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Research Article

Executive Decision Support System Implementation Strategies Based on Big Data Analytics to Improve Operational Efficiency and Corporate Governance in Global Digital Enterprises

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Abstract: This study explores the transformative role of big data-driven Decision Support Systems (DSS) in global digital enterprises, particularly focusing on their impact on operational efficiency and corporate governance. By leveraging big data analytics, DSS offer organizations the tools to process vast amounts of real-time data, enabling executives to make more informed decisions that optimize resources, improve productivity, and reduce operational costs. The research highlights the integration of predictive analytics, machine learning, and real-time data processing within DSS, which allows businesses to gain strategic insights and anticipate market trends. Furthermore, the study emphasizes the significant role of DSS in enhancing corporate governance, improving transparency, accountability, and compliance with regulations. These systems foster better decision-making processes, which contribute to building trust among stakeholders and ensuring long-term organizational success. However, the study also identifies several challenges in implementing big data-driven DSS, including data management complexities, technological integration difficulties, and the need for skilled personnel. Despite these challenges, the findings demonstrate that big data-driven DSS are pivotal in driving competitive advantage, operational optimization, and governance improvements. The research concludes with actionable recommendations for executives to adopt and implement big data-driven DSS, emphasizing the importance of continuous support, training, and system integration. The study also suggests future research directions, including exploring the integration of emerging technologies like AI and IoT into DSS and assessing their long-term impact on sustainability and corporate governance.

Keywords: Big Data; Corporate Governance; Decision Support; Operational Efficiency; Predictive Analytics.

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1. Introduction

In today's digital era, executives face growing challenges in transforming vast amounts of data into actionable insights that drive operational efficiency and governance. The rapid increase in data volume and complexity necessitates a more intentional approach to analytics governance [1]. Digital transformation (DT) has revolutionized business operations, leading to new business models and improved performance, particularly in manufacturing. However, many companies struggle to achieve their digitalization goals due to a lack of infrastructure, understanding of technology, and the intangibility of benefits. The relentless pace of disruption and the critical need for continuous business and workplace transformation further complicate the landscape, requiring proactive leadership and organizational agility [2].

Making data-driven decisions in global digital enterprises is fraught with difficulties. Despite the potential benefits, only a few companies have successfully transitioned to becoming data-driven organizations due to numerous challenges and barriers [3]. These challenges include insufficient buy-in from executive management, resistance to technology adoption, inadequate technical and soft skills, and poorly-directed investments [4]. Additionally, the integration of multiple emerging digitization technologies can lead to worse decision-making results, highlighting the difficulty in combining real-time operational data from various sources [5].

Organizations often find their data management approach unprepared for analytics-based decision-making, making the journey to becoming data-driven a bumpy ride [3]. The adoption of data-driven approaches in business process management (BPM) by micro, small, and medium enterprises (MSMEs) also faces significant barriers such as technological limitations, resource constraints, and data management issues [6]. Furthermore, the integration of digital technology to promote organizational change and data governance presents additional challenges for leaders [7].

In the age of digital transformation, global enterprises are increasingly relying on big data analytics (BDA) to support executive decision-making processes, enhance operational efficiency, and strengthen corporate governance. The integration of BDA with decision support systems (DSS) is key to providing executives with timely and actionable insights. By leveraging machine learning algorithms and real-time data processing, organizations can optimize their decision-making processes, reduce latency, and improve accuracy [8].

An effective DSS architecture integrates various data sources, including structured, unstructured, and behavioral data, to create reliable performance indicators that provide comprehensive insights [9]. However, the success of such systems heavily depends on managerial commitment, organizational expertise, and continuous support from top leadership [10]. Furthermore, the integration of artificial intelligence (AI) in DSS not only enhances decision-making capabilities but also raises ethical concerns regarding transparency, accountability, and algorithmic bias [11].

One of the challenges organizations face in implementing BDA-driven DSS is aligning these systems with their strategic goals, which is crucial for performance monitoring and ensuring that decisions contribute to the long-term success of the company. Additionally, the need for ongoing training and development within organizations ensures that employees are equipped with the skills necessary to navigate and leverage BDA tools effectively [12].

2. Literature Review

Big Data Analytics in Decision Making

Big Data Analytics (BDA) has become an essential tool in modern decision-making, enabling organizations to derive real-time insights that enhance strategic decision-making, operational efficiency, and competitive advantage. By analyzing large volumes of data, BDA provides executives with the tools necessary for informed decision-making, thus optimizing business processes such as supply chain management, inventory optimization, and resource allocation [13], [14]. One of the key benefits of BDA is its ability to drive competitive advantage by enabling organizations to make data-driven decisions that foster innovation [15]. Additionally, BDA enhances operational efficiency by offering insights into performance metrics that can be used to refine processes and improve cost management [16].

Customer insights are another critical benefit of BDA. By analyzing customer behavior, preferences, and trends, businesses can tailor products and services to meet consumer needs, resulting in enhanced customer experiences and more targeted marketing campaigns [16], [17]. However, despite these benefits, BDA is not without its challenges. Issues related to data quality, integration, privacy, and the need for advanced tools to handle the volume, variety, veracity, and velocity of big data remain significant hurdles [18], [19].

Executive Decision Support Systems (DSS)

Decision Support Systems (DSS) are critical for facilitating decision-making in modern organizations. These computer-based systems help executives analyze data, make informed decisions, and solve problems effectively. The integration of BDA with DSS has expanded their role, enabling real-time analytics, predictive capabilities, and deeper insights into operational and strategic decisions [17]. Modern DSS applications are particularly important

for enhancing corporate governance by improving transparency, risk management, and the efficiency of decision-making processes [19].

DSS also plays a vital role in operational management by improving reporting accuracy and driving business performance through advanced analytics tools. These systems allow organizations to continuously monitor and improve key performance indicators (KPIs), leading to more effective decision-making at various levels of management [20]. Furthermore, the integration of artificial intelligence (AI) with DSS allows for continuous auditing, risk assessment, and predictive analysis, which are crucial for managing environmental, social, and governance (ESG) risks [13], [19].

Operational Efficiency and Governance: Concepts and Intersection with DSS

Operational efficiency is a critical factor in modern organizations, referring to the ability to deliver products and services in a cost-effective manner while maintaining high-quality standards. It involves optimizing organizational processes, reducing waste, and improving overall productivity. Decision Support Systems (DSS) play a significant role in enhancing operational efficiency by providing data-driven insights that facilitate informed decision-making, optimize resource management, and improve strategic planning [21], [22]. Through real-time data analysis, DSS enable organizations to streamline operations, thereby contributing to cost reduction and performance enhancement [23].

Corporate governance refers to the system of rules, practices, and processes by which a company is directed and controlled. It ensures accountability, fairness, and transparency in a company's relationship with its stakeholders. Effective corporate governance can significantly impact an organization's profitability and operational efficiency. Studies show that strong governance mechanisms directly enhance operational efficiency by improving decision-making processes, fostering transparency, and strengthening accountability, which in turn positively influences the company's financial performance [24], [25].

DSS plays a critical role at the intersection of operational efficiency and corporate governance by providing the tools and data necessary for effective decision-making. By optimizing resource management, DSS help reduce waste and enhance productivity [22]. In operational management, DSS supports better decision-making by providing high-quality data and predictive analytics that inform strategic and operational decisions [21]. Additionally, DSS enhances corporate governance by ensuring that decision-making processes are based on accurate, timely data, thus improving transparency and accountability [24].

Moreover, DSS integrates seamlessly with both operational efficiency and corporate governance frameworks by offering tools that support real-time data processing and predictive analysis. These systems can facilitate better strategic planning, optimize resource allocation, and ensure that decision-making is aligned with the organization’s long-term objectives [26], [27].

Challenges and Successes in Big Data-Driven DSS

While the potential benefits of big data-driven DSS are clear, several challenges must be addressed for successful implementation. One of the primary challenges is data management, as handling large volumes of data and ensuring its quality, integration, and real-time processing can be resource-intensive [28]. Technological integration also poses challenges, as integrating DSS with existing systems, such as Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM) systems, requires significant expertise and investment [29]. Moreover, ensuring the transparency and interpretability of AI models used in DSS is crucial for maintaining trust in the system and avoiding biases [30].

Despite these challenges, several organizations have successfully implemented big data-driven DSS, resulting in enhanced decision-making, improved operational efficiency, and better strategic capabilities. By leveraging predictive analytics and real-time data, DSS has improved resource management and process optimization, contributing to enhanced organizational performance [22], [23]. Furthermore, DSS has empowered companies to respond more effectively to market changes, improving strategic agility and competitiveness [25].

Future research in DSS should focus on the integration of emerging technologies such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT) to further enhance their capabilities. This integration can provide more comprehensive insights, improve decision-making accuracy, and facilitate more agile responses to changing business environments [29]. Additionally, addressing challenges related to data bias and scarcity

remains critical, as ensuring data quality and mitigating biases are essential for the effectiveness of big data-driven DSS [28]. Finally, improving the user-friendliness of DSS interfaces will be crucial in encouraging their adoption and ensuring their effectiveness in real-world applications [21].

Blockchain and Digital Governance in Enterprise Decision Systems

Blockchain technology has emerged as a transformative tool in strengthening transparency, accountability, and trust in digital governance systems. In the context of Executive Decision Support Systems, blockchain can provide a secure and immutable record of transactions and organizational data, ensuring that decision-making processes are based on reliable and verifiable information.

Research has shown that blockchain-based systems can significantly enhance digital governance by improving document authentication, transparency, and data integrity. For example, blockchain-based AlphaSign systems have been proposed to support secure digital literacy initiatives and strengthen e-governance infrastructures through decentralized verification mechanisms [31]. Such systems can help organizations ensure that information used in decision-making processes remains authentic and tamper-resistant.

Moreover, the integration of blockchain with artificial intelligence and corporate social responsibility frameworks has been explored in the CICA (CSR, AI, and Blockchain) framework. This framework demonstrates how digital technologies can support sustainable digital culture and responsible governance practices within organizations [32]. By combining technological innovation with governance principles, organizations can create decision-support environments that promote transparency, accountability, and long-term sustainability.

3. Proposed Method

This study employs a combination of case-based analysis, system architecture evaluation, and performance metrics assessment to explore the implementation of Decision Support Systems (DSS) based on big data analytics in global digital enterprises. Case-based analysis examines real-world case studies to understand how DSS enhances operational efficiency and corporate governance. System architecture evaluation focuses on the design, data flow, and integration of DSS, while performance metrics assessment measures the effectiveness of DSS using key performance indicators (KPIs) like resource optimization, decision-making speed, and governance transparency. These methods aim to provide insights into the challenges, successes, and impact of DSS on organizational performance and strategic decision-making.

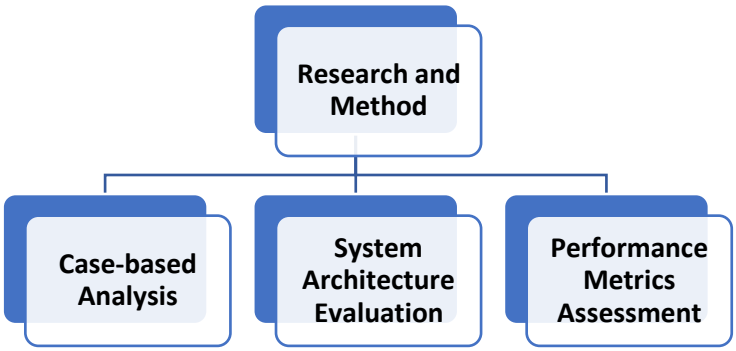

Figure 1. Flowchart structure.

This study employs a combination of case-based analysis, system architecture evaluation, and performance metrics assessment to explore the implementation of Decision Support Systems (DSS) based on big data analytics in global digital enterprises. The following sections detail the methodology used in this research.

Case-Based Analysis

The first methodological approach used is case-based analysis, which involves the selection and analysis of relevant case studies that demonstrate the successful implementation of DSS leveraging big data analytics in global digital enterprises. This method allows for an

in-depth understanding of how DSS are applied in real-world contexts and provides insights into the challenges and successes associated with their deployment. By analyzing case studies, the research explores how DSS contribute to improving operational efficiency and enhancing corporate governance practices. Key case studies are selected from various industries, with a focus on organizations that have successfully integrated big data-driven DSS into their decision-making processes. The analysis considers factors such as the integration of data sources, the role of predictive analytics, and the influence of DSS on strategic decision-making and governance.

System Architecture Evaluation

The next component of the methodology involves evaluating the architecture of big data-driven DSS systems. This evaluation focuses on the design and structure of DSS, emphasizing key elements such as data flow, processing, and decision-making capabilities. The research outlines how various components of a DSS interact to process and analyze data in real-time, providing executives with the insights necessary for informed decision-making. System architecture evaluation is crucial for understanding how data is collected, integrated, and processed within a DSS framework. This study examines the role of machine learning algorithms, real-time data processing, and pattern recognition in enhancing the capabilities of DSS to provide actionable insights. Additionally, the study explores the integration of emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT), which are increasingly being incorporated into DSS to improve their effectiveness and decision-making power.

Performance Metrics Assessment

To assess the success of DSS in improving operational efficiency and governance practices, this study employs performance metrics assessment. Key performance indicators (KPIs) are identified to measure the effectiveness of DSS in various organizational domains, including resource optimization, decision-making speed, and governance transparency. Performance metrics include the accuracy of predictions made by the DSS, the efficiency of resource allocation, and the impact of DSS on strategic outcomes such as profitability and operational costs. In addition to operational efficiency, the research evaluates the impact of DSS on corporate governance by measuring improvements in decision-making transparency, accountability, and compliance with governance frameworks. This assessment is essential for determining the return on investment (ROI) of DSS and for identifying areas where further improvements are needed.

4. Results and Discussion

Big data-driven Decision Support Systems (DSS) have significantly improved operational efficiency and corporate governance in global digital enterprises. These systems enable better resource allocation, cost savings, and enhanced decision-making by integrating real-time data and predictive analytics. They optimize processes like inventory management and service delivery while fostering transparency and accountability in governance. However, challenges like data integration, ensuring data quality, and aligning DSS with existing systems remain. Despite these hurdles, DSS have been effective in strengthening governance by improving compliance and proactively addressing risks, ultimately leading to more informed, strategic decisions.

Results

The case analysis revealed that big data-driven Decision Support Systems (DSS) significantly enhance operational efficiency and corporate governance in global digital enterprises. These systems facilitated better-informed decision-making by integrating real-time data and predictive analytics, which allowed executives to optimize resource allocation and streamline operations. Several organizations reported improvements in inventory management, cost reduction, and more efficient resource utilization. For instance, one case study in the manufacturing sector showed how DSS helped improve demand forecasting, which reduced stockouts and overstock situations. Additionally, in the service industry, the

real-time data processing capabilities of DSS led to better service delivery by enhancing resource allocation, ultimately contributing to improved productivity and cost savings.

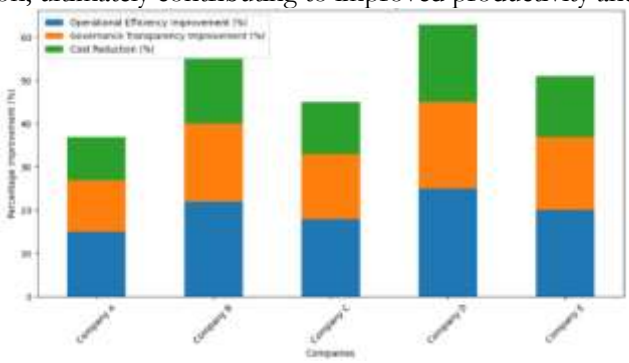

Figure 2. Impact of DSS on Operational Efficiency and Governance.

The supporting graph illustrates the impact of DSS on operational efficiency, governance transparency, and cost reduction across different companies. It shows the percentage increase in operational efficiency, which reflects how DSS implementation has helped streamline operations, optimize resource allocation, and reduce waste. Additionally, the governance transparency improvement percentage highlights how DSS has enhanced transparency and accountability in decision-making by providing accurate, real-time data. Lastly, the cost reduction percentage demonstrates how DSS has contributed to decreasing operational costs through improved decision-making and resource management. This visual comparison supports the findings from the case analysis, showing that DSS implementation significantly improves both operational efficiency and corporate governance.

Furthermore, DSS had a positive impact on corporate governance by enhancing transparency and accountability. The case studies highlighted how the integration of real-time data insights into governance processes improved financial reporting accuracy and ensured better compliance with regulations. This transparency fostered trust among stakeholders and strengthened the company's reputation. The application of predictive analytics allowed companies to anticipate risks and take proactive measures to mitigate them, improving overall governance and decision-making practices.

Discussion

The implementation of big data-driven DSS has had a transformative impact on operational efficiency. One of the key benefits observed across the case studies was the optimization of resource management. DSS allowed companies to analyze large datasets and identify patterns, which led to more effective allocation of resources. By leveraging predictive analytics, these systems enabled organizations to anticipate changes in demand and adjust their operations accordingly, leading to cost savings and improved operational performance. This capability was particularly important in industries such as manufacturing, where efficient resource management is critical to maintaining competitiveness and profitability.

However, the implementation of big data-driven DSS was not without challenges. One of the primary difficulties reported was the integration of DSS with existing systems, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. This integration required significant investment in technology and expertise, which some organizations found to be a barrier. Additionally, data management issues, such as ensuring data quality and consistency across different sources, were a common challenge. Without proper data governance, the effectiveness of DSS could be compromised, leading to inaccurate or incomplete insights that could hinder decision-making.

Despite these challenges, the benefits of big data-driven DSS in enhancing corporate governance were clear. By providing accurate and timely data, DSS improved transparency and accountability in decision-making processes. The systems also helped organizations monitor compliance with regulations and internal policies, which strengthened governance practices. The use of predictive analytics enabled companies to proactively identify risks and mitigate potential issues before they became significant problems. These improvements in governance, along with enhanced operational efficiency, contributed to better strategic decision-making and long-term success for the organizations involved.

5. Comparison

Big data-driven Decision Support Systems (DSS) offer significant advantages over traditional executive information systems (EIS) that primarily rely on reporting. Traditional EIS typically aggregate historical data and provide static reports that offer limited insights into future trends. These systems are often based on predefined metrics and fixed reporting structures, which can restrict the scope of analysis and reduce decision-making flexibility. In contrast, big data-driven DSS leverage advanced analytics, real-time data processing, and predictive models, allowing executives to make more informed, data-driven decisions. These systems are designed to analyze large volumes of structured and unstructured data from diverse sources, providing a more comprehensive view of the organization's operations. This shift from reactive reporting to proactive decision-making enhances the effectiveness and timeliness of strategic decisions.

Big data analytics offers more comprehensive, actionable strategic insights compared to traditional systems. Traditional EIS primarily provide historical performance data, which can be useful for understanding past trends but offers limited support for future decision-making. Big data-driven DSS, on the other hand, utilize real-time data, predictive analytics, and machine learning algorithms to uncover hidden patterns, trends, and correlations that traditional systems might miss. These insights not only help executives understand current operations but also allow them to anticipate future challenges and opportunities. The ability to forecast market trends, customer behavior, and resource needs equips organizations with the tools to make more strategic and forward-thinking decisions, thereby enhancing long-term competitiveness and sustainability.

Another key advantage of big data-based DSS is their scalability and flexibility. Traditional systems often struggle to handle large-scale, diverse data sources, especially as organizations grow and their data volumes increase. These systems are typically designed to work with structured data from a limited number of sources, which can constrain their ability to adapt to changing business needs. Big data-driven DSS, however, are built to manage and analyze vast amounts of data from both internal and external sources, including social media, IoT devices, and customer interactions. The scalability of big data systems allows them to accommodate growing data volumes without sacrificing performance, while their flexibility enables organizations to integrate new data sources and adjust to evolving business environments. This adaptability is particularly crucial for global enterprises that operate in dynamic markets and require real-time insights to remain competitive.

6. Conclusions

This study has demonstrated the transformative impact of big data-driven Decision Support Systems (DSS) on decision-making in global digital enterprises. The findings reveal that these systems enhance operational efficiency by enabling organizations to make more informed, real-time decisions that optimize resource allocation, improve productivity, and reduce costs. Furthermore, big data-driven DSS have significantly strengthened corporate governance by improving transparency, accountability, and compliance, thus fostering trust among stakeholders. The integration of predictive analytics and machine learning in DSS has enabled organizations to anticipate future trends, mitigate risks, and respond to changes more effectively, providing them with a competitive edge in the marketplace.

Based on the findings, it is recommended that executives prioritize the integration of big data-driven DSS to enhance both operational efficiency and governance. Executives should invest in robust system architectures that incorporate real-time data processing and predictive analytics to optimize decision-making. Additionally, it is crucial to ensure that the organization is equipped with the necessary infrastructure, skills, and training to manage and utilize these systems effectively. Emphasizing a data-driven culture and providing continuous support for DSS initiatives will enable organizations to fully leverage the benefits of big data analytics. Executives should also focus on integrating DSS with other organizational systems, such as ERP and CRM, to ensure seamless data flow and enhance decision-making across departments.

Future research should explore the integration of emerging technologies such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT) into DSS to further enhance their capabilities. Investigating the long-term effects of big data-driven DSS on corporate sustainability and environmental, social, and governance (ESG) outcomes would also provide valuable insights into the broader impacts of these systems. Moreover, future

studies could focus on the challenges of data governance, particularly in ensuring data quality and minimizing biases in decision-making. Research into the ethical implications of using AI in DSS, particularly regarding transparency and accountability, will be essential to ensure these systems are used responsibly and effectively.

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