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REVIEW

# Data-driven business decision making: leveraging predictive analytics and BI dashboards

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In today's world of Big Data, organizations are beginning to rely on data-driven decision-making (DDDM) and business intelligence (BI) to increase operational performance, improve strategic planning, and gain a competitive advantage with the help of predictive analytics and dashboards. This paper focuses on the fundamental role of DDDM in business through the use of cutting-edge analytics that make predictions about upcoming outcomes using traditional data integrated with data modelling, data mining, and machine learning. In addition, BI dashboards, such as BI tools, can be used to explore data from basic data sets to improve business decisions. This study also explores the DDDM and BI core concepts and identifies the research gaps and difficulties by applying the methodology of reviewing peer journals related to data-driven business decisions through the use of predictive analytics and BI dashboards from 2018 to 2025, where 50 journals were selected. This paper describes how predictive analytics and BI dashboards can be used for DDDM in the future. An overview article is read that explains the method and presents the results.

**Keywords:** Data-driven business decision making, Predictive analytics, Business intelligence, BI tools and dashboards, Big data, Artificial intelligence, Data visualization

## Introduction

### Background and theory

Data-driven business information, which is available everywhere today, is necessary for companies to make smart and fast decisions. The company has some challenges to overcome to continue this process without struggles (1–3). In the past, companies relied solely on simple analyses such as the balance sheet to comprehend their business, future revenue and profits, customer loyalty, and to develop new products based on market research. Today, the same process by using Information Technology has been very fast, and surprisingly that nowadays organizations and institutions can also not provide or trust a simple report having the declaration of past or present without having many factors or a detailed explanation for the reason something happened. To obtain real-time business intelligence (BI) and continuously improve, we must rely more on data. Data has become more powerful and is the foundation of new business models in recent times. Data-driven organizations are becoming essential for today's modern business needs (4).

Companies are aware of the importance of data and technology, but how can they use and incorporate data-driven decision-making (DDDM) methods that can improve their organizational performance? Now, they can measure output and not just profit. By measuring output, these tools can also help organizations increase productivity, improve customer satisfaction, and support the growth and learning process at a high level (5).

Regardless of the size of the organization, data is one of the key strengths of today's business world. The development of information and communication technology has led to an aggressive increase in data from various sources, such as social networks, business interactions, transactions, and sensors. Data plays an important role in DDDM. Compared to other companies that do not apply business analytics principles, data-driven organizations are more productive

and profitable (6). BA is the process of analyzing data from different perspectives to measure and improve business performance. Analytics is not only used for general reporting, but also to connect and support innovation with business strategy (7,8).

Dynamic insights for strategic advantage can be gained by implementing artificial intelligence (AI)-driven dashboards, which can improve market conditions, increase data volume, and reduce competitive pressure (9). These types of intelligent systems provide an ideal shift from descriptive analysis to predictive and perspective insights, which enable organizations to predict market changes, improve operations, and make informed decisions with unparalleled speed and accuracy (10).

A strategic approach to data interpretation and decision-making in organizations can be achieved by combining AI and BI systems. Traditional BI tools consistently deliver static reports that have no shortcomings when it comes to solving complex business problems. AI-driven solutions, on the other hand, provide accurate real-time insights and predictive analyses that surprisingly increase decision-making capabilities (11).

BI dashboards are also a BI tool that summaries KPIs and business metrics from various sources. In a single screen, they convert different types of data into easy-to-understand graphs, tables, and charts. They also provide an overview of business performance, assess stakeholders to identify trends, find opportunities, and successfully make data-driven strategic decisions (12).

## Objectives of the paper

The main purpose of this article is to explore how predictive analytics and BI dashboards work in DDDM in an organization. This article describes the advances in business decision-making in the light of data-driven strategies, AI and BI analyses, Big Data innovations, impact of machine learning (ML) and deep learning (DL), data-driven improvement, predictive analytics, BI tools, and dashboards.

The main objectives of the paper are:

1. Real-time insights and predictions using predictive analytics and BI dashboards, improving decision-making capabilities in organizations.
2. Identify favourable circumstances and risks, while improving their operations and strategies.
3. Reduce ambiguity by providing a solid and neutral basis for decision-making using advanced analytics techniques.

## Research problem

1. While studies on public organization, education, energy and non-research industries there's a lack of research on integrating AI powered data science into BI.
2. There is an limited research on cross-platform connectivity, and there is insufficient study of the adoption of distributed computing under various technological conditions.
3. There are no extensive studies on long-term issues like data-quality, confounding variables, survey errors, portability and real time analytics costs.
4. The absence of detailed assessments of long-term variables such as integration of statistical modeling and AI techniques, Ethical and governance inference in ML & DL.
5. Due to the absence of systematic evaluation metrics for lean trust, the importance of insuring transparency and understanding of AI decisions is often overlooked.
6. There is a lack of research on how AI-BI integration differs across cultural and regional boundaries, particularly in terms of how local regulatory environments and organizational cultures impact adoption strategies.
7. A lack of qualified data analysts and researchers can hinder the best possible execution of DDDM strategies due to skill gaps.

# Literature review

According to this literature review, the basic structure of DDDM is to combine the data to match the values of the decision maker by utilizing the integration of BI with analytics (13). Analytics such as predictive and prescriptive are shifting organizations from deliberation to planning. Traditional BI functions such as reporting, analysis, monitoring and forecasting are the silent backbone of the decision-making process (14).

Decision making along with analytics in an organization, decision making research gradually fix the dashboards or analytics as information generating system to figure out options and operations (4, 15).

## Predictive analytics in business decision making

In business, decision-making is important beyond problem-solving, as it plays a crucial role in resource allocation, strategic direction, risk management, and market positioning. In order for businesses to thrive, they must make decisions that align with corporate objectives and market trends (16–18). Data analytics has undergone a significant transformation, evolving from a descriptive to a prescriptive perspective. There are structures such as the

ability to understand, explain, and implement data-driven insights that fundamentally structure decision-making processes in organizations (19). Descriptive analytics is the initial phase, then the modification of analytics with significant advancement, which uses statistical models and ML algorithms to predict future outcomes, is predictive analytics (20, 21).

### Techniques and applications

Big data plays an important role in increasing the accuracy and accountability of predictive analytics by giving importance to volume, velocity, variety, veracity and value for a powerful model.

#### *Techniques of PA*

1. Traditional data is analyzed by key techniques like statistical modelling, machine learning, and data extraction to predict future outcomes, trends, and actions. **ML** and **DL** are two AI technologies that utilize big data to provide significant patterns and information for making decisions (22, 23). An advanced tool that uses ML, statistical modelling, and real-time data streams to anticipate future outcomes. Operational forecasting has not only been transformed by predictive analytics but also enables organizations to gain a ruthless advantage through proactive decision-making (24). The AI-powered process of data extraction, transformation, and loading improves the modification of data to prepare it for advanced analyses (25, 26).
2. Another key techniques such as **regression analysis** to estimate the correlation between dependent and independent variables in different data sets, **algorithms** to predict future outcomes, **decision trees** to capture and clarify the data based on feature values by creating a model like a tree to provide decisions and possible outcomes (27), **neural networks** to capture informal and high-dimensional data through interconnected points that process information in an ordered manner, and **ensemble methods** to integrate multiple learners to improve prediction accuracy and reduce conflicts in predictive analytics techniques (28).

***Applications of PA.*** AI and ML are changing BI in many companies. Key applications for predictive analytics include AI-enabled financial analytics and risk management to analyse market trends, fraud detection, risk assessment, cybernetic credit scoring, and real-time financial monitoring. Humanized customer know-how in marketing and sales to enable hyper-humanized marketing using ML clusters, improve customer service using chat bots and virtual assistants, suggest products and services using past, present and future analytics to increase sales (29). Operational efficiency in supply chain management to forecast the future, enable smart logistics and route optimization, automate quality control, and make suggestions for risk mitigation and incident management. And also in manufacturing, retail, e-commerce, and health-care (21, 26, 30).

### Benefits and limitations

#### *Benefits*

1. Reduced operational cost through efficient resource allotment.
2. Increasing security via fraud detection.
3. Minimized credit possibility and informed advanced strategies
4. Enhancing customer satisfaction and honesty (21, 31, 32).

***Limitations.*** Data quality, perplexing variables, ascertainment bias, Portability and Real-Time analytical costs, Ethical and Governance inference in ML&DL, and integrating statistical models and AI Techniques (33).

Data Integration, Resource Limitation, like a large level of measurable and financial value of AI integration (34, 35).

## Business intelligence and dashboards

A tool that visualizes key performance indicators and other business performance from multiple sources on a single screen by transforming complex data into easy-to-understand BI dashboards. It also features charts, graphs, and tables that make it easier to understand (36, 37).

### Role in data visualization and decision making

The consolidation of AI in data visualization has transformed corporate reports from static, descriptive results into interactive ones (38).

They help users understand the analytical findings and make sense of the reasons behind certain recommendations. Technologies and platforms are provided by historical BI and analytics providers due to data visualization (7, 39).

By implementing ML-driven segmentation, industries are implementing insights into BI dashboards and decision support tools. Transforming complicated data into an easy-to-understand visual structure, quickly highlighting trends, patterns, and outlines with accurate, faster, and data-driven decisions, is only possible through the use of data visualization (40).

### Tools and applications

Since AI has completely transformed the entire world of BI, powerful tools have emerged that can access industries to perceive the data's complete potential (41, 42).

1. Collaborative Data Visualization with the help of tools like **Tableau** and AI enhancements is possible

to visualize trends, patterns, and correlations in raw data to lead a more forward-thinking way of working with data.

2. Building Predictive Models by **Microsoft Power BI** AI insights data has combined AI into its analytics function to help its work. It also helps users to create a predictive model based on linear and non-linear regression. With the help of Automated ML characteristics, Power BI gives the ability to build future-oriented models in businesses with the help of predicting trends, reducing risk, and creating data-driven recommendations (12).
3. Processed by plentiful amounts of organized and unorganized data for industries seeking to see the best intelligence from their information for AI-powered data analytics by using Advanced **IBL Watson.** It's very famous for AI technology and BI tools. Some other tools like **Sisense**, **ALik Sense**, **SAS Viya** (43).

### Benefits and challenges

#### *Benefits*

1. The control of security and approach to handling have made it easily customisable and performable.
2. For branding, user interface, and style, it has modified the data and is perfectly white-labelled (44).
3. Improved decision quality, increased operational efficiency, and improved customer insights (45) Time savings for data providers and users and better decisions (4).

#### *Challenges*

1. Struggling with data
2. Overload One-sidedness of decision-making
3. Lack of real-time insights
4. Difficult to make decisions (46)

## Integration of predictive analytics and BI dashboards

Predictive analytics is one of the most frequently combined components of BI dashboards. It has only gone beyond descriptive insights in the industry, with BI tools offering integrated predictive capabilities for sales or revenue trends (22, 40, 47).

### Synergies and case examples

The Data visualization collaborated by the Predictive Analytics and BI dashboards to integrate the predictive models into visualization platforms. In that case, users can easily predict the traditional data along with trends.

This collaboration is surprisingly increasing the decision-making process (47).

#### *Case example*

1. A financial service industry that integrated predictive Analytics with BI Dashboards enhanced the risk management by 25% while visualizing customer credit mark, and that's connected to a constant rate (47).
2. Walmart company collects the data in real-time from its network in globally, it has accessing the quick decisions concerning stock levels, timings of shipments and ship re-establishment with uses of Predictive Analytics to get the future results to forecast the demands for products, maintain optimal measures from network of stores to utilize the BI tools for analyzing sales structures and forecasting inventory needs, decreasing stock shortage and overstock. Therefore, it has enhanced both customer satisfaction and efficiency of cost (48).
3. General Electric is also enhancing operational efficiency and forecasting maintenance through the collaboration of PA and BI dashboards (45).

### Impact on data-driven decision making

In return, the BI dashboards are fully implemented by the BI tool. In decision-making, predictive analytics and also BI dashboards play an important role in gaining futuristic insights from traditional data, accessing dynamic strategies, increasing sales, and gaining an aggressive advantage (6, 49). The integration of PA and BI dashboards has had some major impacts on DDDM,

1. It has increased revenue growth and reduced operational costs in the organization.
2. It provides an aggressive advantage in market transformation, spotting trends, and winning business over competitors in crucial situations.
3. BI dashboards give useful findings and transparency in data visualization in real-time by using Predictive Analytics.
4. It also enhanced efficiency in operation by recognizing shortages, executing processes, and rationalizing work flow by examining the data patterns in BI dashboards and PA.
5. It presents detailed strategic planning for predicting trends and customer behavior (47, 50).

## Challenges and limitations

### Data quality and integration issues

During the importance of adopting DDDM and BI is considerable, but industries often encounter some kind of challenges when implementing these kinds of strategies. The most important challenge are implementing the DDDM and

BI. At that time the presence of inaccurate data, incomplete or outmoded data produce poor decision-making (45, 51).

With the basic common issues like,

1. Conflicting data
2. Outmoded data
3. Missing data

By integrating new BI tools with previous systems and data sources they also produce the complex task, because some industries already have various legacy systems that are not easily cooperative with BI technologies and tools. The common integration issues are,

1. Difficult to generate a ideal data for analysis in a data warehouse
2. Technical conflicts like the latest BI Technologies do not support the older systems to facilitate collaboration to ensure the data flow is smooth.
3. By collaborating data from various sources can be resource-based, which will enhance Data-Integration Cost (45).

### *Ethical and privacy concerns*

Industries must spot the high priority on data security and privacy by using enhancing usage of BI tools and data analytics. Some serious consequences are displayed by the involvement of financial, operational and customer data.

For privacy concerns,

1. Industries need to implement strong security measures.
2. To protect data and make sure compliance with the official requirements.
3. Securing regular audits, access control and encryption to prevent unauthorized access (15, 31).

### *Skills and adoption barriers*

By analyzing and interpreting BI data for the decision-making process they faced a basic challenge in implementing the business-decision making in DDDM strategies. The lack of experienced professionals in DDDM processes the issues of some skill and adoption barriers like,

1. Insufficiency of data scientists.
2. Need guidance to analyse the Data analyzing, to use BI tools and also to examine statistical methods.
3. Struggle to Adoption like employees may not fully trust with BI tools, without experienced personnel and disabling the system's success (26).

## Future trends and research decisions

### *AI and machine learning (ML) in decision support*

The scenery of predictive analytics and ML continues to develop quickly and is framed by technological progress, regulatory shifts and evolving demands for clarity and ease of use (34). Some techniques are support for the decision-making process by using AI and ML are,

1. XAI - Explainable AI: It's providing transparency, trust and accountability by referring to the techniques and processes to make the decision-making process and get results of AI models. The reason is it is easily understood by humans for decision-making purposes.
2. Federated Learning: It helps to train the AI models that focus on addressing the data privacy and security concerns.
3. Quantum Computing: It has the Prospective to transform AI and BI by using quantum mechanics principles to accomplish the complex calculations at extraordinary speed.
4. Combination of AI and Edge Computing: It focuses on getting predictive analytics nearer to data sources for real-time decision-making (15, 28, 52).

### *Real-time predictive dashboards*

Developments in AI and ML, is operating the evolution of Predictive Analytics, accessing more important and actionable decision-making. While emerging some techniques are enlarging the deadline to achieve and handle the complex and unframed data.

The techniques like DL, Reinforcement Learning, Combination of AI with Predictive Analytics (21).

Predictive Analytics permits real-time decisions created by undertaking the:

1. Entering the data streams
2. Applying ML models
3. Initiating prediction without any delay.

### *Decision intelligence and self-service analytics*

Self-Service BI Tools permit business users to enter and examine data without delay on technical expertise, modifying data across the industries. This authorizes departments like Marketing, Sales or Operations Emma (45). Analytic Process like,

1. Generate custom reports for user's needs and accessing rapid decision-making.
2. Promote Data-Driven Culture by motivating non-technical users to create decisions based on data promoting a culture of data-driven alteration and decreasing the overreliantness in IT.

## Conclusion

In today's data-driven business environment, combining predictive analytics and BI modifies raw data into usable, progressive strategic insights, operating over intuition to open-solid business growth, operational efficiency, aggressive lead. According to leveraging Advanced BI Tools and Dashboards, Predictive Analytics in business decision-making, it will be enhancing value in the future. These kinds of technologies will allow businesses to create real-time, dynamic decisions, stay on top deriving trends and channelize complications with adaptability. As business organizations continue to gather and examine various amount of data, they will definitely need to convert and clarify their business strategies to handle the technological improvements and market changes. The capability to leverage Predictive Analytics and BI Dashboards the DDDM will become a key role in producing output by forecasting the future outcomes for Business endeavoring to guide in their industries.

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