FMDB *Transactions on Sustainable Finance and Data Science*

The Role of Data Analytics in Improving Business Information Systems for Decision-Making

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Abstract: The research examines the literature to demonstrate how decision support is enhanced by analytics, the organisation's tempo is accelerated, and risk is reduced. The research finds that descriptive and predictive analytics are prevalent in strategic and operational decision-making. The paper notes issues related to data quality, integration, and privacy. It recommends that integrating data analytics and business information systems should be the hallmark of organisations seeking a competitive advantage in the digital economy. Business Information Systems (BIS) are indispensable to the digital economy, providing organisations with the enabling foundation for conducting business operations, measuring performance, and supporting both routine and strategic decision-making. Initially, BIS focused on efficiently storing, managing, and retrieving data, helping companies rationalise processes and improve reporting accuracy. Though these remain relevant in many ways, the current business world is characterised by a level of complexity that differs from that of the past. Factors such as globalisation, rapid technological advancement, fierce competition, and the sheer volume of data being generated call for firms to move beyond traditional data management methods. In this case, data should no longer be seen merely as a by-product of operations, but as a critical resource that defines success.

Keywords: Business Information Systems (BIS); Data Analytics; Decision-Making Process; Predictive Analytics; Reporting Accuracy; Technological Advancement; Data Management.

Received on: 15/10/2025, **Revised on:** 08/12/2025, **Accepted on:** 25/01/2026, **Published on:** 19/08/2026

Journal Homepage: https://www.fmdbpub.com/user/journals/details/FTSFDS

DOI: https://doi.org/10.69888/FTSFDS.2026.000742

Cite as: T. Z. Aung, H. H. K. Tin, F. Effendy, P. Nurnazar, A. A. Jamil, and A. Hazarika, "The Role of Data Analytics in Improving Business Information Systems for Decision-Making," *FMDB Transactions on Sustainable Finance and Data Science*, vol. 1, no. 3, pp. 162–171, 2026.

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1. Introduction

Business information systems provide the means to capture, process, and store business data. Data analytics create value through pattern discovery, trend forecasting, and facilitating decision-making by translating insights into actionable information

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for managers. The weakness of traditional BIS has emerged because companies are unable to respond quickly to rapidly evolving market trends and customer preferences [1]. As an example, a company may possess vast databases of customer transactions. Yet, it is unable to anticipate customer requirements or tailor products because it cannot process such information in an organised manner. Once again, as in finance or health, big, fast, up-to-date decisions based on data are the key to success and survival. As a result, organisations are already demanding more advanced tools than simple descriptive reporting, such as predictive modelling, trend forecasting, and prescriptive decision support. The enabler in this transformation has been identified as data analytics [8]. Analytics enables companies to handle structured and unstructured data, uncover hidden patterns, forecast outcomes, and generate insights to guide managerial decision-making [5].

Descriptive analytics provides a historical view; predictive analytics provides a view of what is likely to happen in the future; and prescriptive analytics guides on what should be done. Collectively, these strategies make BIS dynamic systems, which increase their decision-making abilities. This process is independent of industry; the retail sector uses analytics to understand customer behaviour, the manufacturing industry uses it to streamline supply chain management, healthcare organisations use it to predict disease outbreaks, and the financial services sector uses it to manage risk and detect fraud [9]. Analytics used by BIS also indicate a shift from reactive to proactive decision-making. Firms do not react to events as they unfold, but they can foresee the problems that lie ahead, understand the opportunities, and act accordingly [10]. This supplements broader data-driven decision-making (DDDM), in which managerial decision-making becomes less reliant on experience or guesswork and is empirically grounded in data from systematic analysis. Such companies that follow this route have shown gains in efficiency, innovation, and overall competitiveness.

However, there is a cost to adopting analytics-powered BIS. Significant obstacles remain in data quality, system integration, organisational pushback, and privacy concerns. Also, the shortage of qualified professionals who can interpret analytical reports and translate them into strategic action remains a challenge. In this sense, even though analytics is the key to transforming how business decisions are made, its success depends on overcoming not only technological but also managerial obstacles [11]. The paper focuses on data analytics to enhance BIS and advance decision-making. The paper reveals how analytics enhances operational, tactical, and strategic decision-making through a literature review [12]. The paper outlines the benefits and applications of BIS Analytics, as well as the challenges companies face when adopting it. Lastly, the paper argues that integrating data analytics into BIS is not only a technological upgrade but also a strategic necessity for organisations that want to live and thrive in the increasingly competitive, data-sensitive business ecosystem.

2. Related Work

2.1. Progress of Business Information System

Business Information Systems (BIS) exist to facilitate organisational decision-making by assembling, processing, storing, and retrieving business information. BIS did not start with anything other than administrative systems for maintaining records and for periodic reporting. The intent was to provide greater efficiency and reduce human intervention in the processing of activities and transactions. Earlier systems served as precursors to later uses, such as Management Information Systems (MIS) and Decision Support Systems (DSS), by extending the concepts of structured analysis and semi-automatic decision support [4]. With the rise in processing volume, the focus shifted from merely reporting data to gaining insights from vast, complex datasets. This development came against the backdrop of the evolution of the internet and cloud computing, which enabled the management of large amounts of structured and unstructured data. The evolution of BIS also moved from merely reporting tools to dynamic platforms that include BI and advanced analytics features [9]. With the advent of digital transformation, driven by AI, machine learning, and IoT, the scope for BIS use has been further broadened. With technology, organisations can not only identify trends and predict future outcomes but also automate decision-making.

2.2. Data Analytics and Decision-Making

Data analytics is the systematic analysis of data to identify patterns, correlations, and other relevant information from collected datasets. Data analytics has been identified as including various types based on their level of sophistication, including descriptive, analytical, and prescriptive analytics [2]. Using business intelligence and analytics, the process of analysing and using data to make sound decisions becomes very efficient. For example, descriptive analytics can be used to monitor metrics such as sales performance and operational efficiency. On the other hand, predictive analytics are useful for forecasting demand, identifying trends, and measuring turnover rates. In turn, prescriptive analytics can inform pricing policies, logistics processes, and marketing campaigns [7]. The benefits of using analytics in business decision-making are well established in the literature. It has been observed that companies that base their decision-making processes on analytics have an advantage over competitors, as analytics ensures that decisions are evidence-based rather than intuitive [5]. Moreover, integrating business intelligence and analytics is important, as it not only increases efficiency but also enhances innovation and customer value [1].

2.3. Analytics Integration in BIS

The adoption of analytics in business intelligence systems marks a paradigm shift in how businesses use information systems. Whereas previously BIS were merely used as data repositories, the current state-of-the-art BIS operate as smart, intelligent systems. An example of a cloud-based BIS deployment provides access to real-time dashboards, predictive alerts, and scenario modelling, enabling one to assess the implications of their decisions before taking any action [10]. Analytics in BIS promotes decision-making processes at all levels of a collective body. At the operational level, analytics supports decision-making for activities such as scheduling, inventory management, and customer service processes. At the tactical level, analytics assists management in resource allocation, process improvement, and performance measurement. At the strategic level, BIS, supported by analytics, helps with strategic planning, competitive analysis, and risk management [9]. Research indicates that companies adopting BIS that incorporate advanced analytics are very adaptive and effective in their decision-making. Companies that adopt evidence-based decision-making tend to be more productive and efficient [6]. Moreover, companies that harness analytics can sustain a competitive advantage through constant data-driven decision-making [3].

2.4. Applications across Industries

The use of analytics-grounded BIS is not confined to a single industry; it is now common across most industries (Table 1).

Table 1: Applications of analytics-integrated BIS across sectors

Sector	Application for Analytics in BIS
Healthcare	Enhances patient care through predictive models for disease progression, resource optimisation, and reduction of medical errors; Also supports forecasting of patient admissions and staff allocation.
Retail	Enables analysis of customer behaviour, personalised marketing, inventory management, and dynamic pricing; Systems like recommendation engines improve customer engagement and sales
Finance	Supports fraud detection, credit risk assessment, and market trend prediction using data mining and predictive modelling techniques
Manufacturing and Supply Chain	Facilitates demand forecasting, logistics optimisation, and predictive maintenance through ERP and supply chain analytics systems
Public and Government Sector	Improves public service delivery through evidence-based policymaking, fraud detection in social programs, and efficient resource allocation
Education	Assists in tracking student performance, predicting dropout risks, and personalising learning pathways using learning analytics

These case studies demonstrate how analytics-enabled BIS can operate at strategic, operational, and tactical levels, be applicable across industries, and deliver quantitative value for organisational decision-making.

2.5. Adoption Challenges

Even though BIS analytics is increasingly used, there are certain challenges. Data quality is among the most persistent challenges that arise in this context. Poor data quality may lead to misinterpretations, rendering decision-making impossible because it is based on false conclusions [10]. Interoperability is another issue, as organisations have already established IT infrastructure that may make it difficult to integrate it with analytics. Privacy and security are critical concerns when an organisation stores or gathers personal information. With the emergence of data protection legislation such as the GDPR in the EU and the CCPA in California, it became necessary for the business to reevaluate its BI-based analytics approach. Furthermore, adoption often faces organisational and cultural challenges. For example, managers are inclined to rely more on intuition than on data analysis due to the complexity and unfamiliarity of data [5]. Moreover, a skills shortage in data analysis is an ongoing challenge, according to recent literature. Organisations cannot necessarily employ specialists skilled enough to interpret data results and apply them in decision-making.

2.6. Research Gap and Contribution

Despite the abundance of literature on BIS and analytics individually, very little research has clearly shown how integrating analytics transforms BIS's existing information management systems into decision-optimisation platforms. The existing literature largely emphasises technical models or industry-specific applications and fails to comprehensively model the cross-industry impact of analytics on decision-making. The research paper contributes to a literature review across disciplines to reveal how analytics enhances BIS. It also presents ubiquitous impediments and offers research and practitioner insights for

those who wish to design, create, or understand analytics-enabled BIS. The paper is a research and practice contribution that bridges the gap between research and practice by linking potential technologies to their managerial implications.

3. Methodology

Table 2 investigates the impact of data analytics on the creation of Business Information Systems (BIS) to facilitate decision-making using a literature-based research approach. Since the research aims to synthesise existing information, a systematic literature review (SLR) approach was chosen. This approach guarantees a structured, clear, and repeatable procedure of locating, analysing, and incorporating pertinent literature.

3.1. Research Model

This investigation used a qualitative, exploratory research design that aimed to synthesise existing knowledge rather than to collect primary data. Multiple reliable sources, including 37 peer-reviewed scholarly articles, 10 industry reports, and 5 definitive books, were systematically used to collect secondary data. Upon thorough screening and filtering of the inclusion criteria, 52 high-relevance sources were selected for thorough review and analysis, ensuring the analysis is based on high-authority, established literature. The research design has been selected for two reasons:

- The introduction of analytics into BIS spans a variety of industries and disciplines, necessitating the integration of a vast range of literature.
- The SLR methodology captures both known facts and gaps in the research, giving guidelines to future empirical research.

3.2. Source Choice

The literature selected for analysis in this study was sought in reputable academic databases, including Scopus, Web of Science, IEEE Xplore, ScienceDirect, SpringerLink, and Google Scholar. These databases were selected for their extensive coverage of the scientific literature on computer science, information systems, and management. To retrieve all relevant studies, a keyword-based search strategy was employed. Keywords such as Business Information Systems, Data Analytics, Business Intelligence, Predictive Analytics, and Big Data Analytics in Organizations were selected to identify relevant literature for the proposed study. All these keywords were combined using the Boolean operators AND/OR. This allowed the selection of only those papers that investigated the relationship between the concepts mentioned above and the integration of analytics into BISs. The first literature search produced 420 papers and book chapters. After removing duplicates, the number was reduced to 360 unique records. Using the preselected inclusion criteria, the search yielded 87 relevant studies that could contribute to the synthesis of available knowledge. After a second round of relevance assessment, 52 relevant and high-quality studies were selected for further critical analysis and synthesis.

3.3. Analytical Approach

To facilitate the analysis and synthesis of the selected literature, it was organised into four major themes (Figure 1).

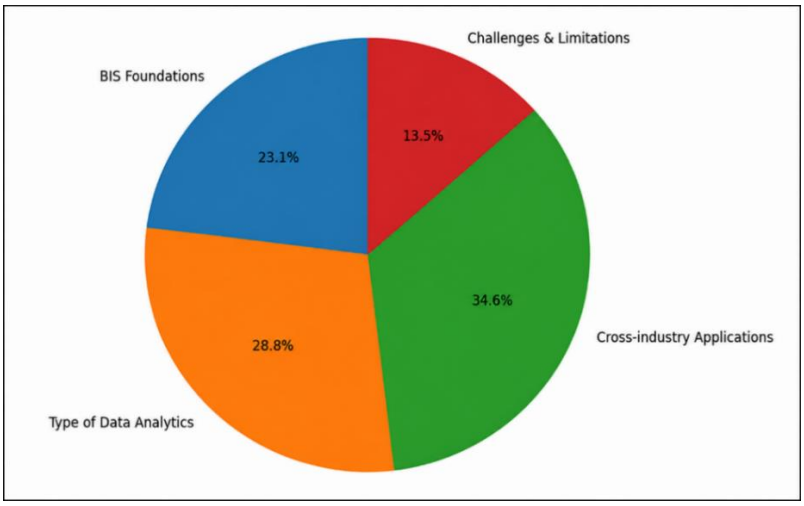

Figure 1: Distribution of literature by thematic category

The following themes address the fundamental concepts that underpin business information systems, the major categories of data analytics, application domains, and key issues. A comparative lens was applied to analyse benefits and challenges across operational, tactical, and strategic decision-making levels.

Table 2: The fundamental concepts of data analytics

Theme	Description	No. of Sources
BIS Foundations	Historical contributions to reporting and decision support	12
Type of Data Analytics	Descriptive, predictive, and prescriptive analytics	15
Cross-Industry Applications	Healthcare, finance, retail, manufacturing, education, government	18
Challenges and Limitations	Data quality, skills gaps, governance, compliance	7

The pie chart clearly depicts the distribution throughout the four primary sections of the study. The largest share goes to Cross-industry Applications at 34.6%, underscoring their important role and broader relevance across multiple sectors. Type of Data Analytics has a significant 28.8% share, indicating a heavy investment in analytical methods and their practical applications. BIS Foundations: 23.1%. This emphasises the relevance of basic concepts and structures in the research. Conversely, Challenges and Limitations make up the smallest category at 13.5% but are still a vital part of identifying hurdles and opportunities for further improvement.

3.4. Limitations of Methodology

Despite its advantages, the SLR method has limitations:

- Reliance solely on secondary sources; no primary data collection (Surveys, Interviews, or Case Studies)
- Findings depend on the quality and availability of published literature
- Some industry insights may be unpublished or inaccessible
- Rapid technological advances in data analytics may render findings less relevant after review

Nevertheless, the systematic, reproducible process ensures that results are grounded in credible scholarly sources, providing a comprehensive overview of the role of data analytics in BIS evolution.

4. Findings and Analysis

The findings are synthesised across the four thematic dimensions identified above: (1) BIS foundations, (2) types of data analytics, (3) cross-industry applications, and (4) challenges and limitations.

4.1. Evolution of Business Information Systems

From the literature review, the development of business information systems has gone beyond simple transaction processing and reporting to more sophisticated intelligence systems (Figure 2).

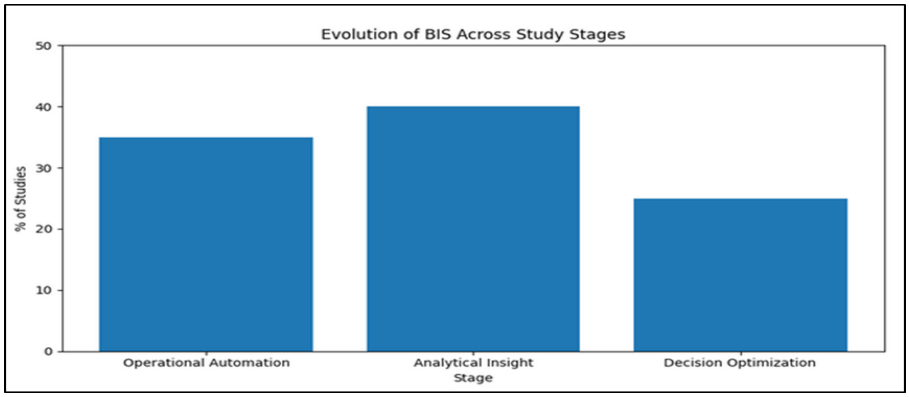

Figure 2: The percentage of studies

Most of the research indicates that the importance of BIS has shifted toward the use of information for analysis and decision-making optimisation (Table 3).

Table 3: Evolution of BIS

Stage	Focus	% of Studies
Operational Automation	Efficiency, transaction processing, and reporting	35%
Analytical Insight	Dashboarding, KPI monitoring	40%
Decision Optimization	Predictive and prescriptive analytics	25%

The transition to decision optimisation represents a major structural shift, transforming BIS from static data repositories to active decision-support systems.

4.2. Role of Different Types of Analytics

The roles of descriptive, predictive, and prescriptive analytics have been clearly explained in Table 4. While descriptive analytics are commonly applied to evaluate past performance, the other two types of analytics provide more value by predicting future events and recommending the optimal path forward:

- Descriptive analytics provides transparency but limited competitive advantage
- Predictive analytics enhances planning accuracy and risk anticipation
- Prescriptive analytics enables proactive, optimised decision-making

Table 4: Different types of analytics

Analytics Type	Contribution	Examples	No. of Studies
Descriptive	Monitors historical performance	Dashboards, reporting	20
Predictive	Forecasts trends, detects risks	Demand forecasting, fraud detection	18
Prescriptive	Suggests optimal decisions	Dynamic pricing, supply chain optimisation	14

4.3. Cross-Industry Applications

From Table 5, business analytics is used extensively across industries, with health care, financial services, and retail having the highest rates of use among the studies analysed. The use of business analytics offers several advantages, including increased efficiency, reduced risk, better decision-making, and improved service delivery.

Table 5: Key applications for industries

Industry	Key Applications	Benefits	Studies
Healthcare	Patient admission forecasting, resource planning	Reduced errors, improved efficiency	8
Finance	Fraud detection, credit risk scoring	Reduced financial exposure and compliance	7
Retail	Customer segmentation, demand forecasting	Personalised marketing, inventory optimisation	6
Manufacturing	Predictive maintenance, logistics optimisation	Reduced downtime, optimised production	5
Education	Learning analytics, dropout prediction	Improved student support	3
Public Sector	Evidence-based policy, fraud detection	Improved service delivery	3

Across industries, analytics-enhanced BIS consistently improves decision quality and operational efficiency, while applications vary according to sector-specific requirements.

4.4. Decision-Making Levels

Table 6 shows that business analytics supports decision-making at operational, tactical, and strategic levels within organisations. Its impact ranges from improving routine processes and resource allocation to guiding long-term planning, forecasting, and competitive decision-making.

Table 6: Decision-making levels

Level	Impact	Examples
Operational	Process automation, real-time monitoring	Inventory management, error reduction
Tactical	Resource allocation, departmental performance	Budget planning, functional coordination
Strategic	Market forecasting, long-term investment	Risk modeling, competitive positioning

4.5. Key Challenges

These issues are outlined in Table 7, which shows that data quality is the most frequently cited problem when implementing business analytics. Other constraints include lack of talent, compatibility with legacy systems, regulatory constraints, and organisational resistance to change.

Table 7: Key challenges

Challenge	Frequency	Notes
Data Quality	30%	Incomplete or inconsistent data reduces model reliability
Skills Gap	25%	Shortage of analytics professionals
Legacy Systems	20%	Integration with modern platforms is complex
Regulatory Compliance	15%	Privacy, security, sector-specific rules
Cultural Resistance	10%	Managers are reluctant to adopt data-driven approaches

The infusion of data analytics into Business Information Systems (BIS) radically transforms organisations' decision-making practices (Figure 3).

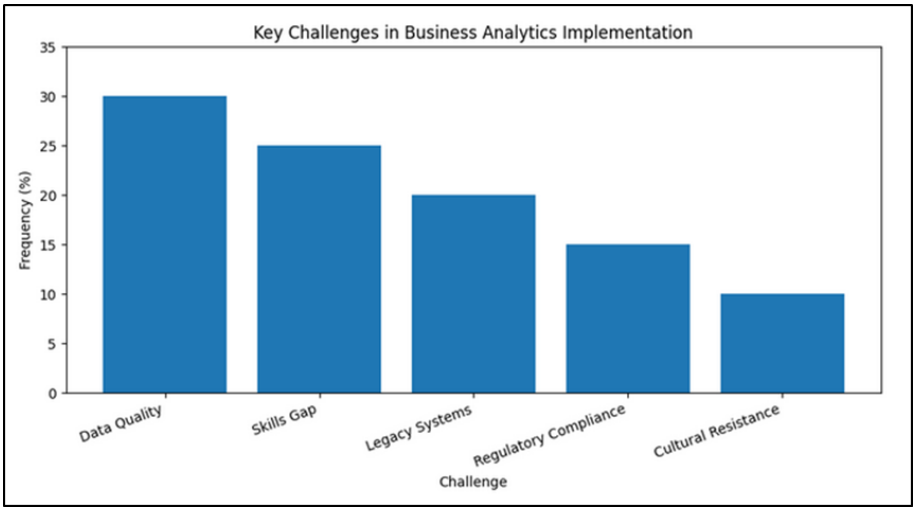

Figure 3: Key challenges in business analytics implementation

The reviewed literature highlights the opportunities and challenges involved in analytics-based BIS and can be analysed across different organisational aspects (Table 8).

Table 8: The aspects of BIS

Aspect	Benefits	Challenges
Decision-Making	Supports data-driven, proactive decisions	Managers may resist shifting from intuition-based to data-driven decisions
Operational Efficiency	Optimises business processes, reduces errors, and improves resource utilisation.	Integration with legacy systems can be difficult.
Strategic Planning	Enables predictive and prescriptive insights for long-term planning	Data quality issues can reduce the accuracy of predictions
Customer Insights	Personalises services and marketing based on behaviour patterns	Requires large volumes of clean, structured, and accessible data

Risk Management	Identifies fraud, operational risks, and market trends early	Privacy, security, and regulatory compliance concerns
Competitive Advantage	Gains an edge through faster and better-informed decisions	Skill gaps in analytics and data interpretation within organisations

4.6. Discussions

The results suggest that incorporating data analytics into Business Information Systems (BIS) represents a fundamental shift in how organisations make decisions, operate, and position themselves in the market. This part places the findings in a theoretical context, discusses managerial and policy implications, emerging trends, and the trade-offs involved in adopting analytics.

4.6.1. Theoretical Perspectives

Various theories account for the benefits and limitations of BIS enabled by analytics. Decision Theory emphasises the transition from intuition to evidence-driven decision-making, where the importance of information becomes apparent because it reduces uncertainty. The combination of descriptive, predictive, and prescriptive analytics expands decision perspectives by making decisions more informed and rational. The Theory of Technology Acceptance Model (TAM) by Ghasemaghaei [10] illustrates the issue of resistance to using BIS, even if such BIS includes advanced analytics tools, if they are viewed as too complex and difficult to use. The Resource-Based View (RBV) introduced by Delen and Demirkan [4] treats analytics capabilities as strategic resources, enabling companies to gain a competitive advantage through proprietary data, personnel, and IT resources.

4.6.2. Managerial Implications

Analytics-enabled BIS requires organisations to focus not only on technological adoption but also on organisational transformation. Managers must foster a culture of data-driven decision-making by:

- Building trust in analytics outcomes
- Ensuring transparency in algorithms
- Implementing training and change management programs

Investment in analytics should balance short-term costs against long-term efficiency and competitive gains. For example, predictive maintenance in manufacturing or fraud detection in banking demonstrates that analytics improves both operational efficiency and tangible financial performance.

4.6.3. Policy and Governance Implications

The widespread adoption of analytics in BIS necessitates robust policy and governance frameworks. Regulatory compliance is critical in domains handling sensitive data, such as healthcare, finance, and education. Firms must adhere to standards such as GDPR, HIPAA, and other data protection laws to safeguard privacy. Internally, companies need to improve their data governance practices, which include data quality, security, and ethics. Companies that do not adhere to such practices face both legal consequences and reputational risks.

4.6.4. Future Trends and Directions

BIS is experiencing rapid growth due to the convergence of technologies such as Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), and cloud computing:

- AI-driven chatbots in e-commerce that improve customer engagement while generating predictive behavioural data.
- IoT-enabled manufacturing systems for real-time monitoring and predictive maintenance.
- Cloud-based BIS that allows SMEs to leverage advanced analytics without large infrastructure investments.

These advancements promise more adaptive, responsive, and intelligent decision systems. However, they also introduce challenges such as cybersecurity risks, vendor dependence, and the digital divide between large corporations and SMEs.

4.6.5. Trade-Off between Benefits and Challenges

The implementation of analytics-based BIS requires a balance between technological potential and human and organisational capabilities. Key considerations include:

- Filling the workforce skills gaps with workforce training and collaborating with academic institutions.
- Balancing BIS integration into the general business strategy so that insights can be acted on.
- Knowing that analytics adds to, rather than replaces, managerial judgment as a tool to improve decision quality.

This study is significant because it examines the use of analytics as a supplement to enhance the BIS process. The analysis demonstrates that an analytics application is not limited to the technical aspect but can be considered a strategy that transforms organisations' decision-making processes.

5. Conclusion

The introduction of data analytics into Business Information Systems represents an innovative breakthrough with significant implications for information management, decision-making, and competitive advantage within an organisation. BIS analytics offers several advantages, including high-quality, fast-paced decision-making, operational effectiveness, a deeper understanding of customer needs, proactive risk management, and strategic value. Nonetheless, many challenges related to its implementation remain, including data quality, compatibility with legacy systems, organisational culture, skills gaps, and regulatory limitations. Data analytics can be seen as a strategic resource and should be embedded in an organisation's processes and culture, rather than treated as an independent technology. A business needs to create a culture of data-driven decision-making, develop human capital, and ensure proper management of data assets. Policymaking should be structured to promote innovation while protecting stakeholders' interests through appropriate regulations. The future for BIS will be characterised by high levels of artificial intelligence, machine learning, the Internet of Things, and cloud computing, as these technologies will enable the development of more sophisticated, flexible, and readily available systems. It is the small businesses that reap most from these advances, while medium-sized companies worry about issues such as cybersecurity, ethics, and technology. Analytics-based BIS is not just a tool for managing organisations; it is a strategic tool that can revolutionise decision-making. Future areas of research may include the impact on performance over time across sectors and how to maximise the use of analytics through human-machine interaction.

Acknowledgement: The authors sincerely acknowledge the academic support and institutional contributions provided by the University of Information Technology, Universitas Nusa Mandiri, Sarbon University, Universiti Teknologi Malaysia (UTM), and Global Interfaith University.

Data Availability Statement: Data relevant to this study will be provided by the corresponding author upon reasonable request, where permissible.

Funding Statement: This study was conducted without any external financial support.

Conflicts of Interest Statement: The authors report no conflicts of interest, and all sources used in this original work have been duly acknowledged.

Ethics and Consent Statement: The study was conducted in accordance with applicable ethical principles, and informed consent was obtained from all participants before their participation.

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