Chapter 1
Analytics Techniques: Descriptive Analytics, Predictive Analytics, and Prescriptive Analytics

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1.1 Introduction

A business is an enterprise-oriented entity where services and products deliver to its customers, and customers are either paid in the form of money or exchanged with other services and products. The main principle of business is to cover all stakeholders like customers, its employees, of course owners, and even directly and indirectly must cover society as a whole too. Ultimately, the main goal of any business is to get maximum benefits, fulfill stakeholders' needs with less input, and gain competitive advantage over others. This calls for strategic business management. A business with short-term objectives and goals will fight to set corporation direction, focus efforts, and acquire competitive benefit. Yet by applying strategic management, organizations can not only live, but flourish. Here is why strategic management can improve performance. Strategic management is the management of a business's resources to effectively accomplish its objectives and targets. It is a proposal to act to ensure performance goals are achieved, and the business remains

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1

to grow. Strategic management suggests complete path by developing strategies and rules designed to attain targets and then assigning means to implement the tactics. Ultimately, strategic management is for organizations to increase a competitive edge over their rivals [1]. Strategic business management focuses on setting goals, surveying the competitive surroundings, organization internal operation, assessing strategic planning, and making sure that management spreads out the strategic planning across the organization through wise decision-making processes [2].

Decision-making drives the businesses and ensures better performance. The decision-making process designs the roadmap to reach its customer desires and indirectly reaches its business goal. Certainly, a good decision brings organization, administrators, and branches nearer to their target and even resolve all involved issues too. The decision-making forms the basis in any businesses. The significance of decision-making for successful businesses in ecommerce, specifically for online shopping websites design and forecasting of customer requirements has been highlighted by [3–5]. Decision intelligence is a new buzzword that acts as a better framework for decision-making models. It embeds the machine learning methods into decision-making processes to serve the purpose. It comprises decision-making constituents that brings to concrete decision with the help of executing, modeling, designing, adjusting, and tracking the processes [6].

To make business decisions, the decision intelligence has functionalized artificial intelligence and machine learning for better understanding the unpredictable failures. By bringing computer science, big data, psychology, neural science into a single platform, it can transform the meaning of decision-making completely in politics, business, government agencies, and defense or even where humans think and make decisions [7].

Organizations often have to make firm decisions for better efficiency, threat management, and profits. Premium quality, quick, and prompt decision-making process strengthen the organization efficiency and performance, and proper threat management is required failing which it may lose the organization projected objectives such as following the Regulatory Acts, Economics, etc. In the same way, a good decision maker system assists to flourish and increase its profits as well, and that is why an organization takes firm and professional approach for decisions like SWOT analysis (Strength, Weaknesses, Opportunities and Threats) processes that lead to business success. It has been done for over 50 years for managing threats, planning, and decision-making as well [8]. It identifies the internal and external threats and opportunities in its business world. In addition, the amalgamation of a growing complex business world and the desire to spread data extensively and to gain competitive edge over competitors have now led organizations to concentrate on applying analytics to operate strategic business decisions successfully. In present business scenario, each organization is in quest of a way to have their decision-making more effective and business analytics offers them this benefit.

Analytics [9] is the computation-based analysis method that interprets the old data by applying the specific method and discovers the meaningful information that makes good predictions, understanding the business strategy, and even improves the existing methodology too. Analytics [10] can assist businesses not only in making better strategic decisions but also in attaining good functional efficiency,

higher customer satisfaction, and robust profit and revenue levels. For sustaining its business in a competitive environment, proper analytics [11] strategies are required that give numerous advantages that become more eco-friendlier by using efficient technology oriented resources, by offering quality products and services and of course sustainability oriented methodology [12]. However, with various analytics available in the market like descriptive, predictive, and prescriptive, each having the ability to use the data to answer different questions, it is necessary to explore these analytics and their applicability in context with the strategic business management. To this end, this chapter discusses the available analytics in context with the decision intelligence analytics with the implementation of strategic business management.

1.2 Analytics

Earlier, the processing speed and data stowage have confined analytics. However, now those restrictions no longer apply, generating the way to more complicated deep learning and machine learning algorithms that can control huge amounts of data in several phases. Thus, the typical descriptive, prescriptive, and predictive capabilities of analytics have seen considerable rise with self-learning and automatic technology, steering in the artificial intelligence age. Analytics is essential to numerous functional parts and skills and is now treated as a strategic asset by most companies. It employs calculation and data to reply business queries, determine relationships, forecast unknown results, and automatize the decisions. In addition, it can be utilized to discover meaningful behavior in the data and expose novel information depending on machine learning methods, statistics, predictive modeling, and functional mathematics [13]. Analytics is the planned and proper computational-based analysis using the data and statistics. It helps an organization to understand the effects of changing the marketing methodology which is invaluable while enhancing the business, detection of risk, healthcare, digital advertisement, or many more areas where it can be applied. Analytics has prominent software ACL, IDEA, SPSS, Minitab, R, R+, SAS, IBM Watson, etc. All these software have statistical capabilities. However, using these softwares requires one to have a very good understanding of statistics.

1.2.1 Role of Analytics in Business

The process of analyzing the business refers to business analytics or analytics in the company [14]. Analytics helps businesses make data-driven decisions. It lets companies to automate their complete decision-making process, ensuring delivery of real-time responses whenever needed. Moreover, it aids to gain crucial business insights by offering the right data to work it. It brings a revolution in the technology, competencies, and applications to investigate data constantly, and as a result, this drives the business decision by understanding competently [15]. The technology-

based approach keeps the company close to its customers. All the above types of analytics outcome help to discover possible opportunities in the targeted business [16].

1.2.2   Types of Analytics

Businesses employ analytics to study, assess their data and transform its conclusion into insights that finally assist managers, administrators, functional employees, and executives that improve business decisions. There are various analytics techniques that businesses use in strategic business intelligence such as:

1. Descriptive analytics
2. Predictive analytics
3. Prescriptive analytics

1.3   Descriptive Analytics

Descriptive analytics is a kind of analytics that delivers the "What happened?" information regarding an organizations processes. It works on the past data to identify the changes that have happened in the business. It explains the use of a variety of historic data that helps businesses to draw comparisons. If economic metrics are to be considered, then most usually stated monetary metrics occurs to be product of descriptive analytics—like, year-over-year change in prices, month-over-month sales progress, the number of consumers, or each subscriber's total income. All these are measures that let businesses know what has happened in a business in a fixed period. It analyzes the raw data to make meaningful conclusions which are valuable for various stakeholders like investors, managers, customers, staffs, etc. It utilizes the wide range of data to get clear idea of what has occurred, how it varies with other. With the help of this wide range of old data, it helps to acquire a comprehensive review on line of action and efficiency that can be based on business strategy [17].

Aggregation and mining the data are important steps used in descriptive analytics. Data aggregation is done first to gather and sort the data so that the analyst can manage the datasets efficiently. Later, the data mining is used to extract meaningful data. It identifies and understands the patterns that have been discovered by applying some intelligent methods. It becomes essential to represent the data visually, after transforming, sorting, and analyzing it. Therefore, descriptive analytics is used to set the sensitive measures along with business targets to evaluate the business' present conditions based on activities that occurred.

Following steps are to be executed to make a successful project based on descriptive analytics:

1. Decide the business benchmark to assess the analytics based system performance.
2. The necessary data is recognized.
3. The data are gathered and put in order to process.
4. The data is examined to discover patterns and calculate its efficiency.
5. The data is visualized by presenting the discovered pattern in the form of graphs and charts that naive user can understand easily.

Today the businesses have gone more data driven. These data come from people who share their views, expressions, experiences, emotions that become possible for the firms to understand customers' views. Decision-making is a vital process when it comes to reach out a final decision from the number of alternative ways [18]. Decision-making has become a data-driven process, and this data makes statistics if some specific method has been applied to reach a proper decision, and to reach a good decision requires a large dataset that can make a proper result. A large dataset is not the only requirement for the decision-making even though it requires a proper analytics method that can retrieve a proper decision smartly and intelligently. Two different traditional decision-making techniques were proposed, viz. programmed and non-programmed decisions [19].

1.3.1 Functions of Descriptive Analytics

Descriptive analytics comprises diverse statistical functions, like suppression summary statistics, and regression analysis. Following are the functions that make descriptive analytics operational [20]:

1. *Business Metrics and KPIs*: This includes identification of the key performance indicators (KPIs) that is to be measured to attain business targets like reducing prices, increase income or better understanding production. Thus, a KPI to calculate income would be items sold.
2. *Data Gathering and Aggregation*: After identifying the business targets and relevant KPIs, then the next phase is to determine the data sources for such information as the data held by businesses are usually in many locations, like databases, desktops, and more. This generates need for organizations to catalog data.
3. *Data Extraction*: Data extraction is a tedious task. It includes data transformation, data cleaning, data replication, and more. To carry out these tasks, the data automation tool is usually used.
4. *Data Analysis*: After the data is organized properly, it needs to be analyzed. To offer insight, the data analysis generally connects the number with business metrics.
5. *Data Presentation*: Once the picture is painted, it should be shared with stakeholders to inform decisions. Data presentation is carried out by data visualization and presentation, via charts and graphs.

1.3.2 Advantages of Descriptive Analytics

Through statistics and summarization, descriptive analytics provides the ability to assess things in a more healthier way as to how processes are functioning, to check whether business targets are being achieved most proficiently. This helps in business perform better. Some of the benefits offered by this analytics are as follows:

1. *Delivers Historical Context*: Through descriptive analytics, businesses can analyze the past data to gain insight on how consumers and products relate to one another. It results in predictive analytics that directs companies in moving forward.
2. *Measure Business Goals*: Through KPIs, the descriptive analytics can demonstrate how present processes are functioning. This helps in assessing the business goals.
3. *Holistic Approach*: Descriptive analytics aids to recognize trends and then visualize patterns. This helps to classify an organization's strengths and weaknesses and thus offer a historical summary to support function more optimally in the future.

1.3.3 Descriptive Analytics and Its Uses

To have more clear view on descriptive analytics, let us see an example of an online review of any product, the descriptive analytics could be applied to evaluate the number of consumers involved in the review forum. In addition, it can be used to know how many times the individual consumer shared in the forum. Descriptive analytics can be employed to better understand the customers' behavior by segmenting the customers into dissimilar audiences and then tailoring the marketing strategies. Some other examples of how descriptive analytics can be used include the following: summarizing past events such as sales and operations data or marketing campaigns. Another example as cited by ScienceSoft's practice says that if total number of metal parts manufactured in each month, income on each group of product, and monthly profits are analyzed, then it would help manufacturer to respond to a sequence of "what happened" queries, helping them focused on product classes. This analytics can help bank in assessing and revealing the loan risk with their customers. Like, when the loan rate of interest is high, the married struggles more than the single one and hard to repay it. Hence, if the rate of interest increases in the future, then the bank may be able to reduce the probable risk. Thus, the bank can use descriptive analytics to better recognize its exposure to risk.

1.3.4   Need for Other Analytics

Descriptive analytics parses historical data to better recognize the changes that have happened in a business. Using a variety of historic data and benchmarking, decision makers get a complete view of performance and trends on which to base business strategy. Thus, businesses can utilize the descriptive analytics for more improved decision-making leading to successful business. Descriptive analytics manipulates raw data from several sources of the data to provide actionable insights into the past. But, these findings just specify that something is incorrect or correct, without focusing on why. As a result, only descriptive analytics is often not recommended to highly data-driven companies. Rather they are suggested to be used with other data analytics for better outcome [21].

1.4   Predictive Analytics

Predictive analytics is about using past data; ML and AI predict what will happen in the future. The objective is to give a finest evaluation of what will happen in near future. The past data is given to a mathematical model that takes into account key patterns and trends in the data followed by application of model to present data in order to forecast what will occur next [22]. This analytics can be employed to decrease risks, enhance operations, and increase revenue. Thus, more organizations are now inclined to predictive analytics as it can resolve complex problems and reveal new opportunities [23]. It is progressively being used to model everything. Consumer behavior patterns, weather forecasting, predicting political events, predicting the course of diseases in patients to name a few. It is based on data and facts as well as information indicating that it is scientific and methodical and not based on instinct and rumor. This sets it different from other methods [24].

Predictive analytics has bagged the support of various organizations, with a global market projected to achieve around $10.95 billion by 2022 as per 2017 report by Zion Market Research. It helps organizations to sift through current and past data to discover trends, predict events and situations that should happen at a particular time, based on provided factors. Moreover, organizations can detect risks and opportunities through finding and exploiting patterns present within the data. Models can be drawn, to learn associations between several behavior features. Such models allow the evaluation of promise or threat presented by a particular set of situations, managing informed decision-making across several classes of procurement events and supply chain [25]. Predictive analytic models support rational decision-making, limiting the threat of biases in decisions [26]. Asniar et al. proposed predictive analytics to forecast consumer behavior by using behavior informatics and analytics method in order to improve business decision making [27].

1.4.1 Steps in Predictive Analytics

According to [28], following are the steps involved in the Predictive Analytics:

1. Recognize what you want based on historical data.
2. Next, check availability of data with you to answer those questions.
3. Train the module to learn from our data and forecast the results.
4. Schedule modules.
5. Use the forecasts and perceptions to move on these decisions.

Predictive analytics can prove beneficial to the companies in targeting customers on the basis of their behavior. Companies may use this analytics to collect data on consumers followed by predicting future actions based on past behavior. This information obtained can then be used to make decisions that influence the business's bottom line and impact outcomes.

1.4.2 Predictive Analytics and Its Uses

According to [29], following are some common uses of predictive analytics:

- *Enhancing marketing movements* to determine buyer reviews to marketing movements or buying behavior.
- *Making better processes* to efficiently manage accounts and other means, or to fix costs for services.
- *Monitoring fraud*. Analytics can detect movement and catch or note uncommon or out of the usual buyer movement, often immediately.
- *Mitigate risk*. Today, suppliers like car merchants, use beyond the credit score to decide whether to finance someone. Likewise, they are used to things such as driving records and insurance claims to elect if the customer is a threat.

1.4.3 Predictive Analytics Examples

Predictive analytics has been widely used by organizations today in a number of ways. It is now being used in fields such as healthcare, retailing, finance, hospitality, etc. [25]. Predictive analytics can also be used to reduce crime, combat terrorism, and solve trivial healthcare issues related to how diseases can spread in some places, and the prediction for their spread to other areas and patients [28] has cited some real-life examples depicting how predictive analytics can be better utilized. These are as listed below:

- Identifying customers that may stop a service or product.
- Refer marketing movements to buyers who are inclined to purchase.

- Improve customer service through proper planning.
- Aiding sellers' goal as to which consumers will cancel the buying or indulge in the purchasing process.

The important point about predictive analytics is that it is about knowing the unknowable which means that the known unknowns can be transformed into known knowns. This supremacy qualifies it to be a game changer in the field of business. Predictive analytics can strongly assist to transform your company by helping you achieve key strategic objectives by competing more efficiently to protect strongly and distinctive competitive stronghold through increasing sales revenues, retaining customers, and determining new buyer bases. It may include applying security strategies by better avoiding fraud, noticing, and managing and refining processes and advancing our core business volume to become more competitive. It paves way for learning key insights that can improve in making business policies. It focuses on to satisfy customer expectations and acting on insights to attain anticipated outcomes [30]. It utilizes all kinds of data to reach at models that envisage human behavior. It can be extended to explore what inspires customers to buy or not buy products as well as map evolving trends in marketing and business strategy [31].

1.5 Prescriptive Analytics

Prescriptive analytics emphasizes on discovering the best way given the available figures. It relates to both predictive and descriptive analytics, but it stresses on actionable insights in place of data observing. Descriptive analytics provides BI insights into what has occurred, and predictive analytics focuses on predicting possible results, and prescriptive analytics targets to discover the best result among a variety of options. Moreover, the field also empowers companies to make decisions based on optimizing the outcome of future events or threats, and offers a prototype to learn them. It is basically a statistical technique used to draw decisions and produce recommendations based on the computational results of algorithmic prototypes [32].

Prescriptive analytics analyzes the raw data to make good decisions in businesses. Especially, it factors information about probable scenarios or circumstances, previous performance, present performance, and available resource, and suggests strategy or plan. This analytics can be used to make decisions on any time horizon. Prescriptive analytics is not restricted to predicting future outcomes only. Rather, it goes beyond it and suggests actions to benefit from the predictions depicting the decision makers the consequences of each decision choice. It not only predicts why it will occur and what will occur but also when it will occur [33]. Prescriptive analytics is evaluated as the top level of data analytics. It uses optimization to recognize the best method to reduce or increase the intended objective. It needs a predictive model with actionable data and a feedback system that tracks the results generated by actions [26]. The prime objective of prescriptive analytics is to suggest what act to be done to address the upcoming problems. It is carried out

after predictive analytics to aid business and understand the fundamental reasons of difficulties and plan and suggest the best way. It discusses insights on possible outcomes and results that in turn maximize the main business metrics. It works by merging numerous business rules, data, and mathematical models. It can have a major impact on the overall processes and upcoming business development. Organization uses this to fix charges for the products, create plans, and determine the locations for bank branches.

Prescriptive analytics can prove beneficial to healthcare strategic planning by analytics to leverage the operational and usage data combined with external aspects like people demographic trends, financial data, and people health trends, to more precisely plan for future capital investments like new facilities and equipment utilization. It helps to understand the trade-offs between adding extra beds and increasing an existing facility or going for constructing a new one. To design and implement an effective prescriptive analytics strategy, an organization needs an information management strategy that includes both internal and external data as well as both structured and unstructured data, a technology strategy, and a data science strategy [34].

1.5.1 Advantages of Prescriptive Analytics

Prescriptive analytics can assist to increase efficiency, avoid fraud, meet business goals, limit threat, and make more reliable consumers. However, it is not perfect. It proves effective only if companies know what questions to ask and how to reply. It depends largely on the input assumptions and thus if they are not proper or valid, the results also will not be correct. When used effectively, however, it can help companies make decisions based on examined facts. It can simulate the likelihood of various outcomes and show the probability of each, helping organizations to gauge the level of risk and uncertainty they face than they could be relying on averages. Organizations get to know the likelihood of worst-case scenarios and plan accordingly [33]. In addition, prescriptive approach offers some benefits such as:

1. Long-term/strategic thinking
2. Coordinating effort
3. Learning from each other

1.5.2 Prescriptive Analytics and Its Uses

Many data-intensive government agencies and businesses can benefit from using prescriptive analytics. This includes healthcare and financial services domains where the cost of human error is high. It can be a great tool for fire department as it could be employed to evaluate to know if a local fire department needs residents

to empty a particular area when a wildfire is burning nearby. It could also be used to forecast chances of popularity of article based on data about searches and social shares for related topics. Another use could be to regulate a worker training program in real time based on how the employee is replying to each lesson [33].

1.5.3 Prescriptive Analytics Examples

The best example of this analytics is in a traffic domain that enables one to choose the best path to home, considering the distance of the shortest path, the speed of traveling, and prevailing traffic conditions in the town [35]. Another example is energy and utilities. Natural gas rates vary dramatically depending upon geo-politics, demand and supply, econometrics, and climate conditions. Transmission (pipeline) companies, gas producers, and utility firms are eager to forecast the precise gas rates so that they can lock in favorable terms while avoiding risk [34]. Google's self-driving car, Waymo, is an example of prescriptive analytics in action. On each tour, the car does number of calculations that assists the car decide when to change paths, whether to slow down or speed up, and when and where to turn—the same decisions a human driver makes behind the wheel [36]. Additionally, the prescriptive analytics can be applied in the following sectors for effective decision-making and more improved outcomes [33, 37].

- Hospitals and clinics
- Airlines
- Sales
- Higher education
- Banking
- Retail

1.6 Conclusion

Strategy business management can be achieved through effective decision-making.

Of late, the organizations often have to make firm decisions for better efficiency, threat management, and profits. In addition, the amalgamation of a growing complex world and the desire to spread data extensively and to gain competitive edge over competitors has now led organizations to focus on applying analytics so as to operate strategic business decisions effectively. Decision intelligence provides a framework for best practices in organizational decision-making.

In light of the above, this chapter has discussed the available analytics in context with the decision intelligence analytics with the implementation of strategic business management. Descriptive, predictive, and prescriptive analytics have been discussed in this chapter. The study highlighted the applicability and areas of each

of this analytics and their ability to use the data to answer different questions. It is realized that the incorporation of decision intelligence analytics with strategic business management decreases the functional risk and helps to forecast the profits and revenues. The study reveals that all these analytics can aptly guide the organizations in efficient decision-making which in turn will help in delivering strategic business management. It is realized that the chapter will assist the user to gain insights on various analytics, their scope, and applicability and how they can be applied for more improved decision-making leading to successful business.

1.7   Future Directions

Integrating decision intelligence analytics with strategic business management reduces the functional risk and helps to forecast the profits and revenues. However, this giant integration can be utilized in the future for the following:

1. Artificial intelligence-based system might be prescribed the perfect solution, can be implemented crucial decisions, even it will suggest to modify the existing Optimization Algorithm and subsequently include all those knowledge will recognize all expected and unexpected situations and try to take out from them. Eventually, through this integration, the future system will become self-dependent, self-educated, self-instructor.
2. Through this integration, opportunities and threats will be understood in advance, it might also be possible to think beyond the organization walls itself and will help to design the complete business model.

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