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REVIEW ARTICLE

Business intelligence and its pivotal role in organizational performance: An exhaustive literature review

Kawtar Moussas[1,*], Jihane Hafiane[2], Allal Achaba[1]

[1] *Management Sciences, LARTI2D Laboratory, ENCG, Ibn Zohr University, Agadir8000, Morocco*

[2] *Management Sciences, PRISME Laboratory, EST, Ain Chok University, Casablanca 20520, Morocco*

*** Corresponding author:** Kawtar Moussas, k.moussas@yahoo.fr

ABSTRACT

Background: In today's constantly changing business world, the role of Business Intelligence (BI) in organizational decision-making is increasingly critical. This literature review aims to provide a comprehensive understanding of BI's multi-dimensional nature and its immense potential in enhancing organizational performance. **Methods:** This study employs a systematic literature review methodology, analyzing peer-reviewed articles, case studies, and seminal works in the field of Business Intelligence. The review focuses on key themes such as BI's components, its role in strategic decision-making, operational efficiency, and metrics and KPIs influenced by BI. **Results:** The review synthesizes findings from various studies, revealing that BI significantly influences strategic decision-making, improves operational efficiency, and impacts various metrics and KPIs across sectors. Sample sizes for the analyzed studies range from smaller focus groups to large organizational surveys. **Conclusions**: The study concludes that Business Intelligence is an indispensable tool for modern organizations, offering various functionalities that enhance decision-making and operational efficiency. Its application spans multiple sectors, providing a competitive advantage and contributing to business success.

Keywords: business intelligence; organizational performance; decision-making

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1. Introduction

In today's complex and highly competitive business environment, organizations face multifaceted challenges necessitating strategic and timely responses. Information has unequivocally established itself as the basis for gaining a competitive edge in the contemporary commercial landscape. As industry landscapes continue to transform and market variables fluctuate, it is increasingly imperative for organizations to be agile, adaptable, and well-informed. The critical interdependence between access to high-quality information and effective decision-making is both manifest and essential.

Business Intelligence (BI), with its profound capabilities, offers a promising bridge between the voluminous data reservoirs and actionable insights. Jordan and Ellen[1] encapsulated this sentiment, suggesting that the potency of decisions is directly proportionate to the clarity and quality of information at one's disposal. Leveraging BI, leaders can unearth profound insights, enabling informed decisions that can refine processes and fortify an organization's competitive position in the market. Yet, the intrigue surrounding BI is not just about its promise but also its realization. The corporate world's burgeoning interest in BI underlines its potential as a vehicle for operational efficiency, service excellence, and enriched decision-making

paradigms. But BI's odyssey towards its full potential is not without its complexities[2].

Scholars like Foley and Guillemette[3] have embarked on endeavors to understand the multifaceted nature of BI, exploring its definitions, constructs, and implications. Their insightful work accentuates the importance of a clear understanding of BI as a nuanced blend of product and process. As both business and IT stakeholders' environment through this evolving terrain, recognizing the inherent potential of BI becomes paramount. This sentiment is echoed by industry insights, with luminaries like Luftmann et al.[4] earmarking BI as a top priority for managers in the upcoming years. But as we delve deeper into the world of BI and its implications for organizational performance, a pertinent question arises: How does the integration of Business Intelligence tools not only shape but potentially transform the performance trajectories of enterprises? This paper undertakes an exploration to address this question, aiming to shed light on the intricacies of BI, its application, and its undeniable impact on organizational prowess.

2. Tracing the evolution of business intelligence

The notion of Business Intelligence (BI) has experienced substantial evolution since its origin, akin to a multi-phasic developmental process. An examination of its diverse definitions offers a comprehensive historical account of its advancement. **Table 1** provides a retrospective analysis of this transformation across multiple decades.

Table 1. Chronological evolution of business intyelligence.

Time	Author	Title 3	Title 4
BI definitions from 1980–1990s	Ghoshal and Kim[5] Gilad[6]	Initial stage: technological tools Emphasis on data-centricity	Early emphasis on using technology for informed decision-making. Primarily seen as tools for data collection and analysis.
BI definitions from 1990–2000s	Sawka[7] Collins[8] Vedder et al.[9]	Recognition of BI's importance Transition from mere tools to processes/products	Increased focus on external environments and competition. Overlap with terms like Competitive Intelligence; more holistic views.
BI definitions from 2000–2010	Wei et al.[10] Williams and Williams[11] Muntean[12]	Data-centricity & strategic nature Broadened view: process, strategy, tool/product	Emphasis on turning data into actionable knowledge. Introduction of user perspectives; more strategic applications.
BI Definitions from 2010 and beyond	Turban et al.[13] Ackermann[14]	BI as an encompassing term Contextual and wide applications	Comprehensive integration of technologies, methods, and processes. BI's definition matures; focuses on data integration & synthesis

Source: According to the literature.

Analyzing these definitions across timeframes showcases BI's profound evolution. It's intriguing how the early definitions portrayed BI in a rudimentary form, while recent ones elucidate a holistic, integrated perspective. While the essence remains—turning data into actionable insights-the intricate nuances have evolved. The evolution of BI, from its initial inception to its current level of complexity, is a testament to the dynamic nature of technology and its deep-rooted influence in shaping business paradigms. The trajectory suggests that while BI's core principles remain steadfast, its application and interpretation will continuously adapt to the changing business environment

3. Business intelligence: Process or product?

Business Intelligence (BI) often straddles the line between being perceived as a product and as a process. This distinction may seem minor at first glance, but it holds substantial implications for how organizations approach and implement BI[15].

When viewed as a product, BI typically refers to the tangible tools and technologies deployed by businesses. This encompasses software solutions, dashboards, reporting tools, and other systems that enable data analysis[16]. Organizations looking at BI as a product are usually focused on acquiring the best platforms and tools available in the market to gain a competitive edge. Conversely, when conceived as a process[17], BI pertains to the methodologies and practices that organizations employ to gather, process, and analyze data. This perspective emphasizes the importance of the human element—how employees, from C-suite executives to operational staff, understand, interpret, and apply data insights to their roles[18]. Here, the emphasis is on continuous learning, refinement, and evolution to keep pace with changing business landscapes. In reality, BI is an intricate blend of both. While cutting-edge tools and software are indispensable for effective BI, they are only as valuable as the strategies and processes that govern their use system[19,20]. Organizations stand to gain the most from BI when they recognize its dual nature and work to seamlessly integrate both components. This integrated approach ensures that the technological capabilities of BI tools are fully harnessed, and insights derived are actionable and aligned with business objectives[21,22].

4. Elucidating business intelligence and related concepts

Business Intelligence serves as a comprehensive term for a range of practices and technologies dedicated to collecting, analyzing, and presenting business information. To fully grasp the breadth and depth of BI, it's crucial to understand the related concepts that often intertwine with it[23].

a) Competitive Intelligence (CI): This primarily revolves around collecting and scrutinizing information about competitors and the broader market dynamics. CI extends its purview to comprehend customer-client relationships and is largely outward-facing, zeroing in on a business's external environment. Some scholars even argue that CI is just a specialized subset of BI[24].

b) Decision Support System (DSS): Simply put, a DSS is a computational tool designed to bolster the decision-making process of individuals or groups[25]. Although BI embraces the ethos of DSS, it expands upon it. While DSSs cater to specific decision-making tasks, BI systems offer precise and current information to back decisions that aren't predefined and kindle new organizational knowledge, often deploying data mining methodologies.

c) Executive Information Systems (EIS): Often synonymous with Executive Support Systems (ESS), these are digital systems tailored for aiding the managerial and executive functions of an organization, ranging from communication to strategic planning[26]. An EIS is generally viewed as a DSS variant fashioned for the higher echelons of management. Given BI's imperative to bolster strategic decision-making, it closely aligns with the EIS paradigm, equipping executives with crucial insights via dashboards and other strategic intelligence tools.

d) Knowledge Management (KM): At its core, KM involves harnessing an organization's collective knowledge to gain a competitive edge[27]. Knowledge Management Systems (KMS) empower employees with access to the organization's reservoir of documented facts, information sources, and solutions. It's vital to note the distinction between KM and BI. While the former focuses on human-derived subjective knowledge, the latter zeroes in on objective data and information. Yet, KM often dovetails with BI to provide data analysts with a holistic understanding of BI's context.

e) Business Performance Management (BPM): BPM encapsulates a suite of processes and tools geared towards enhancing the formulation and realization of business strategies[28]. While some interchange BPM with terms like corporate or enterprise performance management, its essence lies in its strategic focus. While BPM hones in on overarching corporate strategies, BI operates across operational, tactical, and strategic tiers within organizations[13].

In the evolving realm of Business Intelligence, the convergence of various interconnected domains illustrates the multifaceted nature of BI. From competitive intelligence that gauges the market pulse, to decision

support systems enhancing decision-making, to the strategic alignment brought forth by executive information systems and business performance management-each element plays a pivotal role. Moreover, knowledge management acts as the bridge, connecting human insights with empirical data. While the technological facets like data warehousing remain indispensable to BI's architecture, they should not be conflated with the broader BI concept. Linking to the paper's core issue, this intricate web of BI-related concepts underscores the importance of a holistic understanding. In an era where data-driven decisions can shape the fate of enterprises, it's imperative to approach BI not merely as a standalone tool, but as a cohesive system that interlinks various specialized domains. Grasping these interconnected components is key to harnessing the full potential of BI, thereby driving more informed, strategic, and impactful business decisions.

5. Technological components of business intelligence

In today's competitive market environment, the ability to make well-informed decisions is paramount. Businesses operate in an increasingly data-rich setting, where vast amounts of information are generated every moment. To harness this deluge of data and transform it into actionable insights, companies have turned to Business Intelligence[29]. At its core, BI is an amalgamation of tools, technologies, practices, and architectures that enable the collection, integration, analysis, and presentation of business information. Beyond merely presenting data, BI systems aid in decision-making, identifying new opportunities, forecasting trends, and providing a holistic view of organizational operations. Central to BI's efficacy are its underlying technological components. One of the foundational components of BI is the Data Warehouse (DW). Defined as a "subject-oriented, integrated, time-variant, and non-volatile collection of data"[30] a DW consolidates data from various sources across different business subjects. This organization promotes easy access and interpretation of the data, facilitating management's decision-making process. Data warehouses are pivotal in controlling and storing standardized data for the entire enterprise[31]. However, the realm of BI does not limit itself to data warehousing. Other significant components, such as Data Marts, provide efficient solutions tailored for specific business areas. Meanwhile, techniques like Data Mining and Online Analytical Processing (OLAP) delve into discovering patterns, relationships, and insights from the vast amounts of data at disposal[32,33]. In this vast expanse of data, Machine Learning (ML) stands as a beacon, employing algorithms that learn and predict from historical cases. Furthermore, the Extract, Transform, and Load (ETL) process ensures that data is seamlessly integrated into BI systems from various sources[34]. In essence, the technological components of BI form an intricate machinery, each part playing a crucial role in harnessing the data's true potential. By understanding these components, we not only appreciate the complexity of BI systems but also recognize the importance of each element in the broader picture of data-driven decision-making. The information systems utilized in Business Intelligence frameworks, as previously discussed, are visually summarized in the **Figure 1**.

Figure 1. Information Systems Utilized by Business Intelligence. Source: According to the literature.

6. The role of BI in strategic decision-making: An in-depth analysis

Business Intelligence has revolutionized the way organizations approach decision-making. Serving as a strategic compass, BI integrates and interprets vast swathes of data, transforming it into actionable insights that shape an organization's future.

The Holistic Role of BI in Decision-making: BI is not limited to providing insights on isolated business aspects. Instead, it casts a wide net, influencing both strategic and operational decisions at individual and organizational levels[35]. By converting raw data into coherent visualizations, BI simplifies complex business dynamics, making them easily comprehensible. These visualizations are multifaceted, serving dual purposes: offering strategic insights and monitoring operational processes. Hence, decision-makers can seamlessly shift between high-level strategic considerations and granular operational insights[36].

Enhancing Decision Quality: Quality decisions are a blend of intuition and empirical evidence. BI amplifies the latter by enabling the discovery of novel information patterns and pinpointing data discrepancies. By doing so, it ensures that decisions are grounded in robust data, eliminating reliance on mere gut feelings.

Innovations in BI for Improved Decision-making: Traditional BI systems might have limitations in capturing user interests, potentially leading to interactions that aren't productive[36]. Addressing this, innovations like collaborative recommender systems have emerged. These systems leverage models like the Markov model to gauge user interests, tailoring BI insights to individual needs. Another promising development is Agent Buddy, which refines search results using machine learning models and bandit algorithms, ensuring that Customer Care Agents receive the most relevant information[35].

BI as a Knowledge-Sharing Catalyst: Knowledge is the foundation of strategic decisions. BI tools don't just present data; they promote an organization-wide culture of knowledge sharing[35]. They amplify the collective intelligence of an organization, ensuring that decisions benefit from a diverse range of insights. By doing so, BI nurtures a shared mental model among decision-makers, harmonizing individual expertise into a cohesive strategic direction.

From Data to Decisions: In the contemporary business arena, data inundates organizations. However, data in isolation lacks meaning. BI acts as the bridge, transforming this data into actionable information and further into organizational knowledge[37]. It offers a panoramic view of the business environment, encompassing market dynamics, competitor activities, technological evolutions, and public policies[38]. This all-encompassing perspective ensures that strategic decisions aren't myopic but are rooted in a holistic understanding of the business ecosystem.

The Value Proposition of BI: Beyond aiding in decision-making, BI offers tangible value. It steers organizations towards avenues of innovation, helping them craft novel business rules and practices that grant them a competitive edge. By ensuring decisions are timely, relevant, and of high quality, BI acts as the foundation upon which sustainable business growth is built.

7. BI's influence on operational efficiency

Business intelligence systems have grown to be pivotal assets for heightening operational efficiency across an array of sectors. Their profound impact in driving streamlined operations, especially in the realms of banking and manufacturing, is evident. In the banking domain, the capacity of BI to delve profoundly into operations empowers banks to refine their activities. Through examination of their operational data, they can pinpoint bottlenecks, redundancies, or sectors that can be fine-tuned for enhanced output. This analytical prowess also allows banks to adapt their strategies for individual branches. Given the unique nature of every bank branch, understanding the cash flow, staff dynamics, and distinct needs of each allows for a more tailored approach to decision-making. Furthermore, the ever-changing landscape of the financial sector demands

agility[39]. BI grants banks this very nimbleness, enabling them to swiftly respond to evolving market conditions or capitalize on newfound opportunities. Such agility is paramount to retaining a competitive edge in banking.

Shifting focus to manufacturing, the incorporation of Business Intelligence Software (BIS) offers enterprises a sophisticated toolkit that substantially amplifies their decision-making capabilities. Such tools are indispensable in bolstering responsiveness and sharpening competitive prowess. Moreover, in environments such as Computer Integrated Manufacturing (CIM), BI's role becomes invaluable[40]. CIM systems necessitate the seamless integration of information systems. Here, BI comes into play by bridging any data gaps, ensuring information from varied sources is cohesively amalgamated, analyzed, and presented for managerial decision-making. The union of organizational data structures with an Information

Delivery System (IDS) through BI further paves the way for enhanced manufacturing management. Such a consolidated data flow aids in the transformation of operational figures into actionable insights. An added advantage of BI tools in manufacturing is the presence of user-friendly interfaces. Especially in settings leveraging linear programming, these intuitive interfaces simplify the decision-making trajectory. Decision-makers can navigate with ease, selecting visual prompts over navigating a maze of commands, ensuring a smooth, streamlined process[41].

Looking at the broader spectrum, a consistent advantage of BI, regardless of the industry, is its ability to facilitate decisions anchored in solid data. By doing so, it eliminates uncertainties, assuring that actions are underpinned by robust evidence, further driving operational efficiency. Additionally, BI offers insights into the optimal allocation of resources, ensuring they're channeled effectively. This strategic allocation ensures resources are directed towards areas yielding the highest returns or those in dire need, subsequently optimizing efficiency. Lastly, BI's knack for interpreting past and present data offers a window into potential future trends. This forecasting capability ensures enterprises, be it banking or manufacturing, can preemptively adjust their strategies.

Business Intelligence stands as a foundation in the pursuit of heightened operational efficiency. Whether it's unraveling the intricate nuances of banking operations or refining manufacturing processes, BI furnishes the requisite tools, insights, and flexibility, setting the stage for augmented productivity and enhanced decision-making.

8. Case studies showcasing tangible impact of BI implementation

Business Intelligence has been implemented in various case studies to showcase its impact. The majority of studies indicate that the implementation of Business Intelligence systems brings tangible benefits to organizations.

In a study by Munteanau and Raduta[42], existing bank platforms were likened to Baroque castles, which led to the introduction of a novel model named "Banking Intelligence Accelerator—Decision Support." This model, aimed at banking and customer-centric applications, was showcased through various case studies. Its efficacy was evident in areas such as strategic planning, bolstering customer relations, profitability analysis, streamlining processes, and refining accounting procedures.

Mehanović and Dželila[43], their study focused on the application of BI in decision-making in digital advertising, analyzing different types of traffic and using logistic regression to detect relationships between impressions and clicks. The data for the study was collected from an advertising platform called tribeOS. The authors used Python and its libraries, such as pandas, for data analysis. The study analyzed multiple types of traffic related to countries, browsers, household incomes, and days of the week. The results of the study showed that business intelligence techniques, such as data analysis, visualization, and logistic regressionare used to detect relationships between the number of impressions and clicks in digital advertising. The authors proposed

various combinations of data that can be used to create different reports for smarter decision making and cost effectiveness in digital advertising.

Bany Mohammad et al.[44] conducted a study in the Arab Bank of Amman. The tangible impact of implementing Business Intelligence (BI) can be seen in various aspects of the banking industry. BI enables banks to acquire valuable insights, make data-driven decisions, and improve their overall performance and competitiveness. By utilizing BI, banks can acquire new customers more effectively, develop innovative products and services, define competition and pricing strategies, improve revenue management, and expand their customer segment. Furthermore, the presence of a robust data infrastructure and advanced IT infrastructure allows banks to better deploy BI applications across business functions, leading to higher rates of BI usage. Effective utilization of BI can enhance operational and management levels of data understanding and analysis within banks, ultimately resulting in increased sales and profits. Moreover, the support of senior management and the presence of a champion within the organization play a crucial role in the successful adoption and use of BI.

In another study, Vallurupalli and Bose[45] analyses the effect of implementation of a new performance measurement. The firm selected had recently implemented a new Performance Measurement System (PMS) that was enabled by the use of Business Intelligence (BI). The implementation of the PMS was done in-house, and the involvement of an external vendor was excluded. According to this study, the implementation of business intelligence systems has several tangible impacts. Firstly, it increases the effectiveness of employees by allowing them to monitor their own or their subordinate's performance using dashboards, resulting in better performance comparison and overall transparency of performance goal setting. Secondly, it improves the productivity of review meetings, making them more objective, focused, and less time-consuming. This leads to acceptable action plans by the people concerned. Thirdly, BI systems with rich visualization features make the analysis of information and communication between employees easier. Data visualization is valuable as it allows decision-makers to notice insights that they would not have seen otherwise, and it presents a more efficient way to communicate large sets of information. Lastly, the implementation of BI systems helps ensure customer delight by focusing interactions on performance with visual information through charts and maps.

Yi Xu et al.[40], in their research, the context of the study is focused on investigating the capabilities of business intelligence (BI) and network learning effect on data mining for start-up functions. The study aims to examine how start-up businesses should identify and prioritize issues when launching a new product or service. It explores the relationship between BI capabilities, innovation, and networked learning impacting start-up performance. based survey conducted on a sample of 150 start-up businesses. According to this study, the implementation of business intelligence has a tangible impact on various aspects of start-up business performance. The findings suggest that BI capabilities significantly influence the efficiency and performance of start-up businesses. By leveraging BI systems, start-ups can create important and vital information about their business, leading to better decision-making. BI provides decision-makers at all levels of the organization with direct access to data, enabling timely and informed decision-making.

Rounding up the studies, the impact of implementing Business Intelligence systems on organizational acceptance is explored by Maghsoudi and Nezafati[41]. The study compared the effectiveness of traditional BI implementation and self-service BI implementation using a dynamic model. The results indicate that implementing the self-service strategy for BI led to higher levels of organizational acceptance compared to the traditional approach, with a difference of 30%. Additionally, three proposed scenarios aimed at improving the traditional approach showed that addressing the lack of domain knowledge, improving cooperation with the requesting team, and developing soft skills in the development team can increase organizational acceptance by 17%–25%. Therefore, implementing BI systems, especially with a self-service strategy and by addressing specific challenges, can positively impact organizational acceptance. However, it is important to note that the

study is limited to organizational acceptance as an outcome measure and does not explore other potential impacts such as user satisfaction, system performance, and business impact.

It becomes evident that Business Intelligence holds transformative potential across a myriad of sectors. The tangible benefits of BI, whether in refining operations, unveiling patterns, or bolstering decision-making processes, are undeniable. However, the success of BI implementation often hinges on a synergy of robust technology, effective methodologies, and, crucially, end-user trust. As the business environment continues to be increasingly data-driven, the integration and utilization of BI tools can serve as a linchpin for both operational and strategic growth.

9. Metrics and KPIs influenced by business intelligence

Business Intelligence tools and systems have made a transformative impact on how organizations measure and evaluate their performance. By using BI, businesses can analyze vast amounts of data in real-time, allowing for more informed decision-making and ensuring that the objectives align with the strategic goals of the organization. BI's ability to collate and process vast datasets translates into more precise and actionable metrics. Whether it's sales data, customer feedback, or supply chain information, BI systems ensure that metrics are based on comprehensive datasets, making them more reliable[46]. For instance, sales teams can use BI to get real-time insights into metrics like lead conversion rates, average deal sizes, and sales cycle lengths[47]. These metrics, when analyzed with BI, can provide a clearer picture of sales performance, helping to pinpoint areas of improvement.

For marketing departments, BI plays a pivotal role in assessing campaign effectiveness and ROI[48]. Traditional metrics such as reach and impressions can be combined with conversion data to derive more nuanced KPIs like Customer Acquisition Cost and Customer Lifetime Value. By using BI tools, marketers can dissect campaign data at a granular level, ensuring that their strategies are resonating with the target audience and delivering the desired outcomes. In the realm of operations, BI aids in enhancing efficiency and productivity[48]. Operational metrics such as production output, defect rates, and inventory turnover can be closely monitored and analyzed through BI. By understanding the patterns and anomalies in these metrics, businesses can optimize their processes, reduce wastage, and ensure timely delivery.

Moreover, BI allows for real-time monitoring of these metrics, enabling managers to make swift corrective actions whenever required. Financial departments also benefit significantly from BI when it comes to metrics. Beyond the typical financial statements and balance sheets, BI can help finance teams delve deeper into metrics like profitability ratios, liquidity ratios, and growth rates[48]. By doing so, businesses can ensure financial stability, monitor cash flows more effectively, and anticipate any financial challenges on the horizon[49]. Lastly, in the domain of customer service, BI proves invaluable in enhancing the customer experience. Metrics such as First Response Time, Customer Satisfaction Score, and Net Promoter Score can be rigorously analyzed using BI[50]. By understanding the dynamics behind these metrics, businesses can tailor their customer service strategies, ensuring higher satisfaction levels and fostering loyalty.

BI doesn't just influence metrics and KPI-it revolutionizes them. It brings about an era where data-driven decisions are not just an advantage but a necessity. By integrating BI into their metric analysis, organizations ensure that they remain agile, proactive, and ready to meet the ever-evolving challenges of the modern business environment.

10. Business intelligence: Beyond the tools

Business intelligence systems have rapidly evolved, offering several tools and solutions for organizations. However, the crux of a successful BI implementation often hinges upon the human element.

The role of human factors in the implementation of business intelligence (BI) systems is a recurring theme in various studies. In Papadopoulos's[51] research, the trajectory from data collection to its dissemination high in the organizational pyramid is emphasized, using the Hellenic banking sector as an illustrative case study. This trajectory underscores the holistic and systemic nature of BI implementation and the importance of considering social and technical issues. Kapoor discusses the merger of BI techniques with human resource management, especially for global organizations. The paper underscores the potential of BI in assisting HR professionals in making data-driven decisions at both operational and strategic levels. Hmoud's et al.[52] study on higher education institutions (HEIs) highlights three pivotal elements for the successful adoption of BI: top management support, staff skills, and information culture. By investing in these areas, HEIs can foster a data-driven decision-making culture. Musarra's et al.[53] research clarify the role of mutual trust in cross-border technology business relationships. They emphasize the importance of emotions and cultural intelligence, suggesting that by nurturing mutual trust, the efficiency of BI implementation can be enhanced. Popovič et al.[54] shed light on the significance of knowledge workers and their information needs in the success of BI systems. They stress the necessity of an analytical decision-making culture and the relevance of aligning BI with business processes. Bao et al.[55] emphasize the role of user access in the development of BI systems, suggesting that granting human resources full access to BI can lead to trusted data and more successful BI implementation. Maghsoudi and Nezafati[41] highlight the challenges of individual and organizational acceptance of BI systems. They suggest that factors such as organizational support, technological capabilities, and data quality play a role in the successful adoption of BI systems. They also discuss potential barriers, like experts' resistance to using BI systems, and offer solutions to mitigate these challenges. In summary, the human factor is integral to the efficient implementation of BI systems. Across various sectors and disciplines, the importance of factors like mutual trust, top management support, staff skills, user acceptance, and an analytical decision-making culture is consistently emphasized.

11. Role of leadership in implementing business intelligence systems

Leadership plays an indispensable role in ensuring the successful implementation of Business Intelligence systems, as observed in various case studies, Key findings from the analyzed papers are summarized below:

Strong Mandates and Facilitation: Leadership, especially at the management level, provides robust mandates which serve as guiding principles for the entire BI implementation process[56]. They also play a pivotal role in facilitating the changes required for successful BI deployment.

Adaptive Leadership Styles: In the context of the study of M. Seah et al., the CEO, demonstrated the importance of adapting leadership styles to better serve the goals of BI implementation. His commitment and flexibility in approach established an effective foundation for BI system use[57].

Overcoming Cultural Barriers: Especially relevant in culturally distinct settings, like China, leadership plays a vital role in addressing and overcoming cultural barriers. Such barriers, like personalism and particularism, can impede the flow of knowledge[54]. By adapting leadership strategies, CEOs can foster a culture of knowledge sharing essential for BI's success.

Employee Involvement: The success of BI systems isn't solely dependent on top-down leadership; it requires the buy-in and active participation of employees at all levels. CEOs and leaders can amplify positive outcomes by emphasizing employee feedback, ensuring comprehensive training, and encouraging active participation in the BI implementation process[58].

Continued Monitoring & Improvement: Effective leadership doesn't stop at the implementation phase. For the sustained growth and performance of the organization, leaders should be vested in the continuous monitoring and improvement of BI systems, ensuring they evolve with the organization's needs[59].

In essence, the role of leadership in implementing BI systems is multifaceted, encompassing strategic direction, cultural sensitivity, employee engagement, and an ongoing commitment to optimization. Effective leadership can pave the way for successful BI system adoption, ensuring organizations remain agile and informed in their decision-making processes.

12. The integration of BI, AI, and big data: A deep dive into the business analytical revolution

A. The Foundational Role of Business Intelligence:

Business Intelligence, at its core, is a technology-driven process that uses data collection, data integration, analysis, and presentation to help business executives make informed decisions. Traditional BI systems have been pivotal in analyzing past performance, revealing historical trends, and creating dashboards for decision-makers to gain insights about the business[60]. They're designed to transform raw data into meaningful information, offering insights about everything from market share, consumer behavior, client preferences, to broader market conditions.

B. The Rise of Artificial Intelligence (AI) in Business:

With the proliferation of data, traditional BI systems were met with limitations. Enter AI. AI goes beyond just presenting data; it analyzes and predicts. By using sophisticated algorithms, AI can recognize patterns, derive insights, and even make autonomous decisions[61]. Techniques such as machine learning and deep learning are subsets of AI that are particularly adept at handling and analyzing vast amounts of data, drawing out patterns, and making accurate forecasts[62]. These tools have been instrumental in enabling businesses to unearth hidden insights, which were previously considered impossible or too time-consuming to find.

C. Big Data: The Fuel Powering the Revolution:

The term "big data" doesn't just refer to the sheer volume of data but also its variety and velocity. The rise of social media, IoT devices, and more has led to an explosion of data from various sources. Big data technologies allow the analysis of these massive datasets, making it possible for BI tools to derive even more detailed insights and for AI systems to have a playground vast enough to train, learn, and predict with increased accuracy. The integration of BI with big data means businesses can now make sense of these gigantic datasets, turning them into actionable and insightful information[63]. The Confluence and Its Implications: When BI, AI, and big data come together, the result is a powerful analytical tool that can transform business operations. This convergence allows businesses not only to look at their past performance but also predict future trends, respond proactively to market changes, and uncover hidden opportunities or threats. Companies can now process, analyze, and interpret data in real-time, leading to informed decisions and enhanced business performance. The combined power of these technologies ensures businesses remain agile, competitive, and ahead of market trends. In essence, the symbiotic relationship between BI, AI, and big data is shaping the future of business analytics. As they continue to integrate and evolve, businesses are set to benefit from sharper insights, better decision-making, and enhanced performance[64].

13. Recommendations for organizations

Given the pivotal role of leadership in BI and the subsequent impact on organizational performance, here are tailored recommendations for businesses:

1) Steps for successful BI adoption and integration:

Leadership Vision: Leadership should possess a clear and compelling vision for BI adoption. This vision serves as a roadmap for the rest of the organization, highlighting the strategic significance of BI initiatives.

Engage and Educate Senior Management: Recognizing the role of leadership in BI success, prioritize the engagement and education of top management. Their buy-in can propel BI initiatives and ensure smoother

implementation across departments.

Collaborative Approach: Encourage leaders to foster a culture of collaboration. Its crucial to bridge the gap between IT professionals, who implement BI systems, and business leaders, who utilize these systems for decision-making.

2) Ongoing training and upskilling:

Leadership Training: Offer specific BI-focused training for leaders. Equip them with the skills to interpret BI insights and make informed decisions.

Promote a Learning Culture: Leaders should champion continuous learning. Encourage departments to frequently update their skills, ensuring the organization stays ahead in leveraging new BI capabilities.

3) Evaluating and updating BI strategies: Regular strategy reviews:

Leadership should schedule periodic reviews of the BI strategy, ensuring alignment with the evolving organizational goals and the BI landscape.

Feedback Mechanism: Establish a robust feedback mechanism. Leaders can gain insights into the challenges faced by teams during BI implementation and address them proactively.

Stay Updated with BI Trends: Given the fast-paced evolution of BI, leaders should be well-versed with emerging trends, ensuring the organization is always positioned advantageously in the market.

As organizations traverse the BI evolution, strong and informed leadership is the key part. By integrating the above recommendations, businesses can optimize their BI strategies, ensuring they extract maximum value while fostering a culture of continuous learning and innovation.

14. Conclusions

In the rapidly evolving environment of Business Intelligence, understanding the dynamic role of leadership, the interplay of emerging technologies, and the foundational principles of BI implementation are paramount. As we dissected in the preceding sections, strong and informed leadership not only serves as the foundation for successful BI adoption but also navigates the challenges and cultural nuances that come with it. The diverse case studies, provided empirical evidence of this crucial leadership function in the BI evolution.

Emerging trends, such as predictive analytics and real-time analytics, are continuously redefining the boundaries of BI, urging organizations to remain agile and adaptive. Additionally, while the integration of BI with other technologies such as the Blockchain presents promising synergies, it also underscores the importance of a well-thought-out integration strategy. In light of the insights garnered, the recommendations section emphasizes the need for a phased approach to BI adoption, the significance of ongoing training, and the importance of periodic evaluations of BI strategies. It is essential for organizations to perceive these not as mere procedural steps but as strategic imperatives that align with their broader objectives.

Furthermore, the intersection of BI with AI and Big Data, as discussed in earlier sections, brings forth a plethora of opportunities for organizations, ranging from enhanced decision-making processes to achieving competitive advantages in their respective industries. In conclusion, as organizations traverse the BI evolution, strong and informed leadership is the foundation.

The onus lies on organizations to not only embrace the technological advancements but to strategically weave them into their organizational fabric, ensuring that the true potential of BI is realized in its entirety. Future research in this domain promises further elucidation on the nuances of BI.

Conflict of interest

The authors declare no conflict of interest.

Abbreviations

BI	business intelligence
CI	competitive intelligence
DSS	decision support system
EIS	executive information systems
KM	knowledge management
BPM	business performance management
DW	data warehouse
OLAP	online analytical processing
ML	machne learning
ETL	extract, transform, and load
CIM	computer integrated manufacturing
ROI	return on investment
AI	artificial intelligence

References

1. Jordan J, Ellen C. Business need, data and business intelligence. Journal of Digital Asset Management 2009; 5(1): 10–20. doi: 10.1057/dam.2008.53
2. Alsaad A, Selem KM, Alam MM, et al. Linking business intelligence with the performance of new service products: Insight from a dynamic capabilities perspective. Journal of Innovation & Knowledge 2022; 7(4): 100262. doi: 10.1016/j.jik.2022.100262
3. Fouché G, Langit L. What is business intelligence? In: Fouché G, Langit L. Foundations of SQL Server, R2 Foundations of SQL Server 2008 R2 Business Intelligence. Apress Berkeley; 2011.
4. Luftman J, Kempaiah R, Nash E. Key issues for IT executives 2005. MIS Quarterly Executive 2008; 5(2).
5. Gbosbal S, Kim SK. Building effective intelligence systems for competitive advantage. Sloan Management Review 1986; 28(1): 49–58.
6. Gilad T, Gilad B. SMR forum: business intelligence-the quiet revolution. Sloan Management Review (1986-1998) 27.4 (1986): 53; cited by Cohen, C. (2007). Intelligence et Performance mesurer l'efficacité de l'Intelligence Economique et Stratégique (IES) et son impact sur la Performance de l'Organisation. Vie & sciences de l'entreprise, 174-175, 15-50. https://doi.org/10.3917/vse.174.0015
7. Sawka KA. Demystifying business intelligence. Management Review 1996; 85(10): 47.
8. Collins RJ. Better Business Intelligence: How to Learn More About Your Competitors. Management Books 2000; 1997.
9. Vedder RG, Vanecek MT, Guynes CS, Cappel JJ. CEO and CIO perspectives on competitive intelligence. Communications of the ACM 1999; 42(8): 108–116. doi: 10.1145/310930.310982
10. Wei CC, Che LT. Developing supply chain management system evaluation attributes based on the supply chain strategy. In: Kordic V (editor). Supply Chain: Theory and Applications. I-TECH Education and Publishing; 2008. pp. 95–112.
11. Williams S, Williams N. The Profit Impact of Business Intelligence. Elsevier, 2010.
12. Muntean M, Mircea G. Business intelligence solutions for gaining competitive advantage. Informatica Economica Journal 2007; 3: 549–552.
13. Turban E, Sharda R, Delen D, et al. Decision Support and Business Intelligence Systems. Pearson College Div; 2010.
14. Ackermann MD, van der Poll JA, van der Poll HM. Re-evaluating the definition of intelligence in business intelligence. GATR Journal of Management and Marketing Review 2016; 1(1): 33–44. doi: 10.35609/jmmr.2016.1.1(5)
15. Shollo A, Kautz K. Towards an understanding of business intelligence. In: Proceedings of the 21st Australasian Conference on Information Systems; 1–3 December 2010; Brisbane, Australia.
16. Herring J. What is intelligence analysis? J. Comp. Intel. M. (1998) 1,2; https://doi.org/10.1002/cir.3880040224
17. Golfarelli M, Rizzi S, Cella I. Beyond data warehousing: What's next in business intelligence? In: Proceedings of the 7th ACM international workshop on Data warehousing and OLAP; 12–13 November 2004; Washington DC USA. pp. 1–6.
18. Lawton G. Making business intelligence more useful. Computer 2006; 39(9): 14–16. doi: 10.1109/mc.2006.318
19. Dekkers J, Versendaal J, Batenburg R. Organising for business intelligence: A framework for aligning the use and

development of information. In: Proceedings of the Merging and Emerging Technologies, Processes, and Institutions; 4–6 June 2007; Bled, Slovenia.
20. Martinsons MG. A strategic vision for managing business intelligence. Information Strategy 1994; 10(3): 17–30.
21. Lönnqvist A, Pirttimäki V. The measurement of business intelligence. Information Systems Management 2006; 23(1): 32–40. doi: 10.1201/1078.10580530/45769.23.1.20061201/91770.4
22. Jourdan Z, Rainer RK, Marshall TE. Business intelligence: An analysis of the literature. Information Systems Management 2008; 25(2): 121–131. doi: 10.1080/10580530801941512
23. Lönnqvist A, Pirttimäki V. The measurement of business intelligence. Information Systems Management 2006; 23(1): 32–40. doi: 10.1201/1078.10580530/45769.23.1.20061201/91770.4
24. Baars H, Kemper HG. Management support with structured and unstructured data—An integrated business intelligence framework. Information Systems Management 2008; 25(2): 132–148. doi: 10.1080/10580530801941058
25. Phillips-Wren G, Daly M, Burstein F. Reconciling business intelligence, analytics and decision support systems: More data, deeper insight. Decision Support Systems 2021; 146: 113560. doi: 10.1016/j.dss.2021.113560
26. Salmeron JL. EIS success: Keys and difficulties in major companies. Technovation 2003; 23(1): 35–38. doi: 10.1016/s0166-4972(01)00076-1
27. Alavi M, Leidner DE. Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly 2001; 25(1): 107. doi: 10.2307/3250961
28. Jarke M, Lenzerini M, Vassiliou Y, et al. Fundamentals of Data Warehouses. Springer; 2000.
29. Frolick MN, Ariyachandra TR. Business performance management: One truth. Information Systems Management 2006; 23(1): 41–48. doi: 10.1201/1078.10580530/45769.23.1.20061201/91771.5
30. Maaitah T. The role of business intelligence tools in the decision making process and performance. Journal of Intelligence Studies in Business 2023; 13(1): 43–52. doi: 10.37380/jisib.v13i1.990
31. Inmon WH. Building the Data Warehouse. John Wiley & Sons; 1996.
32. Dagan B. Why has, data warehouse: Become a dirty word? Natural Gas and Electricity 2007; 23(12): 18–22.
33. Moro S, Cortez P, Rita P. Business intelligence in banking: A literature analysis from 2002 to 2013 using text mining and latent Dirichlet allocation. Expert Systems with Applications 2015; 42(3): 1314–1324. doi: 10.1016/j.eswa.2014.09.024
34. Negash S, Gray P. Business Intelligence. Communications of the Association for Information Systems. 2004, 13(1): 177–195.
35. Sharma R, Mithas S, Kankanhalli A. Transforming decision-making processes: a research agenda for understanding the impact of business analytics on organisations. European Journal of Information Systems 2014; 23(4): 433–441. doi: 10.1057/ejis.2014.17
36. Wieder B, Ossimitz ML. The impact of business intelligence on the quality of decision making—A mediation model. Procedia Computer Science 2015; 64: 1163–1171. doi: 10.1016/j.procs.2015.08.599
37. Ghazanfari M, Jafari M, Rouhani S. A tool to evaluate the business intelligence of enterprise systems. Scientia Iranica 2011; 18(6): 1579–1590. doi: 10.1016/j.scient.2011.11.011
38. J.H. Jr.Thomas, Business Intelligence - Why. eAI Journal, (2001) p 47–49, cited by Nofal M.I and Yusof Z.M, Integration of Business Intelligence and Enterprise Resource Planning within Organizations, Procedia Technology (2013) 11,P 658-665, https://doi.org/10.1016/j.protcy.2013.12.242
39. Rahman MM. The effect of business intelligence on bank operational efficiency and perceptions of profitability. FinTech 2023; 2(1): 99–119. doi: 10.3390/fintech2010008
40. Xu Y, Li X, bin Mustakim F, et al. Investigating the business intelligence capabilities' and network learning effect on the data mining for start-up's function. Information Processing & Management 2022; 59(5): 103055. doi: 10.1016/j.ipm.2022.103055
41. Maghsoudi M, Nezafati N. Navigating the acceptance of implementing business intelligence in organizations: A system dynamics approach. Telematics and Informatics Reports 2023; 11: 100070. doi: 10.1016/j.teler.2023.100070
42. Munteanu A, Răduţă O. Banking intelligence accelerator—Decision support. Database Systems Journal 2012; 3(2): 13–22.
43. Mehanović D, Durmić N. Case study application of business intelligence in digital advertising. International Journal of E-Business Research 2022; 18(1): 1–16. doi: 10.4018/ijebr.293294
44. Bany Mohammad A, Al-Okaily M, Al-Majali M, et al. Business Intelligence and Analytics (BIA) usage in the banking industry sector: An application of the TOE framework. Journal of Open Innovation: Technology Market, and Complexity 2022; 8(4): 189. doi: 10.3390/joitmc8040189
45. Vallurupalli V, Bose I. Business intelligence for performance measurement: A case based analysis. Decision Support Systems 2018; 111: 72–85. doi: 10.1016/j.dss.2018.05.002
46. Jalil NA, Prapinit P, Melan M, et al. Adoption of business intelligence—Technological, individual and supply chain efficiency. In: Proceedings of the International Conference on Machine Learning, Big Data and Business Intelligence; 8–10 November 2019; Taiyuan, China. pp. 67–73.
47. Saputra DIS, Indartono K, Handani SW. Business models based technology for startups. Journal of Innovation in

Business and Economics 2019; 3(2). doi: 10.22219/jibe.v3i02.10168
48. Maria S, Pusriadi T, Caisar Darma D. Marketing intelligence: Benefits and implementation of its business. Problems of Management in the 21st Century 2020; 15(2): 92–99. doi: 10.33225/pmc/20.15.92
49. Huang Z, Savita KS, Zhong-jie J. The business intelligence impact on the financial performance of start-ups. Information Processing & Management 2022; 59(1): 102761. doi: 10.1016/j.ipm.2021.102761
50. Nuseir MT. Designing business intelligence (BI) for production, distribution and customer services: a case study of a UAE-based organization. Business Process Management Journal 2021; 27(4): 1275–1295. doi: 10.1108/BPMJ-06-2020-0266
51. T. Papadopoulos & P. Kanellis A path to the successful implementation of Business Intelligence: An example from the Hellenic Banking sector. OR Insight 23, 15–26 (2010). DOI: 10.1057/ori.2009.14
52. Hmoud H, Al-Adwan AS, Horani O, et al. Factors influencing business intelligence adoption by higher education institutions. Journal of Open Innovation: Technology, Market, and Complexity 2023; 9(3): 100111. doi: 10.1016/j.joitmc.2023.100111
53. Musarra G, Kadile V, Zaefarian G, et al. Emotions, culture intelligence, and mutual trust in technology business relationships. Technological Forecasting and Social Change 2022; 181: 121770. doi: 10.1016/j.techfore.2022.121770
54. Popovič A, Hackney R, Coelho PS, et al. How information-sharing values influence the use of information systems: An investigation in the business intelligence systems context. The Journal of Strategic Information Systems 2014; 23(4): 270–283. doi: 10.1016/j.jsis.2014.08.003
55. Bao Z, Hashim KF, Almagrabi AO, et al. Business intelligence impact on management accounting development given the role of mediation decision type and environment. Information Processing & Management 2023; 60(4): 103380. doi: 10.1016/j.ipm.2023.103380
56. Yang M, Sulaiman R, Yin Y, Mallamaci V, Alrabaiah H, The effect of business intelligence, organizational learning and innovation on the financial performance of innovative companies located in Science Park, Information Processing & Management (2022); 59 (2): https://doi.org/10.1016/j.ipm.2021.102852.
57. Seah M, Hsieh MH, Weng PD. A case analysis of Savecom: The role of indigenous leadership in implementing a business intelligence system. International Journal of Information Management 2010; 30(4): 368–373. doi: 10.1016/j.ijinfomgt.2010.04.002
58. Mai NK, Do TT, Phan NA. The impact of leadership traits and organizational learning on business innovation. Journal of Innovation & Knowledge 2022; 7(3): 100204. doi: 10.1016/j.jik.2022.100204
59. Wilkinson A, Godfrey G, Marchington M. TQM and employee involvement in context. Management Research News 1996; 19(4/5): 66–67. doi: 10.1108/eb028466
60. Rosa MF, Alturas B. Business intelligence solution in project monitoring and control. In: Proceedings of the 5th Iberian Conference on Information Systems and Technologies (CISTI); 24–27 June 2020; Seville, Spain. pp.1–6.
61. Bharadiya JP. Leveraging machine learning for enhanced business intelligence. International Journal of Computer and Information Technology 2023; 7(1): 1–19.
62. West D, Allen J. Turning Point: Policymaking in the Era of Artificial Intelligence. Brookings Institution Press; 2020.
63. Bharadiya JP. Machine learning and AI in business intelligence: Trends and opportunities. International Journal of Computer 2023; 48(1): 123–134.
64. Niu Y, Ying L, Yang J, et al. Organizational business intelligence and decision making using big data analytics. Information Processing & Management 2021; 58(6): 102725. doi: 10.1016/j.ipm.2021.102725