CHAPTER – 3

RESEARCH METHODOLOGY

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Research methodology serves as a clear framework outlining the researcher's intended path in conducting their study. It constitutes a systematic and logical plan designed to tackle a research problem effectively. This methodical approach is essential for ensuring the credibility and validity of the results, aligning with the researcher's goals and objectives. The methodology outlines the researcher's strategy, specifying the data to be collected, its sources, and the methods employed for collection and analysis. In essence, it provides a structured roadmap for conducting research, guaranteeing the reliability and integrity of the outcomes.

3.1 INTRODUCTION

In today's business landscape, organizations aim to align with the principles of the fourth industrial revolution and establish their competitive foundations by offering unique value propositions that cater to customer needs through the utilization of business intelligence. The term "big data" refers to the extensive volume of data, encompassing both structured and unstructured information, that inundates businesses on a daily basis. However, it's not merely the quantity of data that holds significance; rather, it is the actions organizations take with this data that truly count. Big data can be subject to analysis to extract valuable insights, enabling improved decision-making and the formulation of strategic business initiatives.

Many companies use both business analytics and business intelligence (BI) to support their decision-making processes and gain a competitive edge. These two fields complement each other and serve various purposes within organizations. Here's how companies use them:

3.1.1 Business Intelligence (BI) in Companies:

Operational Reporting: Companies use BI tools to generate operational reports that provide insights into daily or periodic activities. These reports help monitor key performance indicators (KPIs[1]), track sales, inventory, and other operational metrics.

Dashboard Visualization: BI dashboards are popular in organizations for providing at-a-glance views of critical data. They help executives and managers quickly understand the state of the business and identify trends or anomalies.

Historical Analysis: BI allows companies to analyze historical data to understand past performance, identify areas for improvement, and make data-driven decisions based on historical trends.

Data Integration: BI tools often integrate data from multiple sources, such as databases, spreadsheets, and third-party applications, providing a consolidated view of business data.

Ad Hoc Reporting: BI tools enable non-technical users to create ad hoc reports and perform basic data exploration, reducing the dependence on IT departments for data queries.

Compliance and Governance: BI solutions help companies ensure data security, compliance with regulations, and governance through features like access controls and audit trails.

3.1.2 Business Analytics in Companies:

Predictive Analytics: Companies use predictive models to forecast future trends, such as customer behavior, demand for products, or equipment maintenance needs. Predictive analytics helps optimize operations and identify growth opportunities.

Prescriptive Analytics: This type of analytics suggests specific actions or strategies to optimize outcomes. For example, it can recommend pricing strategies, supply chain adjustments, or marketing campaigns based on data analysis.

[1]Key Performance Indicators

Customer Segmentation: Analytics helps companies segment their customer base into groups with similar characteristics or behaviors. This allows for more targeted marketing and personalized customer experiences.

Supply Chain Optimization: Companies employ analytics to enhance various aspects of their supply chain operations such as inventory management, demand forecasting, and logistics. By utilizing analytics, businesses can achieve cost savings and improved efficiency in their supply chain processes.

Risk Management: Analytics can be used to assess and mitigate risks. For instance, financial institutions use analytics to detect fraudulent transactions, and healthcare organizations use it for patient risk assessment.

Product Development: Companies leverage analytics to understand customer feedback, market trends, and competitor data to inform product development and innovation efforts.

Market Research: Analytics is used to analyze market data, competitor performance, and consumer sentiment to make informed decisions about market entry, expansion, or product positioning.

In practice, many organizations integrate BI and business analytics into their decision-making processes. BI provides the foundational data and historical context, while business analytics leverages this data to provide deeper insights, predictions, and recommendations. Together, they empower companies to make data-driven decisions that drive growth, improve efficiency, and enhance customer experiences.

3.1.3 Integrating Business Intelligence (BI) and Business Analytics (BA):

Integrating Business Intelligence (BI) and Business Analytics (BA^2) into a cohesive model can significantly enhance an organization's ability to extract actionable insights from data and drive informed decision-making. Here's a framework for integrating BI and BA:

[2]Business Analytics

1. Data Integration:

Centralized Data Repository: Create a centralized data repository where all relevant data, both internal and external, is stored and organized. This could include structured data for BI and unstructured data for BA.

Data Quality Assurance: Implement data quality processes to ensure that data is accurate, consistent, and up-to-date.

2. BI Foundation:

Reporting and Dashboards: Build BI reports and dashboards for monitoring historical performance and KPIs. These provide a baseline understanding of your business operations.

Data Visualization: Utilize data visualization techniques to make information more accessible and actionable for users at all levels of the organization.

Self-Service BI: Enable users without technical expertise to generate their own reports and navigate data effortlessly using intuitive Business Intelligence tools.

3. BA Capabilities:

Predictive Analytics: Employ predictive models to forecast future trends and identify potential opportunities or risks.

Prescriptive Analytics: Develop prescriptive models to recommend specific actions based on insights generated from historical and predictive data.

Advanced Statistical Analysis: Utilize statistical methods and machine learning algorithms for in-depth data analysis.

4. Data Exploration:

Data Discovery: Encourage data exploration by BA teams to discover patterns, anomalies, and correlations in the data.

Hypothesis Testing: BA teams can formulate hypotheses and conduct experiments to validate assumptions and uncover insights.

5. Data Governance:

Establish data governance policies and practices to ensure data security, compliance, and privacy, especially when dealing with sensitive data.

Define data ownership and access controls to maintain data integrity.

6. Collaboration and Communication:

Foster collaboration between BI and BA teams to ensure they work together effectively.

Establish clear communication channels for sharing insights and findings with decision-makers.

7. Continuous Improvement:

Implement a feedback loop to continuously improve BI and BA processes and models based on user feedback and changing business needs.

Stay updated with emerging technologies and methodologies in BI and BA.

8. Executive Sponsorship:

Ensure strong executive sponsorship and support for the integration of BI and BA to drive a data-driven culture within the organization.

9. Training and Skill Development:

Provide training and skill development for team members in BI and BA to keep them updated with the newest tools and techniques.

10. Key Performance Indicators (KPIs) and Other Metrices:

Track KPIs related to the effectiveness and impact of BI and BA initiatives, such as improved decision-making, cost savings, or revenue growth.

By integrating BI and BA within this framework, organizations can harness the power of data to gain a competitive edge, adapt to market changes, and make informed decisions that drive business growth and innovation.

In the current environment, organizations strive to align with the concepts of the fourth industrial revolution, establishing the foundational elements of today's competitive business environment through a unique value proposition centered around fulfilling customer needs using business intelligence. Big data refers to the substantial volume of data – both structured and unstructured – that businesses encounter daily. However, the significance lies not in the sheer volume of data but in how organizations utilize it. Big data can be scrutinized to uncover insights that drive improved decisions and strategic business initiatives.

3.1.4 Five Vs of Big Data:

The five Vs of big data characterize the essential aspects of vast and intricate datasets, offering organizations insights into the specific challenges and possibilities associated with handling such data. These five Vs include:

Volume: Referring to the immense amount of data, often measured in terabytes or petabytes, which has been consistently doubling every forty months.

Velocity: Signifying the rapid pace at which data accumulates in various businesses and organizations, highlighting the need for efficient processing and analysis.

Variety: Encompassing the diverse range of data sources available, including data from enterprise systems, social media, text, video, audio, emails, RFID, web applications, and other digital devices.

Veracity: Emphasizing the crucial aspect of data quality, which is fundamental for accurate decision-making, highlighting the importance of reliable and trustworthy data.

Value: Indicating the potential for economic and social improvements by extracting valuable insights and outcomes from heterogeneous data, emphasizing the practical utility and significance of big data analytics.

Big Data Analytics:

Big data analytics involves employing advanced analytical techniques to process large and diverse datasets, enabling better decision-making by analyzing historical data stored in data warehouses. This comprehensive approach considers not only data quantity but

also its various types and sources, including structured and unstructured data. Tools and methods encompass data warehousing, RDBMS, clustering, classification, association analysis, OLAP, ETL, BPM, both simple and multiple regression, genetic algorithms, and heuristic research. The benefits of big data analytics include delivering valuable insights to customers, enhancing corporate analytics capabilities, and improving specialized analytical applications. However, challenges like staffing issues, insufficient business support, and database software problems can impede its implementation.

Text Analytics:

In online user experiences, the significance of enterprise search systems, document representation and search engines cannot be overstated. These elements are crucial for comprehending user behavior and preferences, thereby assisting businesses in tailoring their recommendations effectively. Valuable insights into customer intentions to make a purchase emerge from the analysis of billions of searches on major platforms such as Google and Amazon. E-commerce giants like Amazon and Jet Airways utilize this valuable information to elevate user engagement. These platforms proactively suggest products or flights by anticipating customer preferences based on their search history. This personalized approach significantly heightens the probability of customers making a purchase during their subsequent visits, thereby enhancing their overall shopping or travel experience.

Audio and Video Analytics:

Audio analytics technology processes audio quickly, typically within a few seconds, primarily for safety reasons in various companies. Its primary purpose is to monitor a variety of sounds in their natural settings. Similarly, video analytics is employed to process and analyze videos from diverse sectors and companies. This aids in identifying relevant events that are valuable for making operational decisions.

Web Analytics:

Amazon, the online retail giant, employs advanced data mining techniques to sift through vast amounts of data, including click streams, web searches, order history, and online activities, among other sources, to extract valuable insights. This data-driven intelligence is instrumental in guiding decisions related to product promotions. Amazon, along with

other businesses, has found this approach highly effective. By analyzing the correlation between previous purchase history and the likelihood of making similar purchases, patterns emerge. These patterns help identify potential customers who might be interested in analogous products based on their past buying behavior. Leveraging this correlation, Amazon and similar platforms can target specific clientele. These potential customers are then reached through digital channels like emails, Facebook, or targeted messages on Amazon.com, effectively promoting various products tailored to their preferences.

Network Analytics:

"Network analytics" encompasses the systematic collection of data concerning interconnected devices within a network and their communication patterns. This valuable information is instrumental in crafting effective network policies and making strategic decisions that drive actionable outcomes. By leveraging network analytics, companies can enhance their overall performance while simultaneously reducing costs. The insights derived from analyzing device interactions empower organizations to make informed choices, ensuring optimal network functionality and efficiency. This proactive approach not only improves operational decisions but also significantly contributes to the company's growth and financial stability.

Business intelligence systems integrate data from operational sources with analytical tools to provide complex and competitive information to planners and decision-makers. Enhancing the timeliness and quality of data inputs is crucial to achieve this objective. Business intelligence aids in understanding an organization's capabilities, the prevailing industry standards, market trends, technological advancements, and regulatory landscapes. It also enables insights into competitors' actions and their implications. The evolution of data warehousing, improvements in data cleansing techniques, advancements in hardware and software capabilities, and the introduction of web-based architectures collectively create a more robust environment for business intelligence, surpassing the accessibility of the past.

The investigation that has been proposed helps to understand the conceptual framework of BDA and BIS, the influence of BDA and BIS on the administrative effectiveness of organizations, the basic role of BDA and BIS in decision making at different levels of

the organization such as top level: strategic, middle level: tactical, and also lower level: operational, and the identification of factors related to technical, structural, and managerial aspects for the implementation of BDA. determine the influence that business intelligent systems have on the efficiency of organizations in the Indian context, identify that BDA and BIS have better economic and financial performance, determine that firms that use business analytics and business intelligent systems have higher productivity than others, and determine the impact that business intelligent systems have on the effectiveness of organizations.

3.2 HYPOTHESES:

1. Big data analytics and business intelligence system have a significant impact on organizations performance.
2. Big data analytics & business intelligent system have better economic and financial performance.
3. There is no significant difference between the impact of big data analytics & business intelligence system on decision making in both type of organizations (Private and Public).
4. There is a significant relationship between big data & business intelligence system success factors and type of organizations.
5. There is no significant impact of big data analytics & business intelligent system on administrative effectiveness of private and public sector organizations in India.
6. There is no impact of business intelligent system on the effectiveness of organizations in Indian perspective.

3.3 RESEARCH DESIGN:

There are three fundamental research types: quantitative, qualitative, and mixed research, which involves a combination of quantitative and qualitative methods. Research methodologies typically encompass five steps. The first step in the research process is to define the research type, either qualitative or quantitative. Following this, the second step

involves identifying a research paradigm that guides the entire study. After determining the paradigm, the research methodology is developed to align with it. The last two steps include choosing appropriate data collection methods from a range of sources and conducting thorough data analysis.

Big data has become instrumental in providing companies with a competitive edge through the application of various analytics techniques. These methods offer insights, patterns, correlations, and associations that were previously inaccessible with traditional small data approaches. This invaluable information aids business executives in decision-making processes by utilizing data from social media, competitive intelligence, cost and time reduction strategies, supply chain analytics, and web analytics. Firms acknowledging the significance of big data and shaping their products around data have experienced significant gains in recent years. Many companies now integrate analytics into various aspects of their operations, benefiting from data-driven decision-making. The proposed research delves into the conceptual framework for building analytics capabilities and explores how this emerging knowledge can empower businesses of all sizes – small, medium, and large – to compete effectively using limited resources. This framework is adaptable, allowing companies to tailor it according to their specific industry and business model. It serves as a foundational point for further analysis, refinement, and future research opportunities. Considering the ongoing digitization in both society and business, the continuous generation of high-speed, high-volume data presents a substantial opportunity for leveraging analytics in decision-making processes.

The proposed study identifies influence of big data analytics & business intelligent system on the decision-making process.

Study Design: Quantitative Research

Study Area: India (Major States)

Sample Design:

1. Sample Size: 200 which includes organizations from private and public sector in India. The organizations included were being classified zone wise as follows:

North Zone:

- Hero MotoCorp
- Fortis Healthcare
- JK Cement
- Infosys Limited
- Bharat Sanchar Nigam Limited (BSNL)

South Zone:

- Infosys Limited
- Wipro Limited
- Tata Consultancy Services (TCS)
- Apollo Hospitals

East Zone:

- Coal India Limited
- Exide Industries
- OIL India Limited
- IDBI Bank

West Zone:

- ICICI Bank
- Yes Bank
- Ambuja Cements Limited
- Life Insurance Corporation of India (LIC)

Central Zone:

- State Bank of India (SBI)

2. Sampling techniques: non-probability-based convenience sampling technique.

The gathered data was being edited then coded, and further tabulated for the purpose of analysis. Various statistical techniques such as percentages, averages, and ratios were applied. After data analysis techniques were employed, further interpretation was done in alignment with the research objectives.

Instrument Development

The questionnaire is structured to gather information on demographic factors and aspects concerning big data analytics and business intelligence systems. It is divided into two distinct sections, Section A and Section B. Section A focuses on capturing the demographic details of the respondents, whereas Section B consists of questions related to the influence of big data analytics and business intelligence systems on decision-making processes. To ensure the reliability and validity of the instrument, evaluations are conducted using methods such as Cronbach's Alpha value and correlation analysis.

Sources of Information:

The proposed study intended to comprehensively delve into various dimensions concerning the conceptual framework of big data analytics and business intelligence systems. Its focus was on evaluating how these systems enhance organizational efficiency, exploring their influence on decision-making across different organizational levels—strategic, tactical, and operational. Furthermore, the research aimed to identify the key factors related to technical, structural, and managerial aspects crucial for the successful implementation of big data analytics and business intelligence systems. Additionally, the study sought to determine whether the adoption of these systems improved managerial decision-making and positively impacted the economic and financial performance of organizations. Another aspect of the investigation was to determine whether firms that embraced business analytics and business intelligence systems exhibited higher productivity compared to their counterparts that did not leverage such technologies. The study was specifically focused on understanding the impact of business intelligence systems in the context of organizations within India. In essence, this investigation aimed to shed light on the multifaceted role of big data analytics and business intelligence systems in organizational effectiveness, decision-making, financial performance, and productivity, with a particular emphasis on the Indian business landscape.

Primary and Secondary Sources:

Gathering Primary Data: The primary data was acquired through a meticulously crafted questionnaire distributed to entrepreneurs, top-level management executives, technical experts, and managers within Indian organizations.

Gathering Secondary Data: To establish a foundation for the current study, the researcher explored a range of sources for secondary data, shaping the conceptual framework. Various search engines like Google and Yahoo were utilized to find relevant articles on the topic. Additionally, the researcher sought guidance from scholars and professionals in the field. Newspapers, magazines, and internal reports from companies also served as valuable secondary sources for this study.

- Secondary information for the research was sourced from various reputable publishers, including Elsevier, Wiley, IEEE[3], Springer, and Saga, through research papers.
- These research papers covered a wide range of topics related to big data and information security and privacy.
- Government websites were utilized to access secondary data, including historical data and statistics, enhancing the research's data sources.
- The research incorporated insights from specialized journals focused on security and privacy issues related to big data and information.
- Books within the fields of computer science and engineering, machine learning, big data management, and data quality were consulted to provide background knowledge and relevant information.
- The study also made extensive use of digital resources, including websites, blogs, and online portals, to gather valuable information and insights from the broader digital landscape.

[3]Institute of Electrical and Electronics Engineers

- This comprehensive approach to secondary data collection aimed to establish a well-rounded foundation for the research.

3.4 TOOLS OF DATA COLLECTION

A well-structured instrument the questionnaire with two components being employed. Part A asks questions about respondents' profiles or demographic characteristics, including inquiries about respondents' ages, genders, designation, educational backgrounds, experience, type of organization and other characteristics. The questions linked to the particular study objectives are included in the second part-B such as questions related to data quality, reports being generated, security aspects, effective decision making, web interfaces, big data management, predictive, descriptive analytics etc.

Structure of Questionnaire:

Mainly the questionnaire includes the questions related to:

- Storing of big data
- Automated System
- Statistical Analysis
- Machine Learning Capabilities
- Data Quality
- Data Velocity
- User satisfaction
- Managerial Decision Making
- Security aspects
- Implementation Aspects

3.5 TOOLS & TECHNIQUES:

Various statistical techniques such as: Principal Component Analysis, Partial Least Square method, Mean Rating, Multiple Regression, Factor analysis, Chi-Square-Test,

ANOVA, Variance & Standard deviation were being used for identification of factors related to technical, structural, and managerial aspects for implementation of big data analytics and business intelligent system.

Software tools such as Excel & SPSS were being used for the data analysis.

SPSS:

SPSS, which stands for Statistical Package for the Social Sciences, is a powerful statistical software package used for data analysis and decision-making in various fields of research. Developed by IBM, SPSS provides advanced statistical analysis, data management, and data documentation features. Below is a detailed description of SPSS and its key features:

- Data Management: Import data from various sources, clean, transform, and handle missing values.
- Statistical Analysis: Calculate descriptive statistics, perform inferential tests, and advanced analytics like predictive modeling.
- Non-Parametric Tests: Support non-parametric tests for specific data distributions.
- Data Visualization: Create diverse charts and interactive graphics for dynamic exploration.
- Output and Reporting: Generate detailed output reports, exportable to various formats.
- Syntax and Automation: Use command syntax for automation and reproducibility, write scripts for integration.
- Data Mining and Machine Learning: Utilize machine learning algorithms for predictive analytics and text analytics for unstructured data.
- Data Security: Implement data encryption and user authentication features for enhanced security.
- Collaboration: Facilitate collaborative data analysis and results sharing among team members.

3.6 RELIABILITY AND VALIDITY:

Reliability, in the context of research, is a critical concept that pertains to the consistency and repeatability of research results. It signifies the degree to which the same results can be consistently produced when the same research methods are applied repeatedly. Put simply, if a study is highly reliable, it means that other researchers should be able to replicate the findings using the same research methodology under similar conditions. High reliability instills confidence in the credibility of research outcomes.

Research validity, on the other hand, addresses the degree to which a study adheres to established scientific study techniques while generating research findings. It essentially assesses whether the study accurately measures what it intends to measure. Validity ensures that the research methods and instruments used are appropriate for the research objectives, and that the findings can be reasonably generalized to the broader population or context of interest.

In this particular research context, internal consistency, often referred to as dependability, is a key aspect of reliability assessment. The Cronbach's alpha approach is a widely adopted method for measuring this internal consistency, especially when dealing with Likert scale items in a questionnaire. Cronbach's alpha offers a numerical measure indicating the extent to which items within a scale are interrelated. A high Cronbach's alpha value signifies a robust level of internal consistency among the items in the questionnaire. This suggests that these items effectively gauge the same underlying construct or concept, emphasizing the reliability of the scale.

Reliability ensures that research results can be consistently reproduced, validity ensures that the research adheres to sound scientific practices, internal consistency, evaluated by methods such as Cronbach's Alpha, assesses how well particular research instrument measures the intended constructs.

Reliability Statistics	
Cronbach’s Alpha	No. of Items
0.88	38

The scale under evaluation exhibited a high level of internal consistency, as shown by Cronbach's alpha, which was found to be 0.88.

3.7 SUMMARY:

The purpose of the study was to find the effect of big data analytics & business intelligent system on administrative effectiveness of private & public sector business units in India, identify the role of big data analytics & business intelligent system in making strategic, tactical and operational decisions, identification of factors related to technical, structural and managerial aspects for implementation of big data analytics and business intelligent system, examine how big data analytics & business intelligent system led to better decision-making by managers, determine the impact of business intelligent system on the effectiveness of organizations in Indian perspective. Accordingly, survey method was being adopted in which questions related to above aspects were being asked to the respondents as executives and users of BI and BA technologies. To assess the reliability and validity of the questionnaire, the Cronbach's alpha method was employed. The results indicated a high level of internal consistency among the questionnaire items.