodology for theory development. Source: Own elaboration.

As shown in the Figure 2 it represents a structured approach to qualitative research that turns raw data into a comprehensive theoretical framework. The first step is the collection of qualitative data from various sources. The process then moves to data coding, which involves initial coding of this collected data to distill it (first concepts) and categorize it into identifiable themes.

Subsequently, in the data analysis phase, these themes are carefully examined to identify patterns and relationships, providing a granular understanding of the underlying data narratives by obtaining second-order themes. This analysis allows the construction of an academic-type conceptual framework based on the knowledge extracted from the data (aggregate dimensions), effectively capturing the essence of the research topic.

The final step, theory generation, leverages the conceptual framework to develop robust theories that contribute to the academic discourse. This methodology’s systematic nature ensures that the research is grounded in empirical data while fostering the generation of rich, well-founded theories that reflect the complexity and dynamism of the field under investigation.

4. Results

The results obtained from the application of both methodologies are presented below, on the one hand, the bibliometric analysis with the SciMAT tool, and on the other hand, those derived from the qualitative Gioia analysis.

4.1. Results of Bibliometric Analysis

Below are the results of the bibliometric analysis first segmented by each of the periods analyzed to conclude with an evolutionary map.

In Figure 3 (overlapping map) the keywords' evolution is shown. The circles represent each subperiod, and the number of keywords for the subperiod is represented inside (33 in the first period, 101 in the second one, and 75 in the last one). The arrows between consecutive subperiods represent the number of keywords shared between them (29 and 65) and, in parentheses, the stability index that reflects what percentage of topics have remained stable between the two periods (in this case fraction, (0, 28) and (0, 59)) is shown. The upper-incoming arrows represent the number of new keywords of the subperiod (72 and 10), and finally, the upper-outcoming arrows represent the keywords that are not present (i.e., discontinued) in the next subperiod (4 and 36) [44].

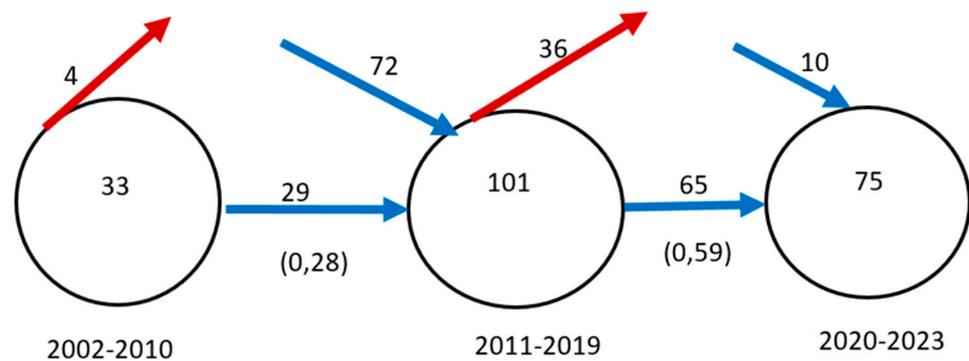


Figure 3. Overlapping map. Own elaboration.

When co-word analysis is used for mapping science, clusters of keywords (and their interconnections) are obtained. These clusters are considered as themes. Each research theme obtained in this process is characterized by two parameters "density" (can be understood as a measure of the theme's development) and "centrality" (can be understood as a measure of the importance of a theme in the development of the entire research field analyzed).

4.1.1. Period 1 (2002–2010)

The analysis proceeds with the strategic diagrams of each period. These will be accompanied by the network graphs of the most important central themes that appear in each one. The strategic diagram of the first period (2002–2010) in Figure 4a, shows a single cluster labeled as "BUSINESS-INTELLIGENCE" located in the upper right quadrant. This cluster has high density and centrality, indicating that it is a well-developed and highly relevant topic in the field of Business Intelligence during that stage. The density suggests that the research within this cluster is closely interrelated, while the centrality reflects its importance in relation to other BI literature topics at that time. The themes that appear in this quadrant are, therefore, central themes. The number "13" inside the cluster represents the number of documents that constitute the core of this topic. The position in the quadrant implies that "Business Intelligence" was not only a consolidated area of research but also influential in terms of connecting with other related areas. The "BUSINESS-INTELLIGENCE" cluster is central and the largest (a motor theme), indicating that it is the most developed and possibly the most cited or discussed. As seen in Figure 4b, which represents the network graph of this topic, it is connected to other clusters such as "INFORMATION", "DECISION-SUPPORT-SYSTEMS", "DATA ANALYTICS", "COMPETITIVE-ADVANTAGE", "STRATEGY", "PRODUCTION-MANAGEMENT", "CORPORATE-STRATEGY", and "KNOWLEDGE-MANAGEMENT". The proximity and lines connecting the clusters suggest strong thematic relationships between them.

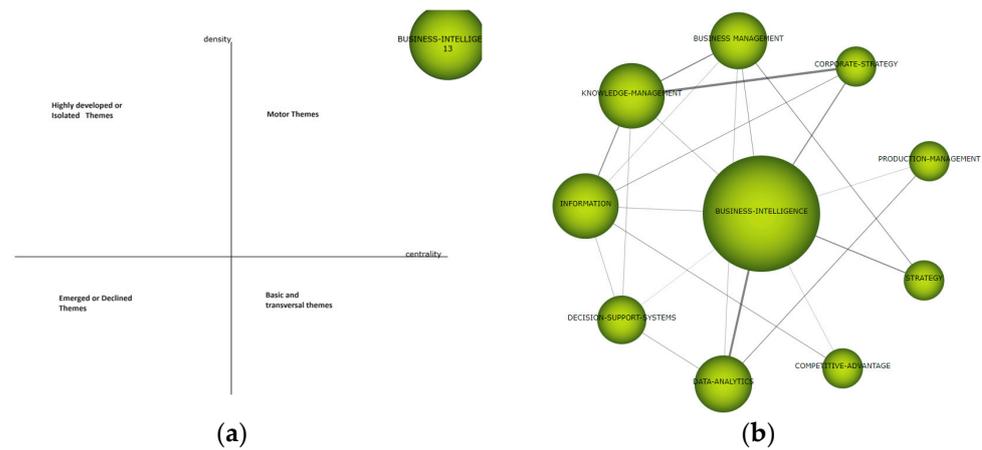


Figure 4. (a) Strategic diagram period 1 and (b) “Business Intelligence” network graph.

We can interpret that during this initial period, BI was primarily considered in the context of information management and decision support systems, with emerging connections to data analytics and competitive advantages. This pattern reflects a view of BI as a set of tools and systems focused on information that supports corporate strategy and knowledge management [55–57]. The strong relationships between “Corporate Strategy” and “Knowledge Management” in your cluster network indicate that, during the 2002–2010 period, there was a significant understanding of how Business Intelligence (BI) informs and enhances corporate strategy through effective knowledge management. This suggests that organizations adopting BI were not only looking to improve their data processing capabilities but also saw BI as a means to strengthen their overall corporate strategy by utilizing knowledge as a strategic resource [55,58,59].

4.1.2. Period 2 (2011–2019)

In the strategic diagram for the second period (2011–2019), analyzed with SciMAT (Figure 5a), we observe a notable transition of “Business Intelligence” within the research field. “Business Intelligence” now appears as a basic or transversal theme, signifying its evolution into a foundational element across various research areas. This shift from a central or motor theme to a transversal one suggests that BI has become ingrained in the fabric of corporate strategy and is now recognized as a fundamental component across multiple disciplines.

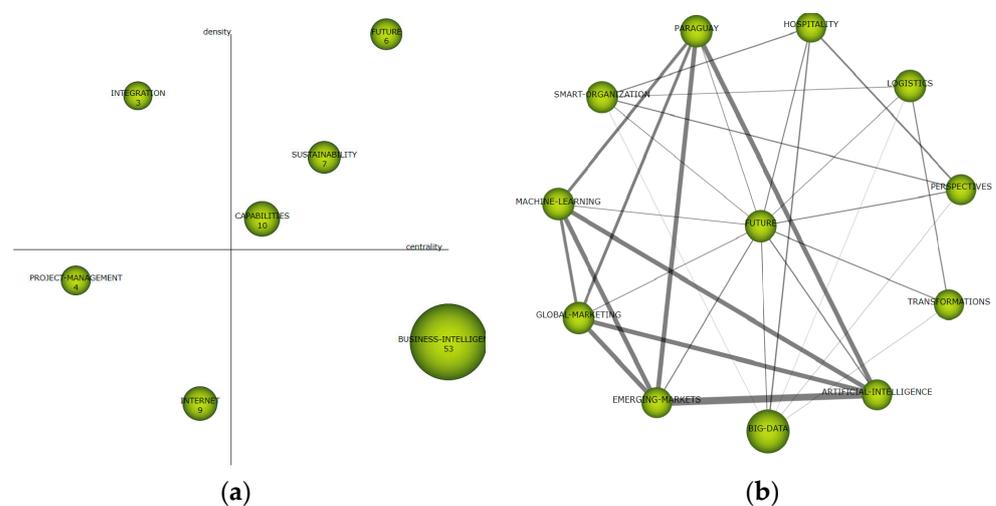


Figure 5. (a) Strategic diagram period 2 and (b) “Business Future” network graph.

During this period, the “Business Intelligence” cluster, though still significant with its presence in the graph, indicates an integration phase where BI principles and practices are no longer emerging or isolated topics. The strategic importance of BI is now reflected in its prevalence and the way it interconnects with diverse themes, emphasizing its role as an essential, cross-cutting asset in the realm of business competitiveness. This transformation may reflect the maturation of BI as a field, where its concepts and methodologies have been assimilated into the standard operating procedures of organizations, becoming indispensable in the pursuit of a competitive edge in an increasingly data-driven era. New driving themes such as Future, Capabilities, and Sustainability emerge. The accelerating pace of technical innovation, coupled with a turbulent socio-political global environment, has created opportunities and challenges for companies in terms of competitiveness and sustainability [60]. On the other hand, several studies reaffirm the positive effect that the use of BI has on resources and capabilities [42,61,62].

In the network graph for this period (Figure 5b), “Future” (the main central or motor theme) appears, reflecting its significance as a focal point of research and discussion within the field. The prominence of “Future” indicates a forward-looking perspective in the domain of Business Intelligence (BI), with research efforts concentrated on anticipating and shaping upcoming trends.

Surrounding “Future”, the interconnected nodes such as “Artificial Intelligence”, “Big Data”, “Machine Learning”, “Global Marketing”, and “Emerging Markets” suggest a multidisciplinary approach to BI, where the interplay between advanced technologies and strategic business processes is heavily emphasized [51]. These connections highlight a shift towards leveraging BI not just for present-day decision making, but for preparing organizations for forthcoming challenges and opportunities. The presence of clusters like “Hospitality”, “Logistics”, and “Smart Organization” further indicates that BI is seen as integral to the transformation and modernization of various industry sectors. This ties back to the strategic diagram interpretation, where BI’s role as a basic or transversal theme underlines its integration into broader organizational and strategic considerations.

4.1.3. Period 3 (2020–2023)

In the strategic diagram for the latest period (2020–2023) (Figure 6a), “Business Management” has emerged as the central and dominant cluster, signifying its critical role as a driving theme in the post-pandemic research context. The cluster’s position in the network graph (Figure 6b) indicates a significant scholarly focus on how business management principles are evolving in response to contemporary challenges.

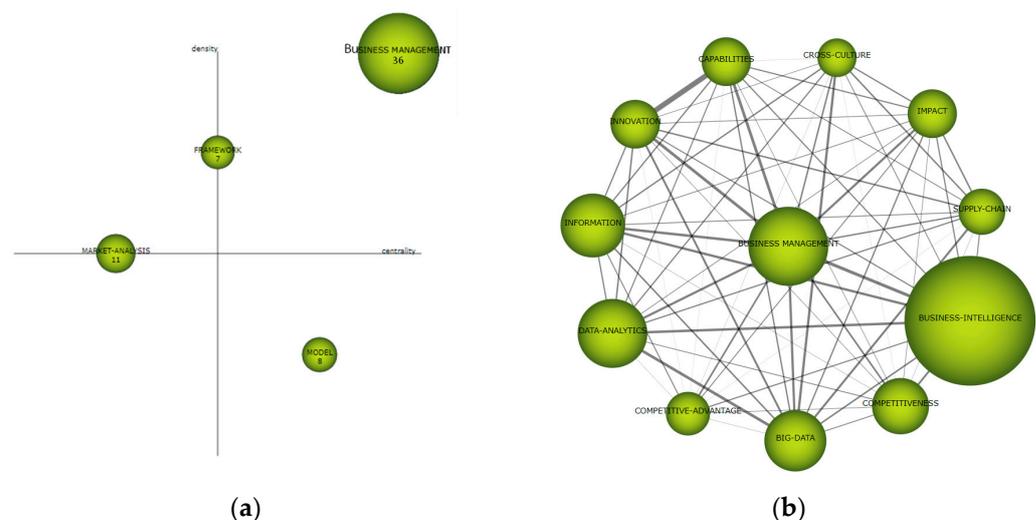


Figure 6. (a) Strategic diagram period 3 and (b) “Business Management” network graph.

The network graph illustrates that “Business Management” is intricately connected with other key research areas, such as “Business Intelligence”, “Competitiveness”, “Big Data”, “Data Analytics”, and “Innovation”. These connections suggest a convergence of traditional management strategies with advanced data-driven technologies, reflecting a comprehensive approach to maintaining and enhancing business competitiveness in the wake of COVID-19’s global impact [63].

Moreover, the presence of “Capabilities”, “Cross-Culture”, and “Supply-Chain” within the network indicates a multidisciplinary approach to understanding and implementing effective management practices. The linkage to “Cross-Culture” points to an increased awareness of the globalized perspective of business [64], while the ties to “Supply-Chain” underscore the critical examination of logistics and operational resilience during uncertain times [65].

This strategic diagram’s results reveal that in the current period, there is a distinct shift towards integrating sophisticated analytics and insights into the core of business management. This integration is likely a direct response to the need for agility and informed decision making, as businesses seek to navigate and adapt to the new normal established by the pandemic [40]. The prominence of “Business Management” as a central theme indicates a recognition that managing the future of businesses requires a harmonious blend of established practices and innovative, data-centric technologies [66].

4.1.4. Evolution Map

The evolution map (Figure 7) illustrates the progression and interconnection of various research themes within the domain of Business Intelligence (BI) across three distinct periods. The columns of clusters represent the thematic focus during each period, with the lines indicating the relationships and continuities between them.

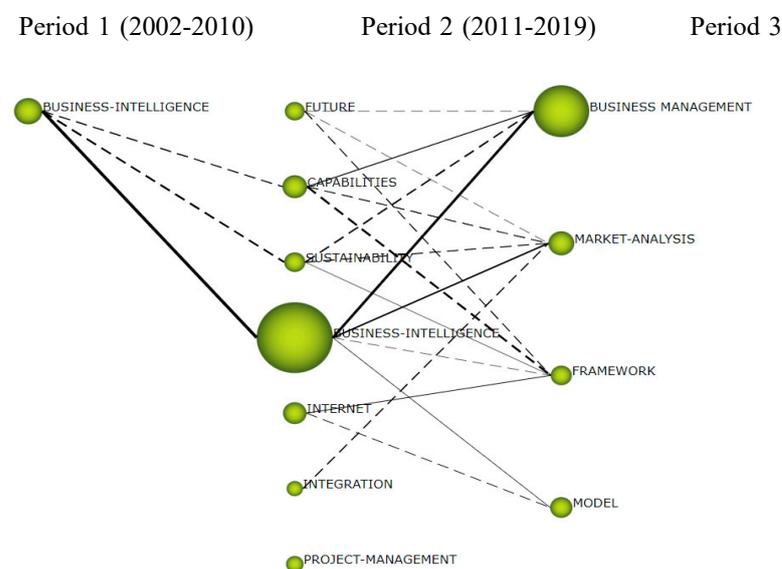


Figure 7. Evolution map.

In the initial period, we see a dominant focus on “Business Intelligence” as a central theme, highlighting its emergence as a field of study and its fundamental role in organizational strategy. In the beginning of this second millennium, the academic world recognizes the validity of this tool for gaining a competitive edge through knowledge management and the application of corporate strategy.

In the second period, the academic community becomes increasingly aware of the significant impact that BI management can have on achieving capabilities, business sustainability, and the necessity to integrate all components of the business process for efficient information and data management.

In the third period, the post-pandemic era, the use of BI is highly connected with business management. It is also linked to achieving outcomes within market analysis. Lastly, although less connected, there is an emergence of different data analysis models and an academic interest in establishing conceptual frameworks for BI study.

The map also reveals the increasing complexity of the field, with the emergence of new themes like “Market Analysis”, “Framework”, and “Project Management”, suggesting that BI is not only expanding in scope but also becoming more integral to various aspects of business operations and strategy.

Overall, this evolution map provides a visual representation of the dynamic nature of BI research, showcasing how the field is not static but evolves with changing business needs, technological advancements, and global events, such as the COVID-19 pandemic. The interconnections between themes across periods underscore the continuous and compounding influence of BI on the business world, shaping how organizations adapt in an ever-changing environment.

Through this analysis, we aim to map the intellectual territory of BI in the sphere of business competitiveness, offering insights into how scholarly perspectives have shifted and expanded over time.

4.2. Results of Gioia Methodology Analysis

The first outcome of the qualitative Gioia study consists in the emphasis on the vital role of knowledge as a company asset and how Business Intelligence (BI) tools are essential for managing and utilizing this knowledge, leading us to the theme of Strategic Knowledge Management. The importance of innovation in information systems and decision-making processes, especially regarding the competitiveness of technology-based companies, is derived from the first-order concepts. This consideration forms the second theme: Innovation in Information Systems and BI. The third theme is Decision-Making Efficiency through BI, focusing on the improvement of decision-making processes and data management via BI tools.

From the induction of first-order concepts that discuss how BI tools, including advanced statistical techniques, contribute to operational marketing capabilities and understanding of business strengths, we arrive at the fourth second-order theme: BI and Marketing Capability Enhancement. The fifth theme, BI in Business Value Generation, addresses the insights provided with BI technologies into business value generation and their implications for performance and competitiveness.

Outlining how effective knowledge management and decision-making processes enabled with BI are key to developing a competitive edge directs us to consider BI for Competitive Advantage as the sixth second-order theme. Similarly, the seventh theme, Technological Evolution and Integration in BI, encompasses the likely integration of BI systems with emerging technologies like AI, machine learning, and advanced analytics.

The eighth second-order theme, Market Influence on BI Evolution, reflects on how changes in the market and business environment influence the use and evolution of business intelligence. The ninth theme, Financial and Operational Impact of BI, groups the first-order concepts related to exploring the direct relationship between the use of BI tools in knowledge management and a company’s financial and operational results. Finally, the last second-order theme represented in the figure is Challenges in BI Implementation, discussing the challenges faced in BI implementation, including data quality and the need for specialized skills.

Figure 8 shows the data structure generated as the result of the application of the Gioia methodology to Business Intelligence (BI) and competitiveness. It shows the generation of five aggregate dimensions that build the theory with which the research question is answered:

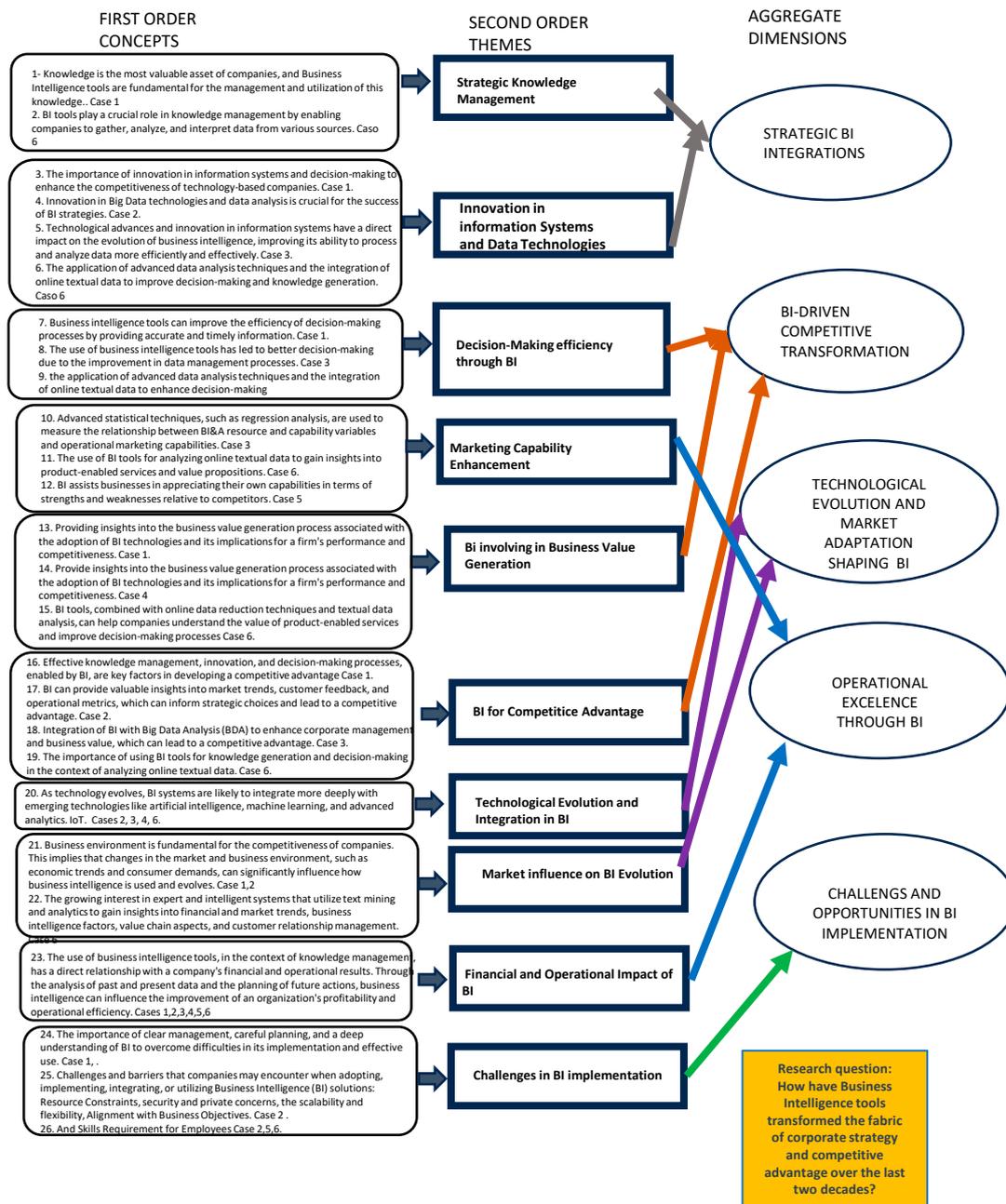


Figure 8. Data structure. Own elaboration from Gioia (2013) [3].

Strategic BI integrations: This dimension brings together the convergence of strategic knowledge management with advanced BI tools, which means a fundamental change in the way companies exploit data for strategic decision making. It underlines the integration of BI into the strategic fabric of organizations, ensuring that data-driven insights help strategic direction and choice;

BI-Driven Competitive Transformation: Reflecting the transformative impact of BI on competitive positioning, this dimension highlights how innovation in information systems and data technologies, driven by BI, enables companies to refine their decision-making processes. It suggests that BI is instrumental not only in improving marketing capabilities but also in fostering an environment where operational excellence is achieved through data-driven insights;

Technological evolution and market adaptation shaping BI: Here, the focus is on the dynamic interplay between ongoing technological advances, market adaptations, and their

influence on BI evolution. It illustrates the importance of BI tools in keeping up with technology trends, such as AI and machine learning, and adapting to market changes, ensuring BI systems remain relevant and effective;

Operational excellence through BI: This dimension underlines the operational impact of BI tools, where efficient data and knowledge management leads to better business processes and performance metrics. It reflects the critical role of BI in achieving operational and financial efficiency and effectiveness;

Challenges and opportunities in BI implementation: The final dimension addresses the dual nature of BI implementation, highlighting not only challenges such as data quality, integration complexities, and skill requirements, but also the opportunities that arise when overcoming these obstacles. It considers that the successful implementation of BI tools can generate a significant competitive advantage and operational improvements, although with the need for careful strategic planning and investment in human capital.

5. Discussion

The research on the evolution of Business Intelligence (BI) during the last two decades, through a bibliometric and thematic analysis, presents content that highlights the strategic integration and the growing importance that it has acquired.

5.1. Synthesis of the Results from the Gioia Analysis and the Bibliometric Study

The bibliometric study, divided into three periods, narrates the expansion of BI and highlights its importance as a business strategic support point.

In the initial epoch (2002–2010), “Business Intelligence” was a nascent theme in academia, signaling its emergence as a pivotal tool for competitive strategy through enhanced knowledge management. This period laid the groundwork for BI’s integration into corporate strategic planning, which is substantiated by the strategic integrations uncovered in our qualitative findings with the Gioia Methodology.

The subsequent period (2011–2019) saw an amplification of scholarly focus on BI’s role in fortifying business capabilities and sustainability. This phase aligns with our thematic analysis’s second-order theme of ‘Operational Excellence Through BI’ and the ‘BI-Driven Competitive Transformation’ dimension, reflecting a broader recognition of BI’s role in business operations and strategy execution.

The latest period (2020–2023), marked by the global upheaval unleashed by the COVID pandemic, highlights the flexibility of BI and its role in business management and market analysis. Qualitative dimensions, such as ‘Technological evolution and market adaptation shaping BI’, reflect this adaptability, indicating a BI field that is responsive to technological and market changes.

Bibliometric analysis recognizes the multifaceted ecosystem in which BI now operates and aims to expand its business applications. BI is not only expanding in scope but also becoming more integral to various aspects of business operations and strategy [55,67–69]. This promotes a series of “Challenges and opportunities in BI implementation”, another dimension of our thematic exploration.

The interlacing of themes over time accentuates BI’s enduring impact on business methodologies. It reinforces the concept that BI systems are evolutionary, shaping organizational adaptability in an ever-fluctuating landscape and underscores that BI tools are not merely static technologies; they evolve alongside the businesses they serve [70].

Therefore, this multifaceted examination of bibliometric and thematic data illuminates a BI field that is increasingly involved with the strategic and operational dimensions of business, sculpting the very essence of corporate competitiveness in the modern era. Future studies should persist in monitoring this evolution, with a focus on the pragmatic implementation of BI systems, skill cultivation for their effective use, and promoting an innovative culture that views BI as a transformative force.

5.2. Response to the Research Question

From the SciMAT analysis and the findings of the Gioia methodology, here is a comprehensive response to the research question “How have Business Intelligence (BI) tools transformed the fabric of corporate strategy and competitive advantage over the last two decades?”.

Business Intelligence (BI) tools have fundamentally transformed the fabric of corporate strategy and competitive advantage. This transformation is characterized by several key developments:

- **Strategic Integration and Evolution:** Initially emerging as a nascent field, BI has gained a prominent place in organizational strategy. The bibliometric analysis across three distinct periods reveals a shift from BI as a concept of academic interest to a critical component of strategic decision making in businesses. This evolution reflects the growing recognition of BI as a tool for not only understanding and managing data but as a strategic asset that informs and shapes corporate decisions. In this sense, some authors consider that Business Intelligence (BI) is a tool that supports proactive strategic management and decision making by producing actionable information that enables the identification of emerging changes and frontline employees as a valuable intelligence asset [5];
- **Operational Efficiency and Decision-Making:** The second-order themes and aggregate dimensions from the Gioia analysis highlight how BI tools have enhanced decision-making efficiency and operational excellence. By providing comprehensive data analysis and real-time insights, BI has enabled companies to make more informed, data-driven decisions, optimizing various aspects of their operations, from resource allocation to customer engagement. However, the effective utilization of data is essential to survive in today’s competitive business environment [71]. Olszak and Ziemba [72] present Business Intelligence Systems as some holistic infrastructure of decision making. Organizations that are interested in improving the quality of decision making, image, or quality of partner service should incline towards the development of information technology infrastructure that will represent a holistic approach to business operations, customers, suppliers, etc. [73];
- **Competitive Transformation and Market Adaptation:** BI tools have played a pivotal role in transforming how companies gain and sustain competitive advantages. In a rapidly evolving business environment, marked by technological advancements and changing market dynamics, BI has allowed companies to adapt quickly and stay ahead of trends. The integration of BI with emerging technologies like AI and machine learning has further expanded its capabilities, allowing businesses to be more agile and responsive to market changes. Given today’s turbulent environments it is increasingly challenging to bridge the gap between establishing a long-term strategy and quickly adopting to the dynamics in market competition; to achieve BI agility, organizations need to focus on dynamic capabilities such as the adoption of assets, market understanding, and business operations [74];
- **Complexity and Expansion of Applications:** The emergence of new themes in BI research, such as market analysis, project management, and the development of conceptual frameworks, indicates the expanding scope of BI applications. This expansion shows BI’s transition from a specialized tool to a more integrated part of overall business operations and strategy. Chaudhuri et al. considered that currently it is difficult to find a successful enterprise that has not leveraged BI technology for their business. For example, BI technology is used in manufacturing for order shipment and customer support, in financial services for claims analysis and fraud detection, in transportation for fleet management, in telecommunications for identifying reasons for customer churn, in utilities for power usage analysis, and in E-business for identifying customers who are likely to respond to a product catalog mailing campaign [75];
- **Challenges and Opportunities:** The implementation of BI tools has brought its own set of challenges, including data quality, integration complexities, and skill require-

ments. However, overcoming these challenges presents significant opportunities for businesses, leading to improved performance, efficiency, and a stronger competitive position. Following [76], four main points seem to be important when taking into account the factors which influence successful BI implementation: First, all levels of management from both the technical and the business side must be involved in BI implementation; second, data quality must be improved on the technical side, and the business side must determine which dashboards and reports are most important to their business needs. Third, an understanding of organizational culture is vital for successful BI implementation. Finally, effective use of BI requires the development of a clear implementation strategy which involves both the business and the technical side. Critical Successful Factors (CSFs) become the guideline for the implementer to adopt BI successfully [77]. The findings categorized the issues and challenges into three dimensions of CSFs for BI implementation, which are Organization, Process, and Technology dimension.

5.3. Practical Implications and Future Trends

The insights gleaned from the SciMAT analysis and the Gioia methodology results in the study of Business Intelligence (BI) tools provide significant practical implications and point towards several future trends:

- One of the primary practical implications is the integration of BI tools in strategic decision-making processes. Organizations should leverage these tools to analyze vast datasets for informed decision making, enabling more precise strategy formulation and execution;
- Companies must utilize BI tools to enhance operational efficiency. By adopting BI, firms can streamline their processes, reduce operational costs, and respond more agilely to market changes and customer demands;
- The findings highlight the need for continuous skill development and training in BI tools. As BI technologies evolve, businesses should invest in training their workforce to keep pace with new tools and analytical techniques;
- The future trend indicates an increasing integration of BI with emerging technologies like AI, machine learning, and big data analytics. Companies should focus on adapting and upgrading their BI systems to integrate these advanced technologies for more sophisticated analysis and forecasting;
- As businesses increasingly rely on data-driven decisions, the importance of data governance and quality management becomes paramount. Companies need to establish robust data governance frameworks to ensure data accuracy, consistency, and security;
- Future BI tools are likely to be more user-centric, providing customization options to meet the specific needs of different industries and departments. This shift will enable more personalized insights and strategies.

A future trend in BI is the shift from descriptive to predictive and prescriptive analytics. Organizations will increasingly use BI tools not just to analyze past data but to predict future trends and prescribe actions for optimal outcomes. Future trends indicate a continuous evolution of BI capabilities, emphasizing the need for businesses to remain adaptable, responsive, and forward thinking in their BI strategies.

Given these insights, it is essential for enterprises to invest in BI tools and cultivate a culture that values continuous learning and adaptation [78]. This includes overcoming the implementation challenges identified in our analysis, such as data quality and skill development.

Educators and industry leaders must also work to close the gap between BI technology and its application, ensuring that tools are used for their innate value in enhancing decision making and strategic competencies, not simply as obligatory instruments [79].

Regarding the limitations of the study, it should be noted that both the bibliometric analysis with SciMAT and the selection of the analyzed articles are carried out with the 174 articles found in the Web of Science Core Collection, filtering by the topics "Business

Intelligence” and “Competitiveness”. The choice of these keywords may have limited the breadth of retrieved studies, and some relevant studies using different terminologies or synonyms may not have been included, which could affect the generalizability of our results. Although WoS is a well-respected and widely used database, it does not include all existing publications in the field of business intelligence and competitiveness. Some relevant journals may not be indexed in WoS and this may limit the representativeness of our sample. However, other articles, outside this database, have been used to compare the results and conclusions of this study, which have been cited.

6. Conclusions

This investigation not only highlights the prevailing academic narratives but also uncovers the undercurrents that might signal future directions in BI research and practice. From the results of this study, we can deduce that Business Intelligence (BI) is not only a technological tool, but a strategic asset of companies. It plays the role of improving knowledge management, driving innovation, and strengthening marketing capabilities. In the same guideline as some authors [80], we propose an agile BI development model to be more intuitive and quicker in implementation to adapt to the changing environment. Also, others [76] emphasize the importance of critical success factors in BI implementation, such as management support, clear business vision, and sustainable data quality and highlight the need for a suitable conceptual framework that aligns BI capabilities and implementation strategies. This study reveals that while BI contributes significantly to operational and financial performance, its full potential is realized only when companies effectively manage the challenges of BI implementation, including the need for skilled personnel and adaptability to rapid technological changes.

In addition, the results indicate that companies must adopt a dynamic approach to BI, constantly adapting to market trends and technological evolution to maintain a competitive advantage. Furthermore, [74] emphasizes the importance of BI agility in the face of market competition. This agility is influenced by dynamic BI capabilities such as the adoption of assets, market understanding, and business operations. Similarly, [81] highlights the role of BI in shaping organizational design and improving performance, particularly in the context of corporate entrepreneurship. This end-to-end approach to BI shapes the future trajectory of businesses in a data-centric world. BI is now not only a tool for data analysis and decision making, but also a platform for integrating cutting-edge technologies.

This integration signifies a paradigm shift in BI, where AI and machine learning deliver predictive insights, and IoT connects vast networks of data sources, dramatically improving BI capabilities. As companies navigate this technologically advanced landscape, their success increasingly depends on their ability to adapt and integrate these innovations. This holistic approach to BI, which encompasses both traditional analytics and emerging technologies, is strategic for companies looking to maintain relevance and competitive advantage in an ever-evolving digital world.

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