
Business Analytics and Business Intelligence

HIGHLIGHTS

Business Analytics (BA) and Business Intelligence (BI)

Types of Business Analytics and Their Objectives

Input to Business Analytics, Types of Business Analytics and Their Purpose

Business Intelligence (BI) and Business Analytics (BA): Differences

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Summary

Business Analytics (BA) and Business Intelligence (BI) _Overview:

The terms analytics, business analytics, and business intelligence are used interchangeably in the literature and are related to each other. *Analytics* is a more general term and is about analyzing data using data visualization and statistical modeling to help companies make effective business decisions. The tools used in analytics, business analytics, and business intelligence often overlap. The overall analytics process involves descriptive analytics involving processing and analyzing big data, applying statistical techniques (numerical methods of describing data, such as measures of central tendency, measures of variation, etc.), and statistical modeling to describe the data. Analytics also uses predictive analytics methods, such as regression, forecasting, data mining, and prescriptive analytics tools of management science and operations research. All these tools help businesses in making informed business decisions. The analytics tools are also critical in automating and optimizing business processes.

The types of analytics are divided into different categories. According to the Institute of Operations Research and Management Science (INFORMS) –[www.informs.org] the field of analytics is divided into three broad categories – descriptive, predictive, and prescriptive. We discussed each of the three categories along with the tools used in each one. The tools used in analytics may overlap, and the use of one or the other type of analytics depends on the applications. A firm may use only the descriptive analytics tools or a combination of descriptive and predictive analytics depending upon the types of applications, analyses and decisions they encounter.

Types of Business Analytics and Their Objectives

The term *Business Analytics* involves modeling and analysis of business data. Business analytics is a powerful and complex field that incorporates wide application areas, including descriptive analytics, including data visualization, statistical analysis, and modeling; predictive analytics, text

and speech analytics, web analytics, decision processes, prescriptive analytics including optimization models, simulation, and much more. Table 2.1 briefly describes the objectives of each of the analytics.

Table 2.1: Objective of each of the analytics

<i>Type of Analytics</i>	<i>Objectives</i>
<i>Descriptive</i>	Use graphical and numerical methods to describe the data. The tools of descriptive analytics help understand the data, identify trends or patterns in the data, and make sense of the data contained in the databases of companies
<i>Predictive</i>	Predictive analytics is the application of predictive models that are used to predict future trends.
<i>Prescriptive</i>	Prescriptive analytics is concerned with optimal allocation of resources in an organization using a number of operations research, management science, and simulation tools.

Input to Business Analytics, Types of Business Analytics and Their Purpose

The flow chart in Figure 2.1 shows the overall Business Analytics process. It shows the inputs to the process that mainly consist of Business Intelligence (BI) reports, Business Database, and Cloud Data repository.

Figure 2.1 lists the purpose of each of the analytics – descriptive, predictive, and prescriptive and the problems they attempt to address are outlined below the top input row. For each type of Business Analytics, the analyses performed and a brief description of the tools are also presented.

Business Analytics: Process, Purpose and Tools

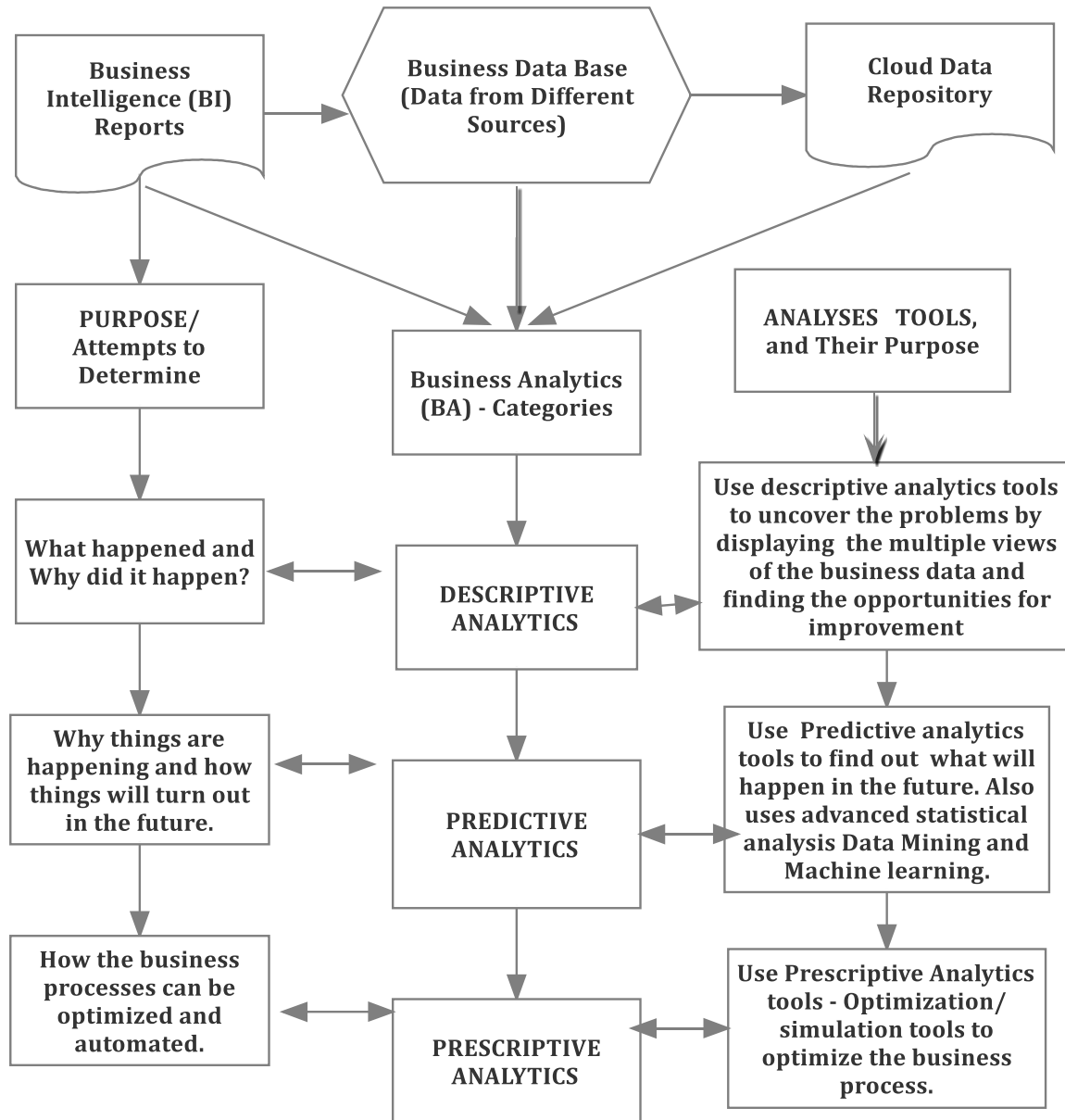


Figure 2.1: Input to the Business Analytics process, types of analytics, and description of tools in each type of analytics

Tools of Each type of Analytics and their Objectives

A summary of the tools used in each type of analytics and their objectives is listed in Tables 2.2, 2.3, and 2.4. The tables also outline the questions each of the analytics tries to answer.

Table 2.2: Descriptive Analytics, questions they attempt to answer, and their tools

ANALYTICS	ATTEMPTS TO ANSWER:	TOOLS
Descriptive	How can we understand the occurrence of certain business phenomenon or outcomes and explain: ○ Why did something happen? ○ Will it happen again? ○ What will happen if we make changes to some of the inputs? ○ What the data is telling us that we were not able to see before? ○ Using data, how can we visualize and explore what has been happening and the possible reasons for the occurrence of certain phenomenon.	○ Concepts of data, types of data, data quality, measurement scales for data. ○ Data Visualization tools - graphs and charts along with some newly developed graphical tools such as, bullet graphs, tree maps, and data dashboards. Dashboards are used to display the multiple views of the business data graphically. Big data visualization and analysis. ○ Descriptive statistics including the measures of central tendency, measures of position, measures of variation, and measures of shape. ○ Relationship between two variables – the covariance, and correlation coefficient. ○ Other tools of descriptive analytics are helpful in understanding the data, identifying the trend or patterns in the data, and making sense from the data contained in the databases of companies. The understanding of databases, data warehouse, web search and query, and Big Data applications.

Table 2.3: Predictive Analytics, questions they attempt to answer, and their tools

ANALYTICS	ATTEMPTS TO ANSWER:	TOOLS
Predictive Analytics	○ How the trends and patterns identified in the data can be used to predict the future business outcome (s)? ○ How can we identify appropriate prediction models? ○ How the models can be used in making prediction about how things will turn out in the future - what will happen in the future? ○ How can we predict the future trends of the key performance indicators using the past data and models and make predictions?	○ Regression Models including: (a) Simple regression models, (b) Multiple regression models, (c) Non-linear regression models including the quadratic or second-order models, and polynomial regression models (d) Regression models with indicator or qualitative independent variables, and (e) Regression models with interaction terms or interaction models. ○ Forecasting Techniques. Widely used predictive models involve a class of Time Series Analysis and Forecasting models. The commonly used forecasting models are regression based

Predictive Analytics...cont.		models that uses regression analysis to forecast future trend. Other time series forecasting models are simple moving average, moving average with trend, exponential smoothing, exponential smoothing with trend, and forecasting seasonal data. ○ Analysis of Variance (ANOVA) and design of Experiments Techniques. ○ Data mining techniques - used to extract useful information from huge amounts of data known as knowledge discovery from data base (KDD) using predictive data mining algorithms, software, and mathematical and statistical tools. ○ Prerequisite for Predictive Modeling: (a) Probability and probability distributions and their role in decision making, (b) Sampling and inference Procedures, (c) Estimation and confidence Intervals, (d) Hypothesis testing/Inference procedures for one and two population parameters, and (e) Chi-Square and Nonparametric Tests. ○ Other tools of predictive analytics: ○ Machine Learning, Artificial Intelligence, Neural Networks, Deep Learning (discussed later)
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Table 2.4: Prescriptive Analytics, questions they attempt to answer, and their tool

ANALYTICS	ATTEMPTS TO ANSWER:	TOOLS
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Prescriptive Analytics	○ How can we optimally allocate resources in an organization? ○ How can linear, non-linear optimization, and simulation tools be used for optimizing business processes and optimal allocation of resources?	Several operations research and management science tools ○ Operations management tools derived from Management Science and Industrial Engineering, including simulation tools. ○ Linear and Non-linear Optimization Models ○ Linear programming, Integer Linear Programming, Simulation Models, Decision Analysis Models, Spreadsheet Models.
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The three types of analytics are dependent and overlap in applications. The tools of analytics sometimes are used in combination. Figure 2.2 shows the interdependence of the tools used in analytics.

Business Intelligence (BI) and Business Analytics (BA): Differences

Business intelligence and business analytics are sometimes used interchangeably, but there are alternative definitions.^[10] One definition contrasts the two, stating that the term business intelligence refers to collecting business data to find information primarily through asking questions, reporting, and online analytical processes (OLAP). Business analytics, on the other hand, uses statistical and quantitative tools and models for explanatory, predictive, and prescriptive modelling.^[15]

BI programs can also incorporate forms of analytics, such as data mining, advanced predictive analytics, text mining, statistical analysis, and big data analytics. In many cases, advanced analytics projects are conducted and managed by separate teams of data scientists, statisticians, predictive modelers, and other skilled analytics professionals, while BI teams oversee more straightforward querying and analysis of business data.

Thus, it can be argued that Business Intelligence (BI) is the “descriptive” part of data analysis; whereas Business Analytics (BA) means BI plus the predictive and prescriptive elements, and all the visualization tools and extra bits and pieces that make up the way we handle, interpret, visualize, and analyze data. Figure 2.3 shows the broad area of Business Intelligence (BI) that comprises of business analytics, advanced analytics, and data analytics.

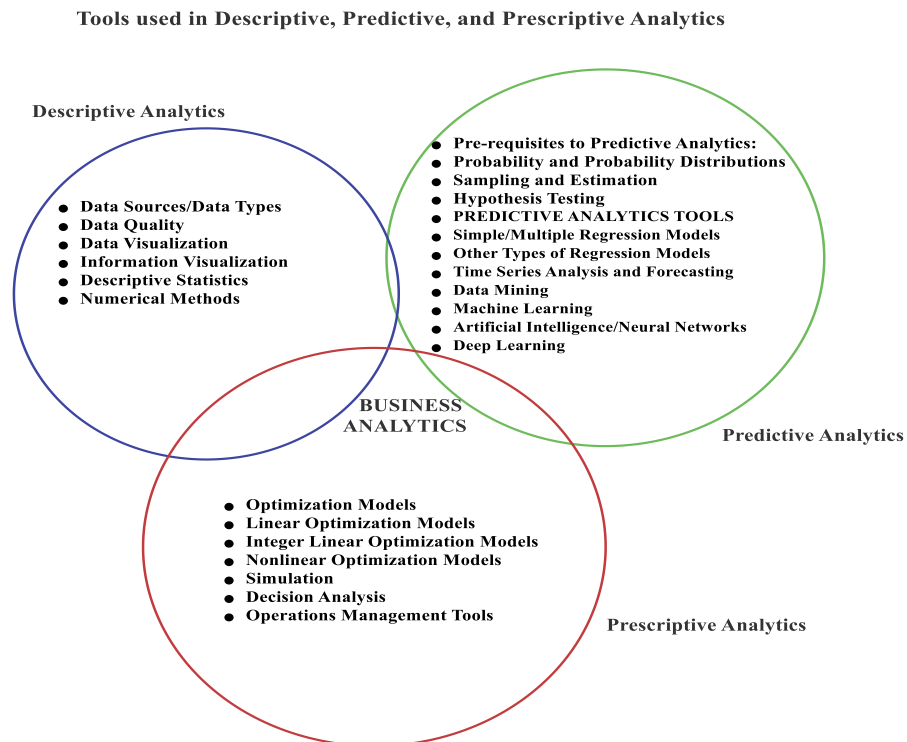


Figure 2.2: Interconnection between the tools of different types of analytics

The Broad Area of Business Intelligence (BI)

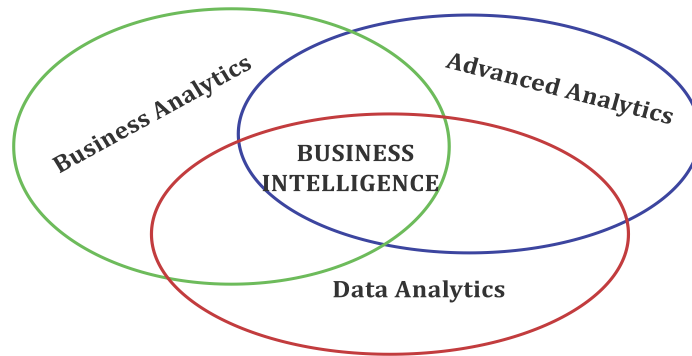


Figure 2.3: The Broad Area of Business Intelligence (BI)

Business Intelligence and Business Analytics: A comparison

The flow chart in Figure 2.4 compares Business Intelligence (BI) to Business Analytics (BA). The overall objectives and functions of a BI program are outlined. Business Intelligence originated from reporting but later emerged as an overall business improvement process that provides the current state of the business. The information about what went wrong or what is happening in the business provides opportunities for improvement.

BI may be seen as the descriptive part of data analysis, but when combined with other areas of analytics - predictive and advanced analytics- it provides a powerful combination of tools. These tools enable the analyst and data scientists to look into the business data, the current state of the business, and make use of predictive, prescriptive, data analytics tools as well as the powerful tools of data mining to guide an organization in business planning, predicting future outcomes, and make effective data-driven decisions.

The flow chart in Figure 2.4 also outlines the purpose of the Business Analytics (BA) program and briefly mentions the tools and the objectives of BA. Different types of analytics and their tools were discussed earlier and are shown in Table 2.2.

Business Intelligence (BI) and Business Analytics: Comparison

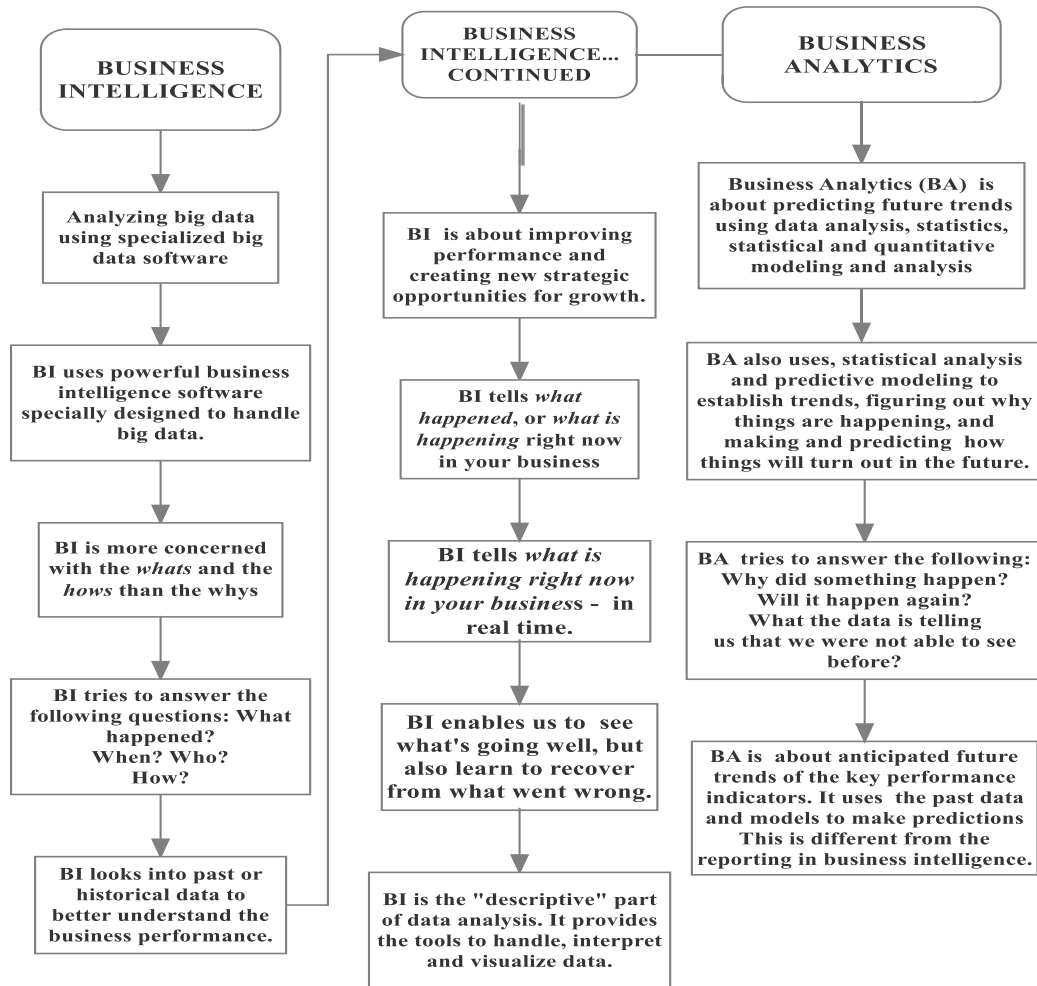


Figure 2.4: Comparing Business Intelligence (BI) and Business Analytics

The terms Business Analytics (BA) and Business Intelligence are used interchangeably and often the tools are combined and referred to as a Business Analytics or Business Intelligence program. Figure 2.5 shows the tools of business intelligence and business analytics. Note that the tools overlap in the two areas. Some of these tools are common to both.

Business Intelligence (BI) and Business Analytics: Tools

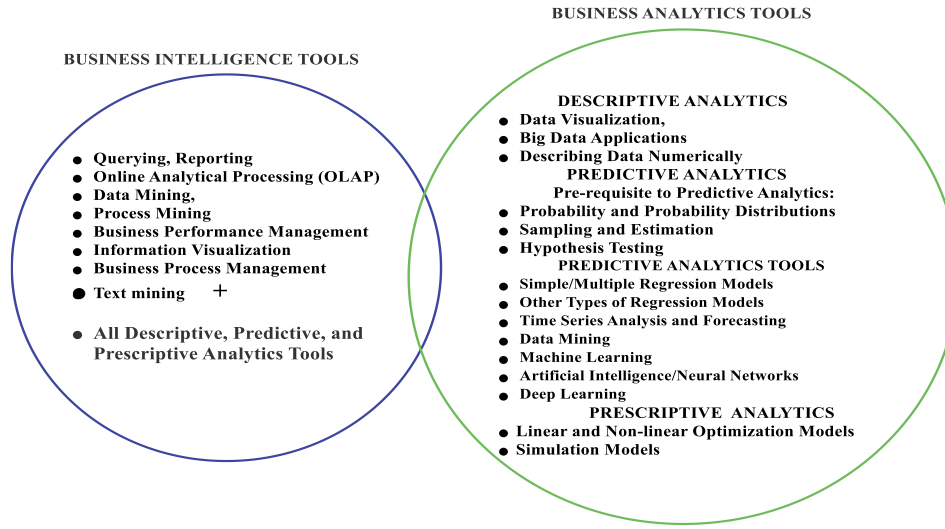


Figure 2.5: Business Intelligence (BI) and Business Analytics (BA) Tools

Summary

This chapter provided an overview of business analytics and business intelligence and outlined the similarities and differences between them. Business analytics, different types of analytics – descriptive, predictive, and prescriptive and the overall analytics process were explained using a flow diagram. The input to the analytics process and the types of questions each analytics attempts to answer, along with their tools, were discussed in detail. The chapter also discussed business intelligence (BI) and a comparison between business analytics and business intelligence. Different tools used in each type of analytics – descriptive, predictive, and prescriptive and their relationship were described. The tools of analytics overlap in applications, and in many cases a combination of these tools is used. The interconnection between different types of analytics tools were explained. Finally, a comparison between Business Intelligence (BI) and Business Analytics was presented. Business Analytics, Data Analytics, and Advanced Analytics fall under the broad area of Business Intelligence (BI). The broad scope of BI and the distinction between BI and Business Analytics (BA) tools were outlined.