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Dovetailing of Business Intelligence and Business Analytics: An Integrative Framework

Rafi Ahmad Khan[1], Tariq Ahmad Lone[2]*

[1]*Scientist B, Deptt. Of Management Studies, University of Kashmir, Srinagar, India*
[2]*Assistant Professor, Deptt. Of Management Studies, University of Kashmir, Srinagar, India*

***Corresponding author: email:** tariq380@uok.edu.in ; **Ph: +91-7006894611**

Email of coauthor: [1]mca_rafi@yahoo.com

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The business environment is constantly changing, and is increasingly becoming complex. Organizations are under pressure to adapt to these changing situations and make frequent, rapid, and complex decisions that may require a vast quantity of relevant data. Business Intelligence (BI) and Business Analytics (BA) are the techniques that help such organizations to take quick and effective decisions. BI uses descriptive analytics while BA goes further and uses predictive as well as prescriptive analytics. This paper investigates many perspectives on the concept of business BI and BA and the relationship between them. For organizations that find it difficult to choose between BI and BA, the best strategy is to begin with BI and then combine it with BA. This paper presents a BI and BA system that explains the BI process and how BA may benefit from BI. This framework may be used as a road map for practitioners who want to adopt BI and BA in their organizations progressively, starting with the BI system and then moving on to the BA system. They may be able to better determine the user's needs and lower the risk of failure by using this strategy. This may increase the chances of successful implementation. This research also identifies the key differences between these two terms.

1 Introduction:

With the continuously changing business world, company procedures are getting increasingly complicated, as a result, managers are finding it increasingly challenging to have a complete awareness of the business environment. Globalization, competition, mergers and acquisitions, deregulation, and technological innovation have forced businesses to rethink their strategies, and many large corporations have turned to Business Intelligence (BI) techniques to help them understand and control business processes in order to gain a competitive advantage. BI is generally used to increase the timeliness and quality of information, as well as to help managers better comprehend their company's competitive position. Companies now use BI tools and technology to assess shifting market share trends, changes in consumer behavior and spending patterns, customer preferences, corporate capabilities, and market circumstances. It supports analysts and managers in determining which changes are most likely to adapt to shifting patterns. It has arisen as a concept for evaluating gathered data in order to assist decision-making units in gaining a more thorough understanding of an organization's activities and, as a result, making better business decisions.

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1.1 Business Intelligence (BI)

BI is an area of the Decision Support System (DSS), which is an information system that can be used to support complex decision making, and solving complex, semi-structured, or ill-structured problems [1]; [2]; [3]. The first reference to BI was made by [4], which has replaced other terms such as Executive Information Systems and Management Information Systems [5]; [6]; [7]. BI, according to [8], is the process of turning data into information and eventually into knowledge. While Stackowiak et.al., argue that it is the process of taking large amounts of data, analyzing it, and presenting a high-level set of reports that condense the essence of that data into the foundation of business actions, allowing management to make fundamental daily business decisions [9]. Cui et.al., claim that BI is a methodology and method of increasing corporate performance by giving executive decision makers with strong support that allows them to have actionable information at their fingertips [10]. BI tools are considered to be technology that improves the effectiveness of company operations by increasing the value of corporate data and, as a result, the way that data is used [11]. According to [12], BI is the process of gathering, processing, and disseminating information with the goal of reducing uncertainty in the making of all strategic choices [13]. Wu et al., contend that BI, is a business management term used to describe applications and technology that are used to acquire, offer access to analyzed data and information about a company in order to enable them make to more informed business choices [14].

BI varies from its predecessor, "decision support," in that it is a strategic tool meant to help in planning and performance monitoring rather than purdy operational choices, according to Van [15]. Business intelligence is the act of acquiring high-quality and useful information about the subject matter being investigated in order to assist individuals in interpreting the data, drawing conclusions, or making assumptions [16].

According to the reference Ranjan, BI is the purposeful, methodical translation of data from any and all data sources into new forms in order to give business-driven and results-oriented information [17].

The BI process idea is defined as a continuous and systematic way of action through which a company receives, analyses, and disseminates important business information to business operations [18]. A business intelligence system is clearly important as a conduit for communication and information dissemination, especially one that is open, trustworthy, transparent, and permanent by supporting the monitoring and assessment of business outcomes while preserving data integrity [19].

According to [20], in order to ensure data consistency across multiple applications in a complex organization, three fundamental criteria must be met:

Timeliness: Data in the system should be in sync with all other apps;

Accuracy: The data should include information from all other applications.

Acceptance: Users who are confident in the timeliness and accuracy of data should be able to utilize the system as a decision-making tool.

BI technology is always evolving and improving in order to address increasingly complicated business problems. Data warehousing (DW), on-line analytical processing (OLAP), and data mining are the most extensively used BI enabling technologies that have evolved over a period of time. These technologies attempt to assist individuals in making "better" business choices by providing them with accurate, current, and relevant data when they need it.

In the present-day competitive environment, BI plays a critical role in assisting decision-making and enhancing competitiveness by establishing a strong relationship between company strategy and IT. Competitive firms gather BI to analyze the environment in order to achieve a lasting competitive edge, and in some cases, such intelligence may be regarded as a valued core capability. BA goes further by using

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firm's data to predict trends and results by using the data mining, statistical analysis, and predictive modelling that aid in making better informed decisions.

1.2 Analytics

Analytics is the process of detecting, assessing, and conveying important patterns in data. [21]. Simply put, analytics allows us to see important data and insights that we might not have seen otherwise [22]. Business analytics focuses on analyzing data to make better decisions that will help businesses increase sales, reduce costs, and improve other parts of their operations. Analytics is a branch of computer science that seeks out meaningful patterns in data using math, statistics, and machine learning [23].

1.3 Business Analytics

Analytics applied to company data is known as Business Analytics (BA). It focuses on the business implications of data, as well as the decisions and activities that should be performed as a result of those implications [23]. It focuses on the business consequences of data, as well as the decisions and actions that should be taken as a result of those consequences.

BA refers to applications and methodologies for acquiring, storing, analyzing, and giving access to data to assist users make better and strategic decisions [24][25]. BA contains querying, OLAP, reporting, and alert capabilities that can answer questions like why this is occurring, what will happen next if these trends continue, what is the best that can happen if these trends continue [26]. It largely depends on data, statistical and quantitative analysis, explanatory and predictive modelling to drive decision-making [27].

Business analytics is the process of extracting meaningful information from business data in order to improve an organization's efficiency and create more revenue [28].

It is a broad umbrella term that encompasses many problems and solutions, such as demand forecasting and conditioning, resource capacity planning, workforce planning, salesforce modelling and optimization, revenue forecasting, customer/product analytics, and enterprise recommender systems [29]. It is an area of management science that may be thought of as an application of operation research, as well as a mix of signal processing, computer science, and statistical understanding [30].

Some researchers [31]have classified BA into three categories: descriptive, predictive, and prescriptive. Descriptive analytics tries to comprehend what has occurred in the past and what is occurring now. Predictive analytics is concerned with predicting future events based on current data. Prescriptive analytics goes beyond the previous two types of analytics and aims to help people make better decisions by generating helpful and practical advice for business challenges. The use of descriptive, predictive, and prescriptive analytics assists businesses in making better decisions and generating more revenue [32]. There is also diagnostic analytics which uses historical data to come at a conclusion about "what went wrong and why it went wrong." The data gathered assists decision-makers in determining how to correct errors after they occur [33].

Predictive analytics, business intelligence, human performance management, data visualization, and a variety of other topics are all included under the term BA [34]. Data mining, data warehousing, statistical modelling, quantitative analysis, visualization, and other information technologies are also used to support business analytics [26][28].

Types of Analytics: Three types of analytics are discussed below:

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1.3.1 Descriptive/Reporting Analytics: What is happening?

Descriptive analytics gives information about the past performance or state of a business and its environment by analyzing data that is stored in databases/data warehouses. With reporting, scorecards, and clustering, it assists businesses in gaining insight from past [35]. Descriptive analytics provides routine, regular and Ad hoc reports that help companies to look at the facts like, what has happened, what is happening, where, and how often. It can execute specific queries so managers can examine the exact problem. Visualization has become an important component of descriptive analysis, as it can develop powerful insights into the actions and operations of a company. Business reporting, dashboards, scorecards, and data warehousing are the main enablers while well-defined business problems and opportunities are the main outcomes of descriptive analytics [36].

1.3.2 Predictive Analytics: What is likely to happen?

Predictive Analytic tools determine the probable future outcome of an event, or the likelihood of the situation that is occurring and identify relationships and patterns [24]. According to Raden [37], the objective of predictive models is to understand the causes and relationships in the data to make accurate predictions. It is an application of statistical techniques as well as other more recently developed techniques of machine learning, and sometimes visualization, to detect patterns and anomalies in detailed transactions. Analysts use patterns into models that can be applied to new transactions to predict behaviors or outcomes [38]. It can answer questions like what will happen, why it will happen. It may, for example, undertake churn analysis to discover which customers are most likely to transfer to a competitor, identify credit risk clients, assess what a buyer is likely to buy and in what quantity, and predict how consumers will respond to a promotional campaign, among other things. Data mining, text mining, web mining, and forecasting are the main enablers while accurate projections of future events and outcomes are the main results of predictive analytics [36].

Various techniques of predictive analytics include:

Classification: classification techniques such as Logistic Regression (LOG), K-Nearest Neighbors, Artificial Neural Networks (ANN), Decision Trees, Support Vector Machines, Fuzzy Sets, Genetic Algorithms (GAs) and Rough Set are used for customer identification, including target customer analysis and subsequently classifying the segments of potential customers so that organizations can direct their resources and efforts into attracting the target customer segments [39].

Clustering: Clustering techniques can be used to divide customers into different groups in order to target specific promotional campaigns to them.

Association: It can identify the relationships between different purchasing behaviors, i.e., if a buyer buys one product, it can predict the other items that he/she is likely to purchase, thus helping in the promotion of related products.

1.3.3 Prescriptive: What do I need to do?

Prescriptive analytics uses comparable modelling frameworks to forecast outcomes, then simulates alternative methods to achieve various outcomes using a combination of machine learning, business rules, artificial intelligence, and algorithms. It then recommends the best course of action for improving organizational practices, thereby, answering what I should do and why I should do it. It relies on previous performance to find answers to queries such as why something is happening or why something happened. It provides firms with a comprehensive understanding of an issue by using techniques such as drill-down, data discovery, and data mining to uncover connections and patterns in historical data [40]. The outcome of this analysis is mostly an analytic dashboard.

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For example, in sales it may indicate a member of the sales team where each of their clients is in the buying process. It can then assist them in ranking their leads by assessing a variety of criteria.

Another example is an academic councilor trying to discover that most learners who lack a specific talent will not complete the newly announced course. What options do we have? Prescriptive analytics can aid with the situation and help select action alternatives. Perhaps an algorithm can identify learners who need that new course but lack that specific expertise, and then offer them an automatic referral to do further training to obtain the missing skill [41]. Optimization, simulation, decision modelling, expert systems are the main enablers while the best possible business decisions and actions are the outcomes of prescriptive [36].

2 Framework of Business Intelligence and Marketing Analytics:

Organizations tailor BI and Marketing Analytics to their needs, history, and environment in order to make educated, useful customer-oriented decisions. The general framework of BA and Marketing Analytics consists of three layers viz., Data layer, BI

Layer and Analytics layer as presented in fig1. These layers are discussed below:

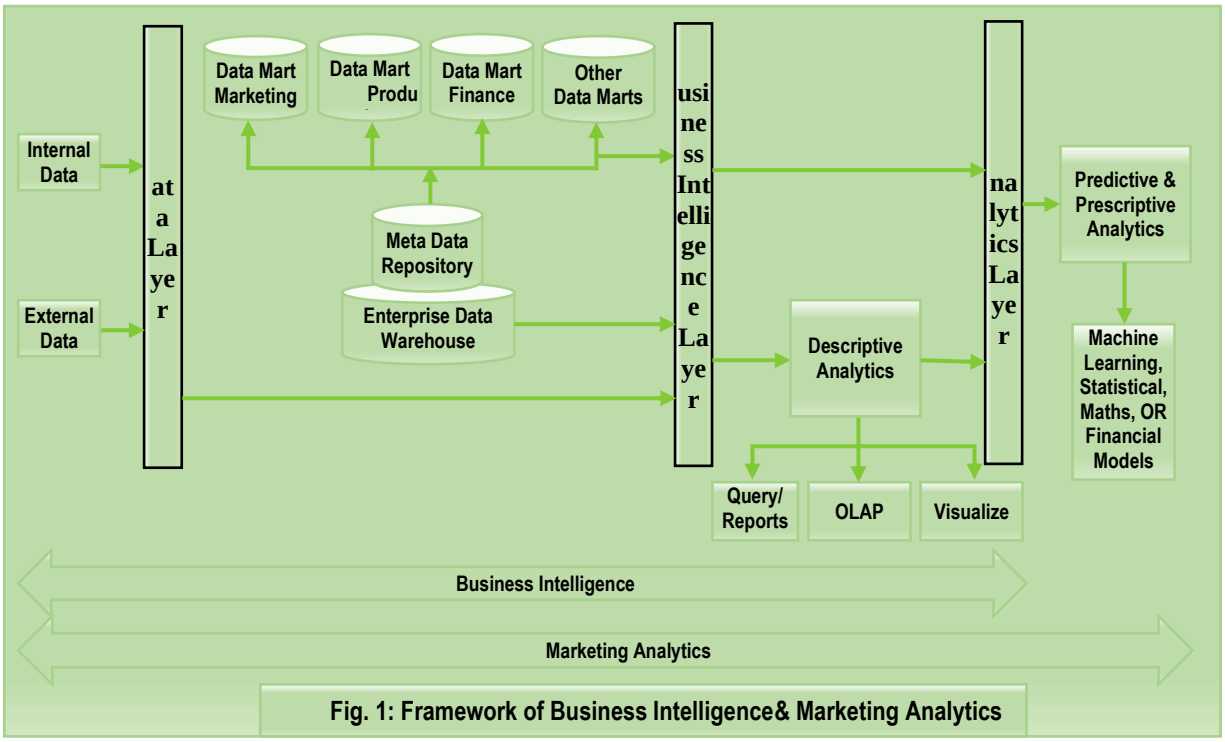

Fig. 1: Framework of Business Intelligence& Marketing Analytics

2.1 Data layer

Data can be found in numerous sources and in heterogeneous forms, therefore, it must be gathered in one location. Organizations gather data from both internal and external sources. Internal sources include an organization's operational database, legacy file systems, SCM, CRM, ERP data, while external sources of data include suppliers, consumers, competitors, government agencies, the internet and social media, among others [17].

The data from these internal and external sources is collected and stored in a data warehouse or data marts, after the ETL (Extract, Transform and load) process. Various tools used in the data layer include:

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(a) Data Warehouse: According to Oracle Corporation, a data warehouse is a collection of company data obtained directly from an operating database (internal sources) as well as certain external data sources [42]. A data warehouse is an organized duplicate of transaction data that can be queried and analyzed. It is more concerned with data, analysis, and decision support than with operational or transaction processing[43]. A data warehouse stores data that is integrated, subject-oriented, non-volatile, and time-variant.

(b) Data Mart: Small data warehouses, also known as localized data warehouses, are often established by individual divisions or departments to assist their own decision-making processes [39]. To avoid significant investment and the risk of failure, some organizations invest in data marts for a few functional areas such as finance or marketing instead of a whole data warehouse. On the other hand, some organizations use both a data warehouse and a dedicated data mart, so that queries are directed to the related data marts, which minimizes query complexity and hence boosts query response time.

(c) ETL: Before a data warehouse or a data mart or both are populated with data from internal sources as well as external sources, data needs to be transformed as it is heterogeneous in nature. Data is extracted from a variety of sources that can be structured (OLTP, CRM, ERP, SCM, flat files) or unstructured (email, web pages, social media). This transformation process is known as Extract, Transform and Load (ETL). The functions performed by ETL are:

•*Extract:* Data is extracted from internal as well as external target sources that are usually heterogeneous. It is then consolidated, and non-relevant data is filtered out.

•*Transform:* Extracted data is filtered, cleansed (cleaned up to correct missing, inconsistent, or invalid values), de-duplicated, validated, and authenticated. Data is integrated into a single standard format, and business rules are applied that map data to the warehouse schema.

•*Load:* The converted data is moved from the staging area to the target data warehouse/data mart in this final stage. This usually entails a full load of all data, followed by periodic loading of incremental data updates and, less frequently, full refreshes to wipe and replace data in the warehouse [44].

The ETL process is automated, well-defined, continuous, and batch-driven in most enterprises that use it. ETL is typically performed during off-peak hours, when traffic on the source systems and the data warehouse is at a minimum.

(d) Metadata: Metadata is data about data. It explains where data is utilized and stored, as well as the source of data, modifications made to the data, and how one piece of data links to other data [45]. Technical and business information about data, as well as business rules and data definitions, is stored in a metadata repository [46]. Business users need a metadata repository to store and standardizes metadata across several platforms. Organizations with well-structured metadata will be able to trace and monitor data flows inside their BI system [45].

2.2 Business Intelligence Layer

On a larger scale, BI is primarily concerned with generating business insights, whether operational or strategic, such as product positioning and pricing in relation to goals, profitability, sales performance, forecasts, strategic directions, and priorities. The purpose is to acquire access to quantifiable features of a firm, research them, and analyze them. Data visualization, scorecards, dashboards, and reporting are all examples of how BI produces information. Various tools used in this layer are:

(a) Multidimensional Data Analysis: Online Analytical Processing (OLAP) is a type of business intelligence software that allows managers, executives, and analysts to acquire insight into data through quick, dependable, and collaborative access to a

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number of multidimensional perspectives of data. It also enables business analysts to rotate that data, modifying the linkages in order to gain a more complete understanding of corporate data [47]. Multidimensional analysis allows users to see the same data in a variety of ways by combining different dimensions. Each dimension is represented by a separate piece of data, such as geography, product, cost, price, or time period.

(b) Dashboards: These are tools for visualizing critical business data presented in the form of graphic indicators, charts, and tables [48][49]. A digital dashboard shows a graphical high-level view of business operations that may be delved down into for more information about a specific process. This degree of detail is frequently hidden deep within an organization's data, making it unavailable to a business manager [50]. It enables users to respond quickly to information presented to them, as well as drill down into root cause analysis of the circumstances at hand [51]. It organizes and reflects information in a simple, engaging, and intuitive manner into the user interface. It also allows users to create customized dashboards with features such as tables, reports, pivot tables, graphs, and prompts.

(c) Balanced Scorecards: Kaplan introduced the Balanced Scorecards (BSC) concept in 1996 [52]. They are semi-standard structured reports that may be used by managers to follow the execution of activities by personnel under their control and to monitor the repercussions of these actions. They are supported by design tools and methodologies [53]. They are a type of performance statistic used to detect and improve various internal activities and the external consequences that flow from them. By assessing and providing feedback to enterprises, BSC enables them to put their strategy into action

(d) Query and Reports: Every organization relies on BI reporting, which involves preparing, analyzing, and visualizing business metrics. Query and reporting tools are extremely helpful tools that allow end users to swiftly access and query data, as well as generate reports for decision-making and management. Standard reports, ad-hoc reports (generated when the need arises), budgeting and planning reports, and metadata reports are among the various sorts of reports available. These are written documents relevant to the situation that end users can produce by providing parameter data. To allow interactive and high-performance viewing of these reports, the pre-executed report findings are cached.

(e) Alerts: These are reports that are automatically triggered when an event occurs, such as sending an e-mail or SMS message to a consumer when a product that he had previously tried to purchase becomes available, or sending an alert to the manager when sales statistics fall below an acceptable level.

2.3 Analytics Layer

Analytics offer various functionalities, like as modelling, forecasting, sales analysis, and what-if scenarios [54]. These apps can be used to assist both internal and external business activities. Users can acquire insights into enhancing the performance of corporate processes by using applications with analytical capabilities [45]. Decision makers may also uncover and comprehend what aspects drive their company's value by using analytical apps, allowing them to capitalize on possibilities sooner than their rivals, thus providing them with a competitive advantage.

In the analytics layer, data from Data Warehouse /DataMart's is analyzed using Predictive/Prescriptive analytics in addition to BI tools. Various tools and techniques used in this layer are:

(a) Data Mining: Data mining is the practice of exploring and analyzing large amounts of data using semi-automated or autonomous methods to find relevant patterns and rules [55][56]. Berzal, et al. defined data mining as the non-trivial process

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of identifying valid, novel, potentially useful and ultimately understandable patterns in data [57]. Data mining is a technique that includes management science, statistical, mathematical and financial models and methods, used to find the vital relationships between variables in historical data, perform analysis on the data or forecast [58]. It's an exploratory data analysis strategy for finding relevant patterns in data that aren't immediately apparent to the data consumer [59][60].

Data mining looks for links and global patterns in enormous datasets that are buried within the massive amounts of data, such as a link between patient data and their medical diagnosis or a link between driver's age and accidental insurance claims [61]. Such a connection conveys useful information about the data base and its objects [62][63]. It's critical to pick the right data mining model/algorithm, which could include linear regression, classification, cluster analysis, rule formation, association finding, data summarization, learning classification rules, finding dependency networks, analyzing changes, and detecting anomalies [64][65].

(b) Machine Learning (ML): Machine Learning (ML) is a type of artificial intelligence (AI) that has been used by a growing variety of disciplines to automate difficult decision-making and problem-solving processes in recent years. It is a set of techniques that aims to train machines on how to solve problems by showing them examples from the past. The Artificial Neural Network (ANN) is the most widely used approach, which was inspired by biological neural networks in the human brain and began as an attempt to simulate human learning skills. Inductive learning, case-based reasoning, genetic algorithms, natural language processing, and so on are some of the other approaches available.

All the layers outlined above must be brought together in a methodical manner for a BI and BA system to function properly. Data must be retrieved, converted, and put into the data warehouse layer from both internal and external sources. When data undergoes the ETL process, it flows from internal and external sources to data warehouse/data marts. As the data warehouse is built for the entire organizational use, data from the warehouse is transferred to data marts for specific functional areas like marketing, finance, production, HR. BI uses data in the data warehouse, and data marts using a range of tools, including dashboards, scorecards, visualization, query and reporting tools to find out what is happening and what has happened in the business, while analytics goes further and answers questions like what will happen and what is the best course of action.

The three levels of BA, i.e., descriptive, predictive, and prescriptive, reflect many areas and applications of business analytics. These four levels help to distinguish between business analytics and business intelligence. According to [31], business intelligence mainly relies on descriptive analytics, while, data visualization is the representative technology of BI. [29] argue that a major limitation of BI is the lack of predictive modelling and algorithm-generated suggestions for decision-making.

The major role of business intelligence is to report historical data and the main focus is descriptive analytics, while focus of business analytics is predictive/ prescriptive analytics [29].

Companies may use both BI and BA to examine data and make better informed decisions. The selection between the two is based on whether the decision influences current or future operations. Even if BI technologies are becoming more sophisticated and capable, there is always a need for predictive business analytics.

The best strategy for business organizations is to start with a business intelligence and then combine business analytics to anticipate trends and outcomes to make more informed decisions.

The key difference between BI and BA business analytics is when events occur. The focus of BI is on current and historical events captured in data and the focus of

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business analytics is on what is most likely to occur in the future. Although both techniques employ the same data, but the timelines for implementing the outcomes differ. BA gathers and analyses data, employs predictive and prescriptive modelling, and provides highly visible results on customizable dashboards.

3 Key Differences between BI and BA

The following are the various differences between business intelligence and business analytics:

•Business Intelligence analyzes both historical and current data, whereas Business Analytics employs only historical data to derive insights and implement business practices that drive customer demands and increase productivity.

•Business Intelligence is a subset of Business Analytics, as Business Analytics encompasses Business intelligence, data gathering, information processing, and risk and security compliance.

•Business intelligence analyzes current data, while Business Analytics uses reports generated by Business Intelligence as inputs for further analytic purposes.

•Business Intelligence employs mathematical, quantitative, and descriptive analyses to uncover trends and explain current performance and occurrences, while Business Analytics uses predictive and machine learning models to predict the future health of the business.

•Business Intelligence provides insights into the current state of business without requiring additional transformations or conversions, whereas Business Analytics refers to how to solve problems using technology and convertraw data types into a usable format for delivering the solution.

•Business Intelligence may be more appropriate for structured data from business applications such as financial transactions, SCM or ERP to obtain knowledge about past business actions, while on the other hand, Business Analytics turns non-structured and semi-structured data into useful information/knowledge to provide more insights into business actions.

•Dashboards, reports, and pivot tables may be built for various users, such as executives, managers, and research organizations, for Business Intelligence, whereas Business Analytics leverages historical data and business intelligence technologies to assist customers get their job done more efficiently and effectively.

•Business intelligence is a tool for efficient business management, whereas Business Analytics is a tool for effective business transformation.

• Business intelligence techniques include common tools, different types of reporting, real-time analysis, scorecards, dashboards, and so on, whereas Business Analytics includes SWOT analysis, simulation, machine learning and statistical modelling, and analysis.

4 Conclusion

Business analysis is essential for a firm to understand where they are in terms of trends and marketing strategies; it allows them to expand and generate more revenue. This is the primary cause for the exponential growth of BA and BI research. BA is a broad term that encompasses three forms of analytics depending on functionality: descriptive analytics, predictive analytics, and prescriptive analytics. BI which is a subset of BA, uses descriptive analytics while as BA uses descriptive analytics and predictive analytics to forecast the future as well as prescriptive analytics which recommends the best course of action for improving organizational practices.

Business intelligence and analytics are increasingly being used to manage organizational performance. Many firms, however, are still having trouble deciding between BI and BA.The best plan for businesses is to start with business intelligence

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and then combine it with business analytics to predict trends and outcomes so that they can make better decisions.

This study has presented a framework of the BI and BA system which describes the BI process and how BA might leverage BI. This framework may be used as a guide for practitioners who want to deploy BI and BA in their organizations in a progressive way, starting with the BI system and then moving on to the BA system. They can determine the user requirements in a better way and avoid the risk of failure that may increase the chances of successful implementation by taking this approach.

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