Addis Ababa University

Collage of Natural and Computational Sciences

School of Information Science

Assessing Big Data Analytics Readiness in Ethio Telecom

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September 2021

Addis Ababa, Ethiopia

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A Thesis Submitted to the School of Information science of Addis Ababa University in partial fulfillment of the Requirement for the Degree of Master of Science in Information System

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DECLARATION

I declare that this thesis is my original work and has not been submitted for any Degree in any other University. I have undertaken the study independently with the guidance of the research advisor. All the sources of the materials used in this dissertation paper have been duly acknowledged.

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ACKNOWLEDGEMENTS

First and foremost, praise to my Almighty God for his blessings and guidance in giving me the strength, courage, patience, and perseverance to start and finalize this study. I am grateful to my research advisor Dr. Melkamu Beyene for his comments and support. I am most grateful for his advice and suggested approaches that gave me direction of the study.

I would like to say thank you to the information system division and security division staff of Ethio Telecom. I am also saying thank you to my father, Mother, sisters, and brother for your support and advise in every part of my life. Special thanks to my beloved wife Etalem and my little kid Eden.

Abstract

In the age of technological and advanced world big data is important as a world new currency. Organizations believe that big data can improve their performance. However, as with any innovation & adoption, big data analytics should be strictly evaluated for a specific organizational context before adoption. Numerous organizations adopt technology without seeing their level of readiness for that technology which, leads to ineffective implementation and may lead to failure. Big data analytics is an expensive, resource-intensive, and complex process that has been plagued by many problems leading to significant project failures in different industries. The organizational readiness for embracing big data technology must be assessed to discover the organization's maturity in revealing the potential of this technology. Assessment of readiness for big data analytics indicates the company's current state of progress in terms of Big Data analytics and provides a practical roadmap of future steps need to be taken. The main objective of this research is assessing the readiness of Ethio Telecom for big data technology adoption. To evaluate its readiness, the study used five-dimensional framework which consists of organization specifications, data ecosystem, data governance, data management, and resources. The research used mixed research approach, Explanatory sequential which quantitative data collection and analysis conducted first, followed by qualitative data collection and analysis to assess big data analytics in Ethio Telecom. The research data relevant to measure the readiness of the organization based on the five dimensions is collected using survey questionnaires and interviews from Ethio Telecom information system security division. Stratified simple random sampling for quantitative and purposive sampling for qualitative was used in this study. The data was analyzed using descriptive statistic and data analysis using theme methods. Result indicate that Ethio Telecom is ready in terms of organization specification, data ecosystem, and data management. The findings of this study show that Ethio Telecom is ready to adopt big data in terms of organizational specification, data ecosystem, and data management and with some effort on data governance and resource (technology and human resource). Five-dimensional model that used by this study helps to Ethio Telecom, to improve their chances of successfully implementing big data analytics.

Keywords: Big Data, Big Data Analytics, Readiness for Big Data Analytics, Ethio Telecom

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LIST OF ABBREVIATIONS

BD	Big Data
BDA	Big Data Analytics
BI	Business Intelligence
CDMA	Code Division Multiple Access
CDR	Call Detail record
CRM	Customer Relationship Management
DM	Data Mining
DPI	Data Packet Inspection
DW	Data Warehouse
ERP	Enterprise Resource Planning
HDFS	Hadoop Distributed File System
IoT	Internet of Thing
ISD	Information System Division
IT	Information Technology
JSON	JavaScript Object Notation
LTV	lifetime Value
M2M	Machine to Machine
MMS	Multimedia Service
NIST	The National Institute of Standards and Technology
OLAP	Online Analytical Processing
RDB	Relational Data Base
ROI	Return on Investment

SQL	Structural Query Language
TDMA	Time Division Multiple Access
VOIP	Voice Over Internet Protocol
XML	Extensible Markup language

Chapter one

Introduction

1.1 Background

Big data (DB) refers to large sets of structured, semi structured, or unstructured data, which are obtained from different unrelated resources (Malaka & Brown, 2015). Big data is the amount of data just beyond the ability of existing technology to process, manage, and store efficiently (Farzaneh et.al 2018).

Organizations have been building data warehouse and business intelligence to create insight for decision making to improve business performance. These systems are conventional analytical system that capture, clean, transform and integrate data only from legacy systems before inserting it into a data warehouse. But even though these conventional systems continue to advance, many different more complex types of data have now emerged into what businesses ought to use to analyze and build on what they already know. This indicates that to leverage on this Big Data, organizations want to create way that will lead to change of skills, leadership, structures, technologies, and architectures; hence calling for readiness to change (Motau & Kalema, 2016).

Big Data solutions in the organization desire to meet the requirements of collecting, managing, and analyzing massive volumes of different data at the right speed and within the right time. Halper and Krishnan (2013) stated that: “big data is in several internal and external sources and can contain different data including streaming data and social media data”. Leveraging all these data sources with success requires BD infrastructure, data analytics, organizational structure, and governance.

The potential benefits of big data are an important topic for companies in all industries. Big data promises new data-driven services to improve processes and enable innovative product and business models (Sivarajah et al., 2017). Against this background, a growing number of companies are investing in big data and looking for competitive advantages (Constantiou, & Kallinikos, 2015).

Due to the rise of constantly tougher challenges in continually changing business environments particularly telecommunication characterized by high complexity and uncertainty, there is a clear need to respond in almost real time to upcoming business challenges and opportunities. Contemporary developments in information and communication technology, and growing competitiveness, have led to the emergence of the real time big data analytics as an enabler of sustainable development and sustainable competitive advantage. Big data analytics (BDA) includes advanced analytical techniques and technologies that work on big data to get enhanced insights and improve the decision-making process (Malaka & Brown, 2015). Chen et al. (2016) mention that BDA as a "unique information processing capability that brings competitive advantage to organizations" and is expected to improve performance (Kwon et al., 2014). Big Data analytics offers opportunities to telecom operators to improve the quality of service. Some of the use cases of big data analytics in telecommunications are enhancing customer experience, network optimization, fraud detection, etc. BDA combines and analyzes data related to customer interactions, innovation, service execution and network performance, providing a 360-degree service experience view. This allows winning telecoms to retain and grow their customer base, increase service utilization, and raise customer lifetime value (LTV).

The telecommunications industry is facing a flood of data daily due to smartphone usage and growth of social media and IoT along with accessibility of next generation communication networks. Data occurs in both batch and real-time modes (Zahid et al., 2019). Significant data include call detail records, user click stream, mobile network usage, geographical user data, network performance, network monitoring, customer/subscriber profiles, hardware and VOIP data. Telecommunication companies need to deal with BD which is a combination of structured and unstructured data that need advanced statistical and instructional methods. BDA can bind big data for telecoms by employing knowledge from diverse domains, notably machine learning, statistics, pattern recognition, and business intelligence. It is mostly implemented in the context of NoSQL databases which tear away from the tight relational storage to more loose, unstructured, and semi-structured data models (Ganesh, 2017). Telecommunication has been moving multiple terabytes of data around its networks for years, today's networks have seen unprecedented changes in term of volumes of data moved, including video, a variety comprising social networking data, and complexity of that data.

Improving customer experience is a major force to meet the challenges of delivering customer satisfaction, operational efficiency, and value creation. As the market of the telecom industry grows more and more mature, the competition among Telecom companies becomes more and more powerful. Any business depends on the customer which is the most important resource. A company cannot be successful without first establishing a strong customer base. But even with a great customer base, a business cannot afford to ignore competition.

Big data allows telecommunications to see various customer related patterns and trends. Studying customer behavior is important to trigger reliability. The extra data a company collects, the more ways and trends a business can be able to recognize. It is necessary to have a big data analytics strategy to expand the data at your disposal. Appropriate customer data analytics mechanism helps to a business will have the capability to gain key behavioral insights that need to be maintained in a customer base. Understanding customer insights will help to organization's business realizes what customers want from it. This is an important step to attain high customer retention. Knowing what consumers need before makes advertising efforts much more customer focused. It enables companies to customize their advertising to focus on one part of their entire customer base. Advertising can be expensive, and it is essential to know how to get the best return on investment (ROI). BDA inspires companies to find out which part of their customer base will respond best to the campaign. Additionally, it is a good agreement at the cost of encouraging the customer to purchase and to increase the whole productivity of marketing and advertising efforts.

Ethio Telecom has controlled the telecom markets for last 127 years in monopoly in Ethiopia. Through this journey Ethio Telecom served its customers with receiving complain related to service quality, tariff exaggeration and other problem. Due to monopolized market, Customer wait until the problem solved, and continued customer contact with Ethio Telecom without satisfaction. Currently Ethiopia communication authority permit to have more telecom operators in Ethiopia. Global partnership for Ethiopia consortium already got license and will star service soon. This consortium is very good in big data analytics like Vodafone which is one of the group members have its own Vodafone analytics platform TelcoTitans (n.d.). According to TelcoTitans (n.d.) Vodafone Analytics is a platform developed to offer insights to your business and extract value from data. The solution works using Big Data and by analyzing telecommunications data based on user geolocation and behaviors and is delivered insights and visualization. To keep growing

telecom market and ever-increasing interest of customer for quality service, Ethio Telecom must be adopted latest technology like big data analytics to observe and estimate customer usage.

1.2 Statement of the Problem

Conventional data systems are not able to handle big data effectively since they are not designed to handle the variety of today's data. As the process of big data is beyond the ability of conventional software tools (Manyika et al., 2011), decisions on investments in big data related technology are not questionable. Big Data analytics works very differently from traditional data systems, which normally relies on a clean subset of manually engineered data placed in a data warehouse to be queried in a limited number of predetermined ways.

Big data tools help telecommunications gain deeper insights into customer behavior, including usage patterns, preferences, and interests. It is hard for a traditional system to derive quick and meaningful insights unlike big data solutions that provide carriers insights into relationships, family, work patterns and location. This is increasingly achieved in real-time using both structured and unstructured data. BDA helps segment the audience with the help of analytics tools and create large-scale personalization.

Organizations understand the opportunities and business values provided by Big Data technologies. However, many problems are derived from the difficulty of understanding the complex dimensions involved in Big Data adoption (Farzaneh et.al 2018). Consequently, companies are only concerned about the benefits that gained from big data by overlooking whether they are ready for this kind adoption. In this respect, assessing companies' readiness to adopt big data technology can be a very useful step to improve Big Data adoption processes. Different aspects should be identified, through a deep and comprehensive investigation of the vast literature and preparedness evaluation framework. Assessing Ethio Telecom readiness is helpful in pointing out components that Ethio Telecom could improve, from a company basis to guiding Ethio Telecom managers to plan Big Data adoption.

An organizational readiness evaluation is an official measurement of the preparedness of company to undertake a major change. According to (Pedro et al, 2019) organizational readiness for a system, technology or investment can be defined as those capabilities an organization needs to

hold to be ready for a successful initiative. Before adopting new technologies, evaluating preparations is always an important issue for complicated subjects such as Big Data. Ethio Telecom have plan to adopt BDA, however, before adoption evaluating their readiness in terms of top management support, vendor support, business and IT alignment, decision making culture, BD strategy and business alignment, data integration, data access, policy, computation, data quality and integrity, resources (human, technology, and finance), security and privacy are very valuable effectively implement BD and minimize cost and time.

BDA is an expensive, resource-intensive, and complex process that has been plagued by many problems leading to significant project failures in different industries (Liebowitz, 2013 & Ohlhors, 2012). Gartner stated that up to 85 percent of BDA projects failed in 2017 (Zahid et al., 2019). According to Gartner (*Weibl* & Hess, 2018) sixty percent of BDA project failed to complete within budget or on schedule or fail to deliver certain feature. A McKinsey survey (Zahid et al., 2019) has verified that the effect of investment in BDA initiatives by telecom companies on the actual benefits; out of the 273 telecom companies who invested in BDA, only 5 percent companies are getting more than 10 percent benefit. 75 percent to 80 percent of companies ran into a loss due to BDA application (Zahid et al., 2019). This is primarily a result of lack of awareness, lack of management support, lack of data quality, poor data management, lack of adequate DBA infrastructures, lack of BDA skill, and the lack of framework for the implementation (Zahid et al., 2019).

There is no research on the area of big data analytics readiness assessment in the Ethio Telecom. Numerous organizations adopt technology without seeing their level of readiness for that technology which, leads to ineffective implementation and may lead to failure. Therefore, the organizational readiness for embracing big data technology must be assessed to discover the organization's maturity in showing the potential of this technology. BDA assessment shows the company's current state of progress in terms of Big Data analytics and provides a practical roadmap of future steps need to be taken. While several studies focus on technological aspects for readiness assessment without looking at other ones (Farzaneh et.al 2018). It should be noted that organizations need to be prepared in non-technological aspects such as their structures, people, financial strategies, etc. (Farzaneh et.al 2018). Therefore, there are various main areas and Big Data-related subjects that should be considered in Big Data systematic assessment to prevent the

problem of poor implementation and failure. There is an urgent need for assessment which guide Ethio Telecom and improve its implementation and readiness level before adopting big data analytics technology. The main aim of this study is assessing the readiness of big data analytics in Ethio Telecom

1.2.1 Research Questions

1. To what extent Ethio Telecom is ready to adopt big data analytics?
2. What change must Ethio Telecom embrace before adopting big data analytics?

1.3 Objective of the study

1.3.1 General objective

The primary objective of the study was to assess the readiness of Ethio Telecom for the adoption of Big Data Analytics.

1.3.2 Specific objectives

- ✓ Conduct critical literature reviews on the idea of big data and big data analytics.
- ✓ To identify factors that affect the readiness of Ethio Telecom to adopt big data analytics.
- ✓ To select assessment framework and influencing factors that allow the measurement of the "readiness gap".
- ✓ To assess Ethio Telecom's current BDA capabilities.

1.4 Significance of the study

Telecom organizations follow Big Data Analytics to improve customer experience, network optimization, and data driven decision making. Assessing readiness for adopting new technologies was always an important issue in organization. BDA is one of the top ten technologies of this century and it consumes high cost. This study will offer a readiness assessment of Ethio Telecom and provide fruitful information regarding the setbacks to implementing Big Data. Additionally, this study will try to distinguish the important factors affected the implementation within Ethio Telecom. From a methodological perspective, the study provides information based on the model, on what kinds of preparation must be made before adopting big data analytics in Ethio Telecom. From a theoretical perspective, very little literature has been academically recorded on the

assessment of Big Data Analytics readiness within telecom sector. This study used five-dimensional model to assess big data readiness in Ethio Telecom. Hence, this study will be contributing significantly to the literature of the information systems body of knowledge especially for big data analytics in telecom.

1.5 Scope and limitation of the study

The scope of this study is to be assess the readiness of Ethio Telecom to adopt big data analytics. The assessment was technological and non-technical perspectives. In this study quantitative and qualitative data is collected from Ethio Telecom information system and security divisions, these division are primarily responsible for new technology. There are 23 divisions in Ethio Telecom due to time and other limitation the study collect data only from information system division and security divisions.

1.6 Organization of the study

The study is organized into five chapters. To provide the reader a guideline on the structure and content of each chapter, an outline is provided, together with a summary of each chapter.

Chapter one: This chapter is an introductory chapter, which offers a brief introduction to the study. This chapter contains problem statement, research questions, research objectives, significance of the study, and scope and limitations of the study.

Chapter two: This chapter describes the literature review of the study and related works done by other researchers. Big Data concepts and Big Data readiness assessments are discussed. Based on the factors identified from the literature review, a research model is presented. This model is essential for data collection as it clearly indicates what type of data is to be collected and from whom.

Chapter three: In chapter three, describes the Methodology used followed by descriptions of the data collection and the data-analysis techniques that were implemented in this study.

Chapter four: This chapter presents the results found from the analysis of the collected data. This is done by generating descriptive analysis, correlation, and regression analysis to test the hypotheses developed. And present discussions based on the finding

Chapter five: In this chapter present conclusion of the research and appropriate recommendation will presented for future.

Chapter two

Literature review

This chapter reviews the different literatures that are related to the objective of the study. In this literatures section will be covered, the basic concept of Big Data, Big Data benefit, the main technological components in a Big Data, Big Data Analytics, Big Data in Telecom, Data analysis in traditional system, Business Value of Big Data Analytics, application of Big Data in telecom, big data management, factors influencing Big Data readiness analytics.

2.1 Big Data Analytics

Big Data is a set of large data that is hard to store, share, search, visualize, and analyze using conventional data processing and is the largest of that, the data warehouses (Agrawal, 2015). The first concepts mainly associated with Big Data are data storage and data analysis. According to Gartner, Big Data is a high volume, velocity and variety information asset that demands cost effective, innovative forms of information processing for improved insight and decision making. After that, the idea evolved to "5 Vs" by adding Veracity and Value to the former "3 Vs" (Erl et al., 2016). Newly, Big Data has been designated by 9 Vs under five categories which are: collecting data, processing data, integrity data, visualization data and worth of data (Sami & *Sael, 2016).* The first V is Volume which is huge amounts of data, from datasets with sizes of terabytes to zettabytes. Velocity is the second V that is large amounts of data from transactions with high rates resulting in data streams coming at great speed and the time to act based on these data streams will often be very short. The third V is variety, which is the nature of the data structured, semi-structured and unstructured. Structured data is a data that is stored in relational databases table in the form of row and column. It generally refers to the data that has defined the length and format of the data (Patil & Bhosale, 2018). Semi-structured data is data that cannot be stored in the form of a table but can be stored in certain types of files which hold some specific marker or tags. In general, it is a data that does not conform to the formal structure of data. Log files, XML and JSON are the examples of this type of data (Patil & Bhosale, 2018). Unstructured data is data without any specific structure and could not be stored in a row or column format. These data do not fit smartly into the traditional row and column structure of the relational database. Text, pictures, and videos are examples of

unstructured data. To analyze the unstructured data advanced technology is needed (Patil & Bhosale, 2018). Veracity is the Fourth V, and it Refers to inconsistency and uncertainty in data that is data which is available can sometimes get messy and quality and accuracy are difficult to control. Big data is also variable because of the multitude of data dimensions resulting from multiple disparate data types and sources. The next V is variability refers to the data which keeps on changing constantly. It is different from variety. It also refers to data arriving constantly from different sources and how efficiently it differentiates between noisy data or important data. Visualization is another important V which indicates how you can present your data to the management for decision making purposes. Visualization can be described as interpreting the patterns and trends that are present in the data. Validity As such, Big Data veracity is a matter of validity, meaning that the data is correct and accurate for the intended use. Clearly valid data is the key for making the right decisions (Mikalef et al., 2018). The other v is Volatility When we discuss about volatility of Big Data, we can simply recall the retention policy of structured data that we implement every day in our businesses (*Sami, S., & Sael, N. (2016)*. Once retention period expires, we can easily destroy it. The most important V is value. The bulk of Data having no value is of no good to the company, unless you turn in to something useful. Data by itself has no use or importance, but it needs to be converted into something valuable to extract information.

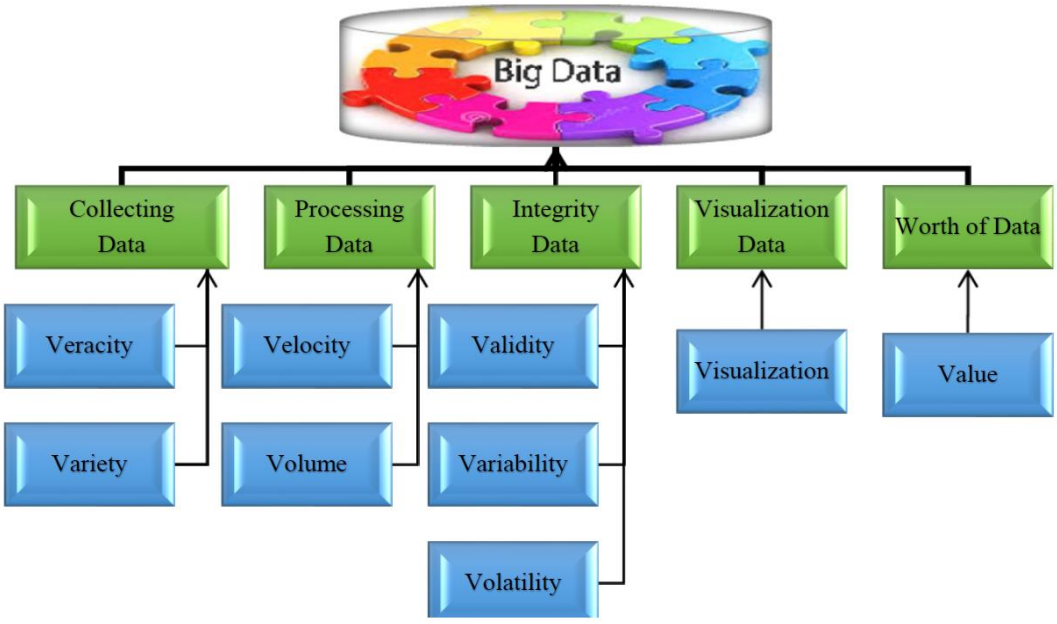

Figure 2-1 9V's of big data. *(Sami & Sael, 2016).*

Big data analytics is advanced analytic techniques operate on big data which hold structured, semi-structured and unstructured data, from different sources (Ved, & B, 2019). BDA is the process of collecting, organizing, and analyzing huge sets of data which is Big Data to discover patterns and valuable information (Cheng et al., 2016). This can help organizations to better understand the information contained within the data and will also help identify the data that is most crucial to business and future business decisions. Using advanced analytics, businesses can study big data to identify the current state of the business and track advancing attributes such as customer behavior. The telecom industry can make the best use of big data analytics for enhanced business decisions and prospects (Ved, & B, 2019).

2.2 Types of Big Data Analytics

According to Riahi et al., (2018) there are four types of data analytics.

Descriptive analytics: It is introductory, retrospective, and answers the question: What is happening? It supports Telcom to understand the relationship between subscribers and products, helping them to gain an appropriate understanding of what approach to take in the future for enhanced improvement. It identifies and examines historical patterns in subscribers' product and service consumption behavior, helping Telcom learn from past behaviors to manipulate future outcomes (Riahi et al., 2018).

Diagnostic Analytics: It contains of asking the question: Why did it happen? Diagnostic analytics looks for the root cause of a problem. It is used to verify why something happened. This type attempts to find and understand the causes of events and behaviors (Riahi et al., 2018).

Predictive analytics: To determine future possibilities looks ahead to the future and are a bit beyond proactive with its findings (Sivarajah, U. et al., 2017). Predictive analytics provides Telecom with actionable insights based on existing data. It provides an estimation regarding the possibility of a future action. It utilizes various machine learning, clustering, and data mining techniques to perform precise and accurate analysis. Telcom can implement their prediction model in different aspects to forecast prospective tendencies to take immediate actions.

Prescriptive analytics: It is about optimization and randomized testing to measure how businesses advance their service levels at the same time as lowering the expenses (Sivarajah, U. et al., 2017). This methodology is the most advanced stage in the business analysis process and the one that

calls businesses to action, helping executives, managers and operational employees make the best possible decisions based on the data available to them. It can identify optimal solutions for telecommunication industries via revenue generation and churn reduction.

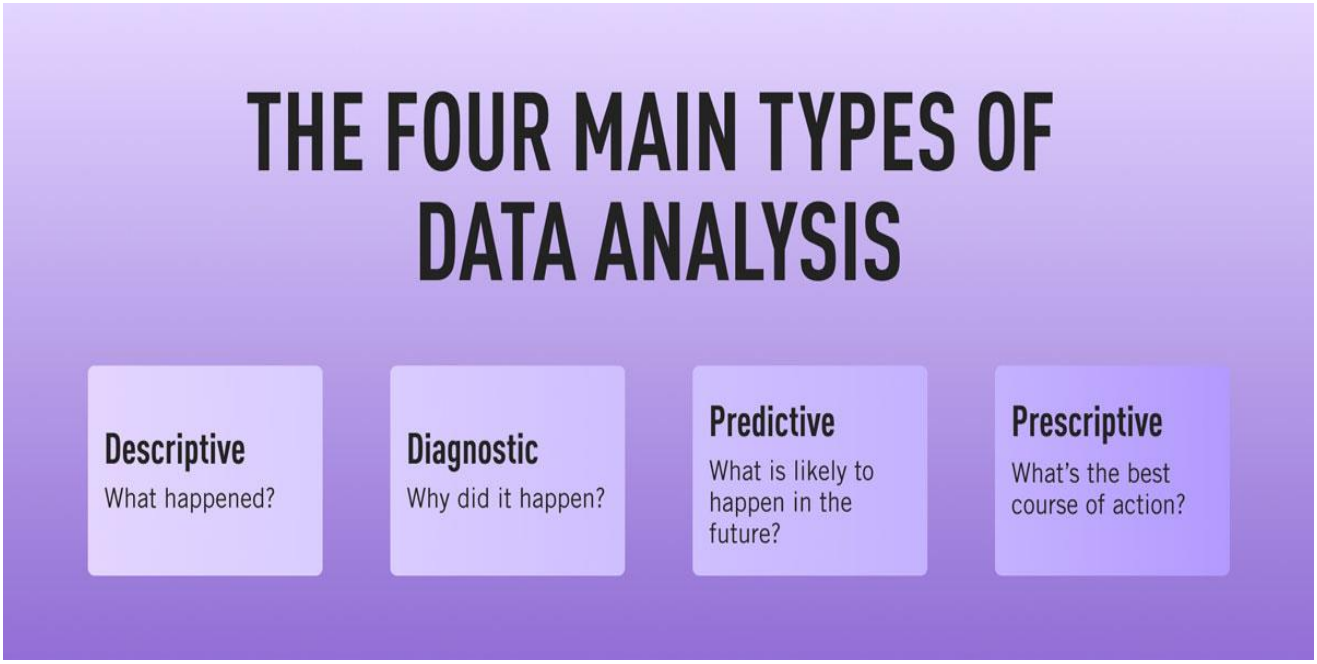

Figure 2-2 Classification of types of big data analytical. (https://dpbnri2zg3lc2.cloudfront.net/en/wp-content/uploads/old-blog-uploads/the-four-main-types-of-data-analysis-1.jpg

2.3 Benefits of Big Data

In the telecom sector, BDA is a game changer, as it gives operators the opportunity to exploit new data sets and extract valuable information to better understand customer behavior. So, telecom operators offer more targeted services, thereby improving revenues and reducing cost timely insights from the huge amounts of data. This includes those already stored in company databases, from external third-party sources, the Internet, remote sensors, and social media (Kastouni & Lahcen 2020). According to Kastouni & Lahcen the benefits of BDA in the telecommunications sector are service quality improvement, The quality of experience can be improved at every touch point through high-performance services, fast feedback, and personalized services, real Time call data CDRs monitoring to detect abnormal behaviors, network proactive care and anomaly detection, network monitoring combined with real-time call drop rate analysis to provide call

routing optimization, automated products generation based on customer preferences, and leveraging social media and web data fused with marketing initiatives to achieve a better return on investment from marketing campaigns.

2.4 Business Value of Big Data Analytics

Big data and analytics are possible causes of revenue for telecom operators, at a time when carriers have been sensing pressure to produce new sources of revenue. One of the sources comes from their capability to mine the huge amount of data they produce or have access to in both their customer base and their networks. Telcom wants to make sure the Over-the-top communication via their network is stable for improving the customer experience based on the key business objectives. This action will lead towards increasing revenue, reducing the churn and operation expenditure (OPEX). Yayah and his friends, Telcom operator believes that adopting big data technology which is extract hidden information within the large data set, offers capability will play a critical role to achieve the business objectives (Yayah et al., 2017).

According to Jony et al., (2015) big data brings business benefits to the organization. Some of them are presented as follows.

1. Create transparency: Organizations can make their business progress and strategies transparent by making their timely big data accessibility for the stakeholder.
2. Supply chain management: Organizations can improve supply chain management using BDA by ensuring real time delivery management, better vendor management automated product sourcing and segmented supply chain.
3. Dynamic pricing: BDA helps organizations to optimize their product pricing based on customer need and market research and business targets.
4. Target marketing: BD allow organizations to do target marketing by providing information about customer.
5. Innovative new business models, service, and products: Organizations get proper insights about market using appropriate data analysis.
6. predictive analysis: It can recognize event before happening and predict the consequence before implementation.

7. Better understand the customer: Organization use their customer data to recognize their customers more efficiently and know how, when, and what they want.
8. Improve performance: BDA offer improved performance by advancing decision making accuracy and saving time.
9. Data-Driven Decision-Making (DDDM): It is the technology to use data analytics as insights for decision making.

2.5 Data analysis in traditional systems

In the past four decades Relational databases and data warehouses, which are traditional data systems, were the primary means of businesses and organizations have stored and analyzed their data (Patil & Bhosale, 2018). These traditional analytical systems are used to capture, clean, transform and integrate data from several operational systems before loading them into a data warehouse (Billy & Motau, 2017). They are intended from the ground up to work with data that has mainly structured data. According to Billy & Motau, (2017) characteristics of structured data include the following:

- Clearly defined fields are organized in records which are usually stored in tables. Fields have names, and relationships.
- Schema that involves data be validated alongside a schema before it can be written to disk. A substantial volume of required analysis, design, and effort up front can be involved in placing the data in clearly defined structured formats.
- Designed to get data from the disk and load the data into memory to be processed by applications. This is an extremely inefficient architecture when processing large volumes of data this way. The data is tremendously large, and the programs are small. The big component must move to the small component for processing.
- The data are managing and accessing Structured Query Language.
- The data is often read in 8k or 16k block sizes by RDB and warehouse systems. These block sizes load data into memory, and then the data are processed by applications.

The word “business intelligence” presented by Howard Dresner of the Gartner Group in 1989, explaining “a set of concepts and methods to improve business decision making by using fact-based support systems” (Power 2007). The first practical BI systems were implemented at large

consumer goods manufacturers like Procter & Gamble and retailers like Wal-Mart for the aim of analyzing sales data (Power 2007). The focus of these traditional BI solutions is on analyzing past data to answer questions like “how much did well sell in a certain region?” and “how much profit did we make last quarter?” (Debortoliet al., 2014).

Basic BI infrastructure encompasses both business processes and practices and technological components. The technological components used to support the business processes comprise tools that include OLAP, DW, DM, business performance management, document warehouses, text mining, executive information systems and decision support systems (*O'Brien* & Kok, 2006).

Comparison of traditional data and big data

	Traditional data	Big data	Advantage of big data
Data architecture	Centralized database	Distributed database	Cost effective
Types of data	Structured data	Unstructured and semi-structured	Improve variety
Volume	Small amount of data. Range- Gigabyte - terabytes	Large amount of data. Range- <petabytes.	Cost reduces and help business intelligence
Data schema	Fixed schema	Dynamic schema	Preserves the information in data.
Data Relationship	Relationship with data is explored easily	Difficulty in relationship between data items.	-
Scaling	More than one server for computing	Single server for computing	Cost effective
Accuracy	Less accurate results	High accurate results	Confident results and reliable

Table 2.1. Traditional data vs big data. (Patil & Bhosale, 2018)

2.6 Big Data Architecture

Big data architecture is designed to handle the ingestion, processing, and analysis of data that is too large or complex for traditional database systems. It is the foundation for big data analytics. It is the overarching system which is used to manage large amounts of data so that it can be analyzed for business purposes, steer data analytics, and provide an environment in which big data analytics tools can extract vital business information from otherwise ambiguous data. The big data

architecture framework serves as a reference blueprint for big data infrastructure and solutions, logically defining how big data solutions will work, the components that will be used, how information will flow, and security details.

The objective of a reference architecture is to create an open standard, one that every organization can use for their benefit. The National Institute of Standards and Technology (NIST) is one of the leading organizations in the development of standards that has developed such a reference architecture: the NIST Big Data Reference Architecture. Big Data reference architecture has benefits to organizations (Chang et al., 2019). It provides a common language for the various stakeholders, It encourages adherence to common standards, specifications, and patterns, It provides consistent methods for implementation of technology to solve similar problem sets, It illustrates and improves understanding of the various Big Data components, processes, and systems in the context of a vendor's and technology-agnostic Big Data conceptual model and It facilitates analysis of candidate standards for interoperability, portability, reusability, and extendibility.

NIST Big Data Reference Architecture

NIST Big Data Reference architecture composed of five logical functional components and roles (NIST Big Data Interoperability Framework: Volume 6, Reference Architecture)

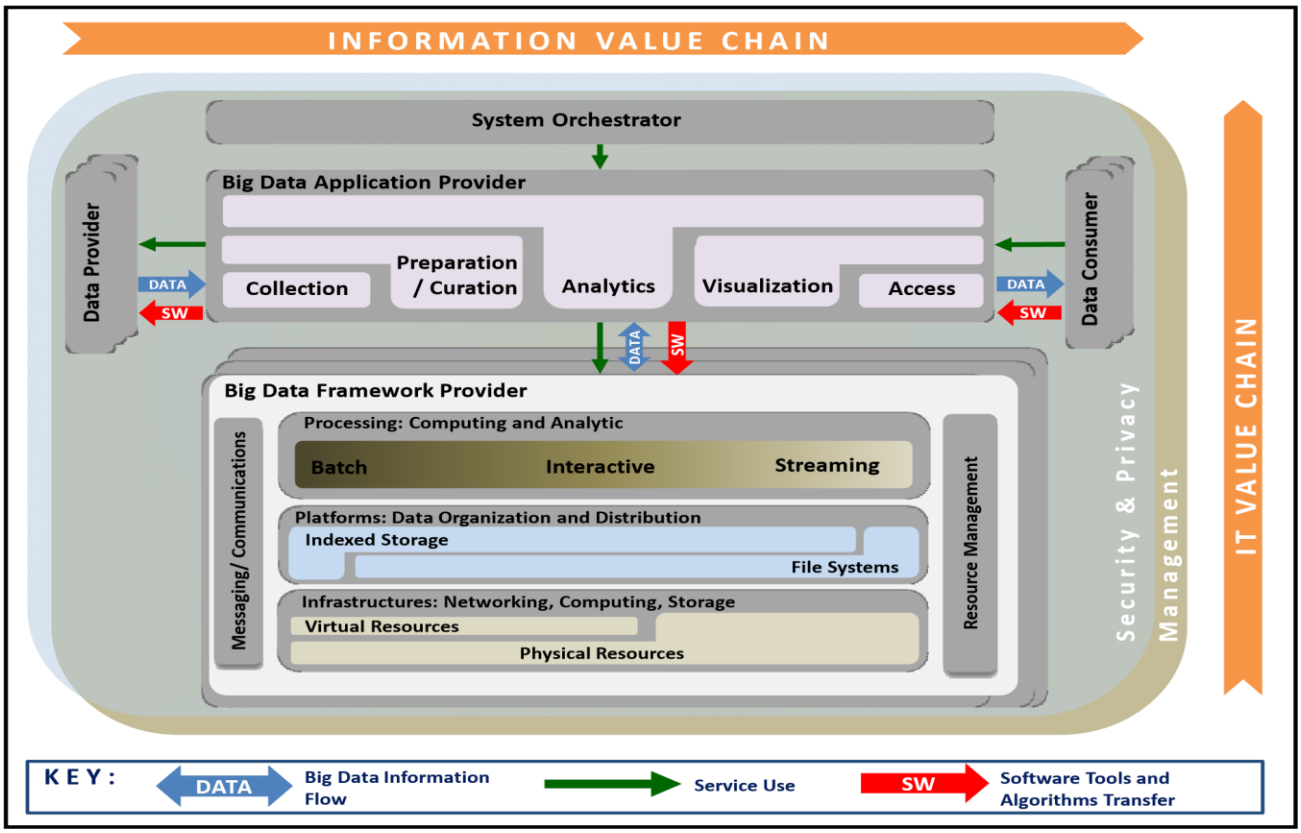

Figure 2-3 The NIST Big Data Reference Architecture. (Chang et al., 2019)

In the NIST special publication, there are five main component of big data reference architecture which are: system orchestration, data provider, big data application provider, big data framework provider and data consumer (Chang et al., 2019).

System Orchestration is the automated arrangement, coordination, and management of computer systems, middleware, and services. Orchestration ensures that the different applications, data, and infrastructure components of Big Data environments all work together.

The Data Provider role introduces new data or information feeds into the Big Data system for discovery, access, and transformation through the Big Data system. The data can originate from different sources, such as human generated data (social media), sensory data or third-party systems. Sources can include internal enterprise systems (ERP, CRM, network, CDR, call center) or external systems (social media).

The Big Data Application Provider is the architecture component that contains the business logic and functionality that is necessary to transform the data into the desired results. The common

objective of this component is to extract value from the input data, and the main activities of big data application provider is collection, preparation, analytics, visualization, and access of the data

The Big Data Framework Provider has the resources and services that can be used by the Big Data Application Provider and provides the core infrastructure of the Big Data Architecture. In this component, the data is stored and processed based on designs that are optimized for Big Data environments. The Big Data Framework Provider can be further sub-divided into Infrastructure: networking, computing, and storage, Platforms: data organization and distribution, Processing: computing and analytic.

The role of Data Consumer within the Big Data Reference Architecture can be an actual end user or another system. In many ways, this role is the mirror image of the Data Provider. The activities associated with the Data Consumer role include search and retrieve, download**,** analyze locally**,** reporting**,** visualization**,** data to use for their own Processes (Chang et al., 2019).

2.7 Hadoop Ecosystem

Apache Hadoop is a so-identified Big Data technology that has an essential support community. It was founded by two Yahoo employee who are Doug Cutting and Mike Cafarella, in 2005 (Uzunkaya et al., 2015). Apache Hadoop Java-based programming framework that allows for distributed storage and processing of large data sets on commodity hardware by avoiding the low performance and complexity encountered when processing and analyzing Big Data using traditional technologies (Oussous et al., 2018). Hadoop provide rapidly process large data sets, due to its parallel clusters and distributed file system and ability to run programs while ensuring fault-tolerance, usually encountered in a distributed environment.

Hadoop has two main subcomponents: HDFS and the MapReduce framework. In addition, users can add modules on top of Hadoop as needed according to their objectives (Oussous et al., 2018).

To store data Hadoop uses HDFS and Apache HBase which is non-relational Database. HDFS (Hadoop Distributed File System) is a distributed, scalable, and portable file system that runs on large clusters of commodity machines (Oussous et al., 2018). HDFS is mostly designed to store a huge volume of data in a reliable and fault tolerant fashion (Suguna 2016). HDFS permits users

to have a single addressable namespace, so it is simpler to manage the data and distribute across thousands of servers, creating a single large file system (Uzunkaya et al., 2015). It offers streaming data access for useful data processing. The master slave architecture used by HDFS also has the concept of a block (Oussous, et al., 2018).

HBase is a non-relational, distributed database management system that works efficiently on sparse data sets and is highly scalable (Oussous, et al., 2018). HBase is a distributed non-relational database built on top of HDFS.

MapReduce and YARN constitute two options to carry out data processing on Hadoop. They are designed to manage job scheduling, resources, and the cluster (Oussous et al., 2018). MapReduce is a framework composed of a programming model and its implementation. It is one of the first essential steps for the new generation of Big Data management and analytics tools. MapReduce has an interesting benefit for big data applications. In fact, it simplifies the processing of massive volumes of data through its efficient and cost-effective mechanisms. It enables writing programs that can support parallel processing (Oussous et al., 2018). YARN provides better scalability, enhanced parallelism, and advanced resource management in comparison to MapReduce. YARN helps to open Hadoop by allowing it to process and run data for batch processing, stream processing, interactive processing and graph processing which are stored in HDFS. It offers operating system functions for Big Data analytical applications. It is a framework for job scheduling and cluster resource management (Nagdive & Tugnayat, 2018).

Apache Pig and Hive provide scripting language to query data from Hadoop. Pig is a high-level framework which make sure us to work in coordination with either Apache Spark or MapReduce to analyze the data. It is an open-source framework that generates a high-level scripting language called pig Latin (Oussous, et al., 2018). Hive is a data warehouse tool mainly used for analyzing, querying, and summarizing of analyzed data ideas on top of the Hadoop framework. Hive offers a SQL-like language called HiveQL (Oussous, et al., 2018). This enables users to access and manipulate Hadoop based data stored in HDFS and HBase.

Sqoop and Flume are used to ingest data to and from Hadoop. Sqoop is a framework applied to transfer the data to Hadoop from relational databases. It offers a command line interface (CLI) that makes sure an efficient transfer of bulk data between Apache Hadoop and structured data stores such as relational databases, enterprise data warehouses and NoSQL databases (Nagdive & Tugnayat,

2018). Flume is designed to collect, aggregate and transfer data from external machines to HDFS. It has a simple and flexible architecture and handles streaming of data flows. Flume is based on a simple extensible data model to handle massive, distributed data sources (Oussous et al., 2018). Storm (Mazumder, 2016) is an open-source distributed system that has the benefit of handling real time data processing in difference with Hadoop, which is designed for batch processing. In contrast to flume, Storm presents better efficiency in implementing complex processing requirements by relying on the Trident API (Oussous et al., 2018).

Spark is an open-source distribution processing framework first developed in the AMP Lab at UC Berkeley. Spark is similar Hadoop but offers a simpler to use preference to Hadoop MapReduce and offers performance up to 10 times faster than Hive and Hadoop via MapReduce memory system (Oussous et al., 2018).

Apache Mahout and R programing are used to data analytic. Apache Mahout is an open-source machine learning software library. Mahout can be added on top of Hadoop to execute algorithms via MapReduce. It is designed to work also on other platforms (Mazumder, 2016). R programming is a programming language for statistical computing, machine learning and graphics (Oussous et al., 2018).

Coordination and Work flow are managed by zookeeper and oozie. Zookeeper is a centralized service which is used to offer coordination between distributed applications of Hadoop (Mazumder, 2016). Oozie: Is scheduling system for workflow management and executing workflow routes for successful completion of the task in Hadoop (Mazumder, 2016). Apache Ambari: Apache Ambari is aimed at making Hadoop management simpler by developing software for provisioning, managing, and monitoring Apache Hadoop clusters. Ambari offers an intuitive, easy-to-use Hadoop management web UI backed by its RESTful APIs (Oussous, et al., 2018).

2.8 Issues related to Big Data

There are many big data related issues (Patil & Bhosale, 2018). Some of them are Big Data management, Storage and transport, Privacy and security, Analytical challenge, technical challenge, Scalability, Quality of data, Heterogeneous data, human collaboration, and Tool selection are big data related issues. Big Data management is the administration, management, and governance of huge volumes of structured, semi-structured and unstructured data is big data management (Kaur & Monga, 2016). BDM is an ability for an increasing number of organizations

in various areas and characterizes a set of challenges containing big data modeling, storage and retrieval, analysis, and visualization (Rossi & Hirama, 2015). It is a new discipline where data management techniques, tools, and platforms involving storage, pre-processing, processing, and security can be functional and its purpose is to ensure the usefulness of big data storage, analytics applications, and security (Siddiqa et al., 2016). Privacy and security are other big data related issue. Big Data should be secured by setting policies and regulations while collecting, storing, sharing, and accessing of these data (Sajjad & Dhary, 2020). Privacy is one of the most critical and sensitive challenges with big data. There are privacy issues in various areas which are privacy issues in big mobile data, Privacy Issues in Social Media data, and Privacy in web Usage Data. The other issue is Analytical challenges**.** Big data gets a huge number of analytical challenges along with it. Big data creates voluminous data along with it which can be in unstructured, structured, and semi structured form and to analyze such data needs advanced skills. Types of analysis needed to be done on the data depends on the results obtained (Patil & Bhosale, 2018).

2.9 Big Data in Telecom

With the adoption of smart phones and growth in mobile internet, Telecom has access to amazing volumes of data sources including customer profiles, device data, network data, customer usage patterns, location data, and apps downloaded, etc. Wang, et al., (2017) stated that telecommunication data is mainly resulting from three sources

1. Data in IT system: user attributes, business consumption information, and terminal information data collected from CRM, billing systems, and terminal self-registration platforms, respectively.
2. Data to access network and core networks: mobile signaling, DPI, M2M data, etc.
3. Data on operators' own Internet applications: online business hall data, palm business office data, wing payment data, etc.

Big Data analytics over telecom data can be used effectively by management to better plan. Some common opportunities that can result from big data analytics in the telecom sector are: Flexible customization of subscriber calling plans, optimization of routing by virtue of real-time network traffic analysis, promotion of location-based marketing campaigns to individual customers, identify fraudulent behavior through real-time analysis of call data records, develop new products

and services based upon insights into customer behavior and usage, customized service plans for different consumers, area wise bandwidth allocation (Ved & Rizwanahmed ,2019).

According to Jony et al., (2015) application area of big data in telecommunication sectors are customer satisfaction, network optimization, marketing, and sales, and improving customer care services.

A satisfied customer is the best business strategy of all. To continue in this ever advancing and highly competitive world, companies need to stay updated with the latest technologies that would further help them grow. Big data analytics in organization become a top priority to enhance customer experience (Billy & Motau, 2017). Customer experience is the response of a customer to communicate with an organization before, during, or after purchase or consumption, across multiple channels, and across time, and has emerged as a sustainable source of competitive advantage (*Holmlund* et al., 2020).

Right offers at the right time can be presented to the customers to increase the number of customers. Helping customers when they are in trouble is the best way to retain them. With digitized customer support systems and the future of customer service, Big Data has been at the center of its development.

Operators have always been worried about network performance enhancement. Now with big data analytics operators can detect problems, perform real-time troubleshooting, and fix network performance issues (Jony et al., 2015). It might also offer improved network quality, less power consumption, and efficient resource management (Islam & Reza, 2019). Telecoms via predictive analysis are seeking to fabricate more efficient data network models. By analyzing real-time network traffic in highly congested areas, network expansion decisions can be made straightforwardly.

Marketing and sales can be considered as the major areas of big data usage in the telecom industry (Jony et al., 2015). Appropriate big data analytics enables operators to build more knowledgeable marketing campaigns, and to do sales analytics to expand the sales. It can also be utilized to improve the results of marketing promotions, increase revenue, and implement geo-marketing and real-time marketing (Islam & Reza, 2019).

According to Jony et al., (2015), Operators can use big data analytics to enhance customer care services. Operators can have visualization on reason of subscribers call, and then execute an automated procedure to resolve their calls faster. Providing a higher level of customer care can be a key strategy in differentiating an operator's brand form its competitors. Big data analytics can allow the operators to reduce the numbers of customer care calls and earn customer satisfaction by solving the subscriber problem in real time (Islam & Reza, 2019).

2.10 History of data analytics in the telecommunications industry

The idea of Data analytics may be new for some organizations while it is not new for the telecom industry (Kastouni & Ait, 2020). According to these researchers, the first generation of telecom industry data was generated which are related to simple data transactions, such as texting and voice calls and data analytics focused, mainly, on business and operational efficiencies.

The second generation 2G networks, employed digital communication over TDMA and CDMA, brought a set of new services, such as text messages, picture messages, MMS, faxing, and voicemail. The second-generation devices were designed with limited storage and processing capabilities. Combining all this, the telecommunications providers were able to perform data-intensive operations, such as automating frequently generated reports and dashboards (e.g., sales, revenues ...etc.). The technical solutions were built upon the old conventional data bases and data warehouses, which used distinctive modes of information accumulation, extraction, and analysis technologies. The analytical capabilities were based on statistical methods (Kastouni & Ait, 2020).

The 3G network and handset were designed to have 2Mbps speed to meet the demand for multimedia through the cellular system. During this phase, the telecommunications operators switched from focused asset behavior analytics to focused customer behaviors analytics. New data types have been made available, notably, graphics and videos, widening the spectrum of exploited data, and providing telecommunication operators with sophisticated analysis capabilities (Kastouni & Ait, 2020).

The advent of the 4th generation mobile networks marked a turning point in analytics usage in the mobile ecosystem. The telecommunications providers started producing new insights on network performance and users' behaviors, which contributed to the creation of new revenue streams, improvement of customer experience, and boosting of customer retention (Kastouni & Ait, 2020).

The launch of the Hadoop ecosystem in CSPs portfolio solutions, revolutionized the data analytics realm, as it provided new tools and techniques to overcome the limitations of the old conventional data bases and data warehouses, in terms of performance, scalability and analytical tools (Kastouni & Ait, 2020).

2.11 Factors influencing Big Data readiness

Researchers explored several factors that influence Big Data readiness in an organization (Billy & Motau 2017). The factors are different from organization to organization. Farzaneh et.al (2018) mentioned in their assessment model twenty-nine factors. TDWI big data maturity model has 25 factors. Billy & Motau (2017) pointed thirteen factors for big data analytic in developing country. Jong & Yun (2019) nine factors are selected on big data adoption in Korean firm. Management support, human resources, business IT alignment, vendor support, competition, integration, data access, data security and privacy, data quality and integrity, technological resources, data policy, decision making culture, business and big data strategy alignment, data storage and processing, and financial resources are some of the factors which are pointed in common at least in two of the research papers.

Management support: according to Jong & Yun, (2019) management support is the degree to which management recognizes the importance and relevance of big data. Getting maximum value from analytics would require full support of management. In many IT projects, top management accepts, and support is crucial, without top management support and a clear vision of the objectives of implementing big data analytics, the project is unlucky to fail (Chanyagorn & Kungwannarongkun, 2011). Organizations will gain the full benefit from Big Data analytics when management supports the adoption of big data analytics by offering the necessary resources and inspiring data-driven decision making (Farzaneh et.al 2018).

Human resource expertise: In studies by Singh & Singh, (2012) and Pearson et al., (2014) for big data analytics show that the main worry is the fact that organizations should have capable employ and attract employees with suitable skills to handle Big Data and analyze them to realize business benefits associated with it. The availability of human resources with the required skillset and competencies is a basic requirement. The availability of professionals with the right IT skills and capabilities to perform business analytics is the key in the situation of BDA usage (Walker &

Brown, 2019). Robust programming, statistical and analytical skills support in implementing big data in organizations. Goss and Veeramuthu (2013) stated that successful analytics of Big Data requires a mixture of a rules-driven business process, analytics, and people with the right skills.

Business IT alignment: Cross functional collaboration between IT (data scientists, IT specialists, data analysts) and other operational departments helps Big Data adoption because it leads to more integrated objectives for such adoption throughout the organization. The alignment between IT and business leads to more data management, high quality data and specific strategies for adopting Big Data (Farzaneh et.al 2018).

Data Quality and Integrity: Walker & Brown (2019) stated that decision-making from big data analytics influence by data quality, which is collected and integrated from different sources. Untrustworthy and inadequateness are also linked with low data quality, which affects difficulty in the big data adoption process. Ensure quality in the acquisition, transformation, manipulation, and analysis of data, as well as in the validity of the results. To get maximum value of big data collecting complete data, validated data, timeless data, and accurate date are the core values.

Technological resources: Naseebullah et al., (2013) who stated that new infrastructure is essential when preparing for BDA to successfully control these numerous types of data structures, organizations that require infrastructure, data, analytics, organizational structure, and governance processes to make Big Data analytics operational and actionable. To collect, store, and process big data, organizations need a flexible and callable technological infrastructure. Due to the increase of data organization needs to be adopted new techniques and approaches. The availability of right big data tool facilitates the big data adoption process (Farzaneh et al., 2018).

Vendor support: Vendors make it easier to run big data technology that is open source and align tool for big data platforms. There are vendors in the market which offer Big Data technological solutions and analytics tools (Farzaneh et al., 2018). BDA implementation has become slow due to the absence of commitment or effectiveness from vendors (Walker & Brown, 2019).

Competition: Manyika et al. (2014), stated that organizations may lose competitiveness if they fail to systematically analyze the available information needed for decision making. To enhance competitive advantage, organizations need to analyze all kinds of data that come from different

data sources (Farzaneh et al., 2018). Proper Big Data analytics needs to be done in comparison with what the competitors in the market are doing (Billy & Motau, 2017). Joseph & Johnson (2013) also stated that Big Data can improve decision-making and increase organizational efficiency and effectiveness, but only if organizations employ a variety of analytical tools and methods to make sense of the data

Data integration: Is the process of merging data from various and heterogonous data sources in unified view to meet users' queries. Telecommunications have multiple legacy systems and databases working for different departments and functions and supporting multiple products and services. It is not easy to address these fragmented data source and structure (Malaka & Brown, 2015). Moktadir et al. (2019) stated that, data integration can be achieved more easily by utilizing dedicated BDA tools.

Data-driven Decision-Making culture: Tekiner and Keane (2013) who stated that organizations need to employ data-driven decision making to gain competitive advantage. Information technology success can be affected by culture. Organizations with a culture that emphasizes analytical and fact-based decisions are more likely to succeed with big data. Goal's clarity, employee's engagement in decision making using data-driven analytics, trained personnel who take data-driven actions, and cross-functional viewpoint to data management are some examples of a data driven decision-making culture (Farzaneh et al., 2018). Adoption of big data is key to success in enhancing organizational productivity by data driven decision making.

Data security and privacy: Security and privacy of data is a critical issue and is an essential antecedent for Big Data adoption in organizations that store big data in the cloud (Farzaneh et al., 2018). Characteristics such as volume, velocity and variety contribute to unique threats that magnify the challenges of managing BDA security. Data security and privacy are a significant concern for telecommunications as they store confidential data of customers (Malaka & Brown, 2015). Chen et al. (2012) and Forbes Insights (2015) who showed that attention should be taken to the increased flow of data into an organization from various sources, as cyber security attacks and fraud may be also on increase.

Financial resources: Availability of finance to invest in big data analytics tools which are every expensive, has a significant role in improving Big Data readiness for adoption (Farzaneh et al., 2018). To process and analyze any kinds of data, organizations should have efficient economic power. There must be a measurable cost-effective way of analyzing them (Walker & Brown, 2019). If an organization is financially equipped, there will be more opportunities to adopt innovative technology. Juniper networks (2012) stated that: "the advent of Big Data analytics will require organizations to upgrade from the traditional online transaction processing (OLTP) data stores and structured query language (SQL) analysis tools to unique query tools.

Business and Big Data Strategy Alignment: To change the firm's business model of the firm to innovative one, aligning business strategy with Big Data resources such as physical infrastructure components, data science skills and knowledge assets is very critical to organizational Data (Farzaneh et al., 2018).

Data access: According to Peter wide-ranging access to data indicates productivity and effectiveness in decision making and provides appropriate responses to information requirements and service delivery (Peter 2016 p 58). This implies that accessibility involves the ease with which users obtain information. Access controls authenticate and authorize individuals to access the information they see and use. Implementing an adequate access control strategy in addition to authentication can be very effective in reducing the attack surface for the most common types of data breaches, such as phishing and social engineering attacks. Sharing of data to the right person at the right time for the right purpose contributes to big data adoption.

Data storage and processing: Availability of techniques and programming models to access large-scale data to extract useful information for supporting and providing decisions. This is basically helpful for adopting big data analytics. The advancement of technology like cloud computing and Hadoop provides solutions for the storage and processing of big data (Chen et al., 2014).

Policy: Sajjad & Dhary, (2020) state that Big Data must secure by setting policies and regulations. Data governance policy is a documented set of guidelines for ensuring that an organization's data and information assets are managed consistently and used properly. Policies must clearly state the accountability in the organization. It is serious that the governance framework recognizes the role

and duties of Data Stewards, data scientists, data engineers and general users for the organization (Peter 2016 p 58). NIST (2019) mention that some silos of data and data access control policies are required, however poorly defined policies could result in inconsistent metadata standards within individual organizations, which can hinder interoperability. Good security and data quality police have great impact on big data adoption.

2.12 Theoretical foundations research model

The intention of this study is to assess Ethio Telecoms' readiness for Big Data analytics based on Big Data adoption readiness models and the factors that influence organizations' readiness. Even though Big Data is in infancy phases, some assessment models that are relevant for big data adoption are recently built and have some limits like poor documentation, theoretically not tested and found to be fitted just for technological assessment (Farzaneh et al., 2018). De Bruin et al. (2005) argued that there is little documentation on how to develop maturity models that are theoretically good, carefully tested and extensively accepted. According to Farzaneh et al., (2018) some frameworks provide some dimensions to evaluate organization readiness of big data adoption.

Framework proposed by Kalema & Mokgadi (2016) grouped big data readiness in to three dimensions. Scalability, ICT infrastructure and security under technological dimensions. Organizational dimensions include top management support, organization size and finance. And computation, customers, and vendors under environmental context.

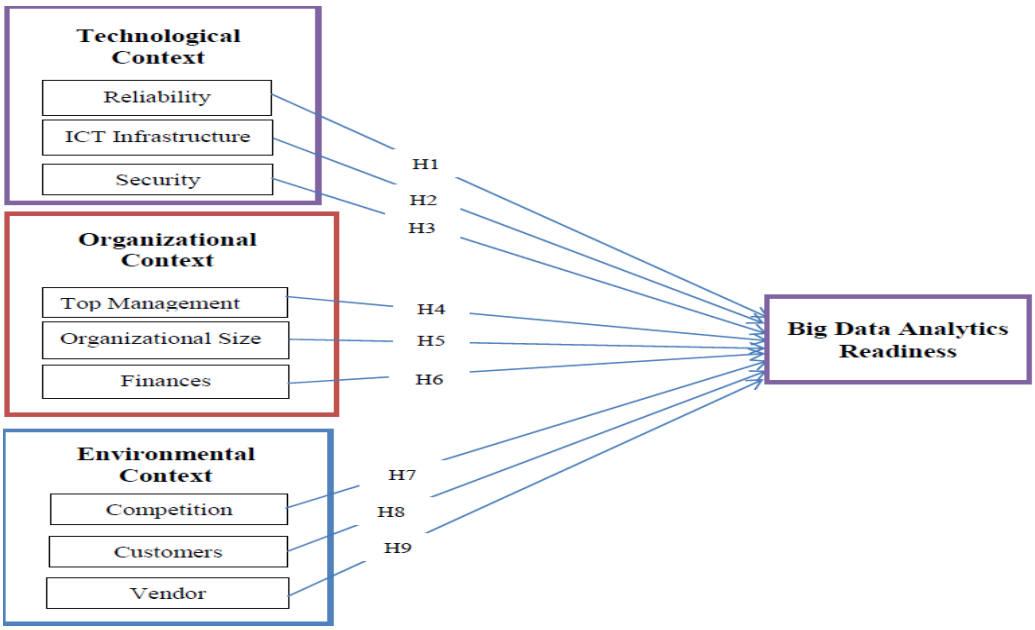

Figure 2-4 Big data readiness Framework. (Kalema & Mokgadi 2016)

Framework suggested by Klievink et at., (2016) has three dimensions organization alignment, organization maturity and organization capability. IT governance, IT resources, internal attitude, legal compliance, data governance, and data science expertise are factors in the framework of big data assessment.

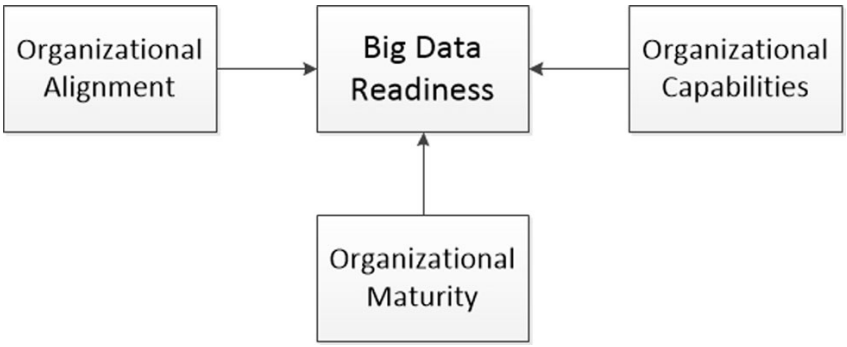

Figure 2-5 big data readiness assessment framework. (Klievink et at., 2016)

Framework suggested by Pedro et al, (2019) big data capability and readiness included alignment to company strategy, strong committed sponsorship, analytical skill, the right analytical tools, fact-based decision-making culture, a strong data infrastructure, legal compliance for data protection, and change management.

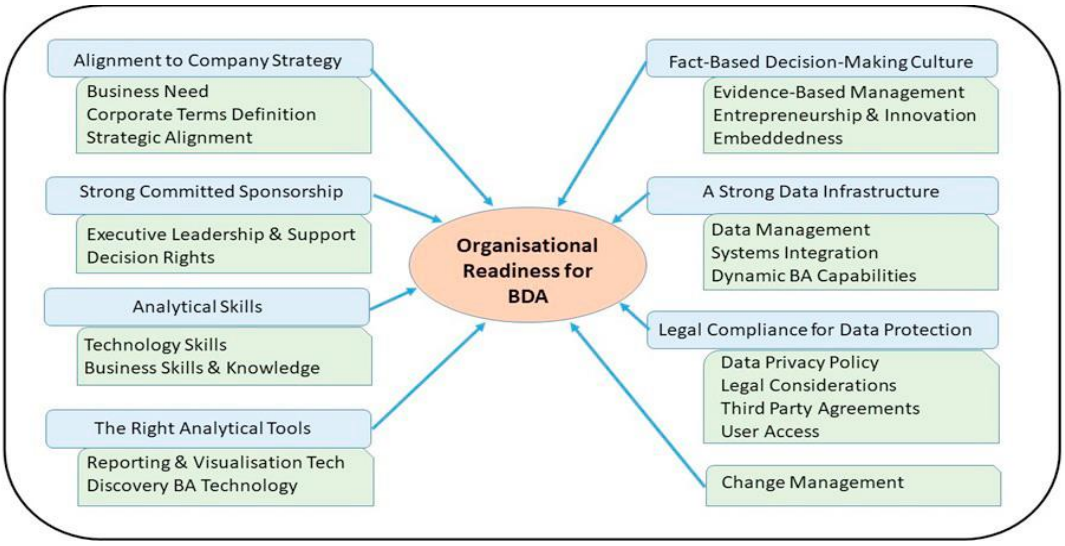

Figure 2-6 Capabilities Emerging from Thematic Analysis. (Pedro et al, 2019)

However, most of the frameworks are suffer from shortage of dimensions assessing for data management, Big Data strategy alignment and data integration (Farzaneh et.al 2018).

Farzaneh et.al (2018) proposed big data readiness assessment model, which has data ecosystem, organization specification, data management, resource (infrastructure, human, financial), and data specifications. In this model one dimension which is data specification was not clearly defined by Iranian telecom researcher and the name is also not convenient.

TDWI created big data maturity model tool to evaluate the maturity of big data in organization proposed by Halper and Krishnan (2013). This model has five dimensions which are organization, infrastructure, data management, analytics, and governance. TDWI big data maturity model tool have consists of five levels: nascent, preadoption, early adoption, corporate adoption and mature.

2.13 Framework dimensions

This study uses the Big Data Readiness assessment framework proposed by Farzaneh et al., (2018) combined with TDWI big data maturity model. Each model has five dimensions, and some dimensions are common like organization, data management, and infrastructure. Data governance is taken from TDWI which is very important dimension and data ecosystem from (Farzaneh et al. 2018). Due to this, in this research the researcher combines the two model and selected five dimensions. Data ecosystem, organization specifications, resources (technological, financial,

human resources), data management, and data governance are the dimensions of the research framework.

This model was used to get better understanding to evaluate the readiness of big data analytics in Ethio Telecom. Becase it provides readiness assessment that focuses on specific big data key areas like data management, data governance and data ecosystem in addition to organization specification and resources. This model was easier to understand and compare with other model, this model acumadeted nessasry dimenstions and factors.

1. **Organizational specifications**: this dimension related to all the decisions the organization has to make to adopt the big data to it needs. looks at support in the adoption of new technology from top management. It's easier for the management to influence the whole organization. This construct view the size, structure of the organization. organization, Data Driven decision making culture and Business & IT alignment led to big data adoption.
2. **Data ecosystem**: this dimension consistes of external factors include vendors, and competitors which are factors of big data adoption.
3. **Resources:** look at whether the organization's existing infrastructure,human resource and finance will still fit with Big Data and therefore this construct relates to the evaluation of the existing technology human experts and financial capabilities of the organization.
4. **Data managemnt**: This dimension ensurs Data quality, data access, storage and processing, and alignment between business and big data strategy to the company to manage its data in support of analytics.
5. **governance**: company's data governance strategy in support of its analytics program. Data governance offers the right sets of data to the right people when the need arises, so that the right decisions can be made The company able to manage users' data discovery and analytical explorations effectively without applying too many restrictions and getting in the way of their pursuit of insight. Data security, privacy and processing as well as data integration should be consid

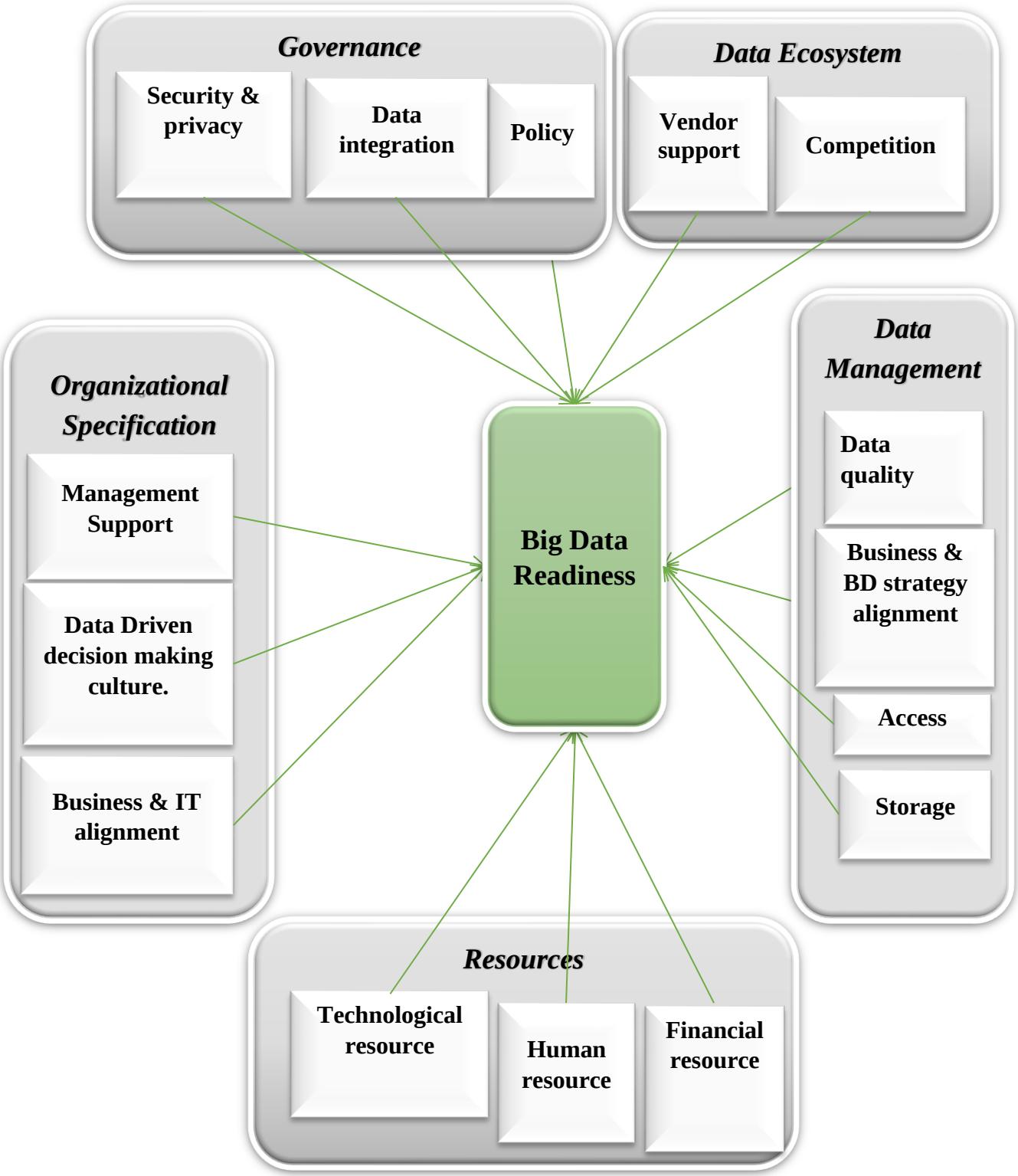

Figure 2-7 Conceptual framework for big data readiness assessment. (Farzaneh et.al 2018; Halper & Krishnan 2013)

2.14 Related works

Billy & Motau (2017) puts that many organizations in developing countries are constrained with restricted access to technology, finances, infrastructure, and skilled manpower. They state that for productive use of these technologies and methods needed for Big Data analytics, both the organizations and their workforce need to be prepared. The major objective for the study was to investigate developing countries organizations' readiness for Big Data analytics. Data for the study were collected from a public sector in South Africa and analyzed quantitatively. Results indicated that scalability, ICT infrastructure, top management support, organization size, financial resources, culture, employees' e-skills, organization's customers', and vendors are significant factors for organizations' readiness for Big Data analytics. Likewise, strategies, security and competitive pressure were found not to be significant. This study contributes to the scanty literature of Big Data analytics by providing empirical evidence of the factors that need attention when organizations are preparing for Big Data analytics.

Mokgadi in his dissertation paper stated that government organizations recognize the opportunities offered by Big Data technologies but are postponing Big Data implementation decisions as they are unconfident if they are ready for its implementation. By identifying factors from literature and combining them with factors affecting technology readiness in general to assess Big Data Analytics readiness within South African parastatals, a Big Data Readiness framework is established, which helps South African parastatals sector organizations with determining their Big Data readiness. The TOE framework and big data readiness factors were used to assess Big Data Readiness in South African parastatals (Kalema & Mokgadi 2016).

According to Klievink et al. (2016) Big Data is a new concept, and therefore there are no, or few assessment methods are available for organizational readiness. To this end, integrating insights from practice with established concepts from literature, a proper framework for Big Data readiness assessment was proposed and reported by Klievink et al. (2016). The framework covers characteristics for organizational alignment, organizational maturity, and organizational capabilities to determine how best organizations can prepare for Big Data. They also stated that by linking the idea of Big Data with the current grounded academic knowledge of technology readiness, organizations will be able to handle new technological innovations.

Pedro and his colleagues studied the capability and readiness of big data analytics. In their studies the used business analytics capability maturity model. They used seven key requirements which are clear business need, strong committed sponsorship, alignment between business and analytics strategy, fact-based decision-making culture, strong data infrastructure, right analytical tools, and skilled people were used to success organization in BDA.

According to Naseebullah et al. (2013), Technology readiness refers to the current use and potential adoption of e-procurement by organizations. Naseebullah et al. (2013) highlighted the technology readiness in terms of IT infrastructure, IT expertise and IT compatibility. The model is based on intensive literature survey of organization's readiness of technology in general. They recommended that the model can be extended with other organizational contexts.

In Borgman et al. (2011) the link between the TOE framework and the decision of organizations to adopt cloud computing, as well as the moderating effect of IT governance structures and processes on these relationships was conceptualized. They developed hypotheses and were able to test these for the main independent variables, showing that, specifically, the technology and organization context factors affect the decision whether organizations should adopt cloud computing.

Authors (year)	Objectives	Methods/ Approaches	Finding
Billy & Motau (2017).	Investigate developing countries organizations' readiness for Big Data analytics.	Quantitate research	many organizations in developing countries are constrained with restricted access to technology, finances, infrastructure, and skilled manpower.
Mokgadi Motau (2016)	To assess Big Data readiness for South African government parastatals	Quantitate research	technology infrastructure, security, reliability, finances, competitors, customers, and vendors are vital constituents in assessing Big Data readiness.
Pedro, Brown & Hart (2019)	To determine what capability large organization, require to be ready for successful BDA initiatives	Exploratory research	Seven major themes emerged, with sub-themes relating to capabilities for supporting or achieving them
Romijn (2014)	To establish whether insufficient readiness for Big Data use inorganizations in the public sector is a reason why Big Data is currently not used in the public sector.	exploratory research	organizations may be technically capable of using big data, but they will not significantly gain from these activities if the applications do not fit their organizations and main statutory tasks.

Table2.2. Summary of related works

Those related works that listed above assesses big data analytics for different organization based on assessment model. The modes are limited on dimensions and factors. This research addresses the necessary dimension and factors to assess big data analytics readiness in Etho Telecom.

2.15 Summary

This chapter reviewed the related literature on technology and big data readiness. The concepts of big data, big data Analytics, characteristics of big data, traditional data analysis, and benefits of big data are presented. Literature relating to technology readiness assessment was reviewed. The factors influencing Big Data analytics readiness were identified by interviewing Ethio Telecom BI expert and from the literature. Some assessment models that are relevant for big data adoption are recently built and have some limits like poor documentation, theoretically not tested and found to be fitted just for technological assessment, not include the data dimensions like data management and data governance. This study not limited to technological, environmental and origination elements. It also includes data management, data governance and data ecosystem dimensions. A theoretical framework that could be used for Big Data readiness assessment within the organization based on the factors identified was formulated.

CHAPTER THREE

Research Methodology

3.1 Overview

This chapter presents research methodology followed by the study. This includes research design, research approach, data collection methods and data analysis methods employed in this study.

3.2 Research Design

The purpose of this research is to conduct descriptive research to gather as much information as possible regarding big data analytics readiness in Ethio Telecom. This research is intended describing the current situation of the problem and answer the research question in the form of what, and to point out the most important factors that are essential to the big data analytics readiness in Ethio Telecom. Moreover, this research explains the phenomenon and assess the current situation of big data analytics in Ethio Telecom. Therefore, descriptive research is being used to fulfill the approach.

Research Approach

To achieve the objective of this study and answer the research questions, the research used mixed research approach, Explanatory sequential in which first quantitative data collection and analysis was conducted. This is followed by qualitative data collection and analysis to assess big data analytics in Ethio Telecom. Utilizing mixed research approach is used to neutralize or cancel the biases of employing any of single approach and a means to offset the weaknesses inherent from a single method with the strengths of the other method (Cresweell, 2008). Leey and Ormrod (2015, p 330) stated that mixed research design is used by researchers due to completeness, complementarity, hypothesis generation and testing, development of appropriate research tools and strategies, resolution of puzzling findings, and triangulation.

3.3 Target population and sampling method

The sample is drawn from target population which is the total group of individuals. The population of the study involve Ethio Telecom Information system staff and security division staff.

Ethio Telecom have 23 divisions. Among those divisions, Information system division is responsible for system implementation and deployment. Therefore, employees who are working in this division are primarily considered as the major parts of the targeted populations. Next, based on the researcher's preliminary survey observation, employees who are working in security divisions are responsible for issues related to security, privacy, and governance of data that will be included as part of the targeted populations for this study. 400 employees are in information system and 200 employees are in security division.

To properly represent the characteristics of the entire population for the purpose of the study, a process of sample selection is required. Samples are a collection of various entities chosen for the purpose of analyzing their potential relevance to the research problem, which include “objects, text materials, and audio-visual and electronic records” (Leedy & Ormrod, 2015). Sampling is the selection of a subset from the population to estimate the whole population, minimized cost and data collection can be faster than measuring the entire population.

Stratified simple random sampling which is the probability sampling methods for quantitative and purposive sampling which is nonprobability methods for qualitative used for the study. This stratified simple random sampling confirms that the population is partitioned into relatively homogeneous groups called strata and a simple random sample is selected from each stratum. Sample size determination procedures will be used to get optimum and reasonable information.

3.4 Sample size

Using Yamane's (1967) sample size calculation formula, the actual sample size is determined from the total targeted populations. Staff working on Ethio Telecom information system

division and security division staffs was the target population of this study. With 95% of confidence level and 5% of confidence interval (margin of error), the sample size should be:

$$n = \frac{N}{(1 + Ne^2)}$$

n= 235

Where N is the population size; e is the level of precision; n is a sample size.

Applying it to a targeted population, in which N =600 with ±5% precision. Assuming 95% confidence level we get the sample size as 235.

Purposive sampling was used for the Qualitative research. One security officer, two information system director, one Database manager, one BI expert, one security director, and one infrastructure managers were involved in the interview.

3.5 Data collection methods

Primary and secondary data were used in this study. Primary data was collected through questionnaire and interviews. Primary data collected for this study could be a basis to understand and identify readiness of the Ethio Telecom to adopt Big Data Analytics. Interview and questioner are used as primary data that contains closed ended questions and semi-structured interviews. Secondary data sources are used including journals, books, and the internet. To get primary data on readiness of the Ethio Telecom to implement Big Data, it is good to collect data through direct connection with the employees of the organization by preparing questionnaire.

3.6 Data Collection Instruments

This study used organization specification, data ecosystem, data management, resources, and data governance framework. The capabilities of the organization from the five contexts are the basis of the decision of whether to adopt big data analytics or not. The data collection tool or questionnaire and Interview questions were implemented based on those five dimensions: data ecosystem,

organization specifications, data management, resources, and data governance. To achieve this, primary data was collected from the selected sample size. For the research, the researcher prefers collecting that data by means of questionnaire from Ethio Telecom information systems and security division employees and interviewing information system division directors, database experts and BI project managers. To design the questionnaire and interview questions, a literature review on big data analytics readiness was undertaken. Some of the Interview questions and questionnaire were also adopted from related research works.

General opinions on big data adoption were obtained from the information system division expert and manager. Concern about the understanding of big data analytics was studied. This measure facilitates the development of theoretical framework and question formulation. More information is obtained via literature review. This process enabled collection of more information and issues related to the topic. This measure generates insight into the real problem that was faced by the organization. All the information was integrated into a logical manner. This helps to conceptualize the problem and formulate possible solutions for the problem of organizational readiness for big data analytics adoption.

Questionnaire

The questionnaire is the primary tool in collecting necessary information from the respondents of a survey. This questionnaire is intended at evaluating the current experience and practices of Ethio Telecom to adopt big data in the company by involving employees from various departments of the Information System (IS) division and security division of the company.

Dawson mentioned that close-ended questionnaires can be used in research to produce a statistical analysis (Dawson 2002). In this study, close-ended questionnaire was used. The questions in the questionnaire are adapted, with modified with the context of Ethio Telecom and rewriting the sentence, from Mokgadi research paper (Mokgadi 2016) and TDWI big data adoption assessment questionnaire.

	Questionnaire Item	**source**	**modification**
1.	5 general questions	Mokgadi 2016	Adopted
2.	Ethio Telecom Strategic plan includes IT investments for Big Data.	Mokgadi 2016	Change the name of organization

3.	Top managers of Ethio Telecom believe that big data analytics has potential strategic value, and they support Big Data initiatives.	Mokgadi 2016	Change the name of organization
4.	Ethio Telecom makes decisions based on data.	TDWI	Modified in the context of Ethio telecom
5.	Top managers in Ethio Telecom plan to use big data for analytics and business models.	TDWI	Modified in the context of Ethio Telecom
6.	There is strong alignment between IT and business strategy in Ethio Telecom.	TDWI	Modified in the context of Ethio Telecom
7.	In Ethio Telecom there is good collaboration between IT department and another operational department.	TDWI	Modified in the context of Ethio Telecom
8.	There are vendors that sell Big Data Analytics innovations to Ethio Telecom.	Mokgadi 2016	Change the name of organization
9.	There are vendors in the market who provide training on this technology.	Mokgadi 2016	Change the name of organization
10	Adoption of Big Data will give a competitive advantage to Ethio Telecom.	Mokgadi 2016	Modified the name of organization
11	Ethio Telecom believes that, lose their customers to competitors if they do not adopt this technology.	Mokgadi 2016	Change the name of organization
12	Ethio Telecom controls access to confidential data through various system function channels.	TDWI	Modified the name of organization
13	Ethio Telecom has adequate tools and mechanisms to provide effective data-protection when using this technology.	TDWI	Modified the name of organization
14	Ethio Telecom has security policies that suit the different types of data in the company when using this technology	TDWI	Modified the name of organization
15	data ownership and access policies are clearly in place in Ethio Telecom.	TDWI	Modified in the name of organization
16	Big data management and analytics policies are in place and documented in Ethio Telecom.	TDWI	Modified the name of organization
17	Ethio Telecom has defined data source integration architecture.	TDWI	Modified the name of organization
18	Ethio Telecom integrates big data technologies into its existing ecosystem easily.	TDWI	Modified the name of organization
19	Ethio Telecom feels there is good practice in gathering and processing all data. They are not overcome by it at all.	TDWI	Modified the name of organization
20	Ethio Telecom has a process in place for dealing with data quality. It's a multi-level process depending on how we're making use of the data.	TDWI	Modified the name of organization

21	Ethio Telecom has a process in place for dealing with data quality that is dependent on the kind of data that we are dealing with.	TDWI	Modified the name of organization
22	Ethio Telecom believes aligning big data and business increases its business value	TDWI	Modified the name of organization
23	Ethio Telecom has a specific big data strategy that helps you utilize data records to get the perfect business plan.	TDWI	Modified the name of organization
24	If people want to access data, they can generally get at it, if they meet the access criteria.	TDWI	Modified the name of organization
25	Ethio Telecom shares data across your company.	TDWI	Modified the name of organization
26	Ethio Telecom can store and process all structured, semi structured, and unstructured data.	TDWI	Modified the name of organization
27	Ethio Telecom understands the annual growth rates of their storage requirements and the cost of their data.	TDWI	Modified the name of organization
28	Ethio Telecom can store and process structured, unstructured, and semi-structured data as well as real-time data and data from external sources.	TDWI	Adopted with Modification the name of organization
29	Ethio Telecom has dedicated analytics resources.	Mokgadi 2016	Adopted with modification the name of organization
30	Ethio Telecom has a big data specific hardware infrastructure in place.	Mokgadi 2016	Adopted with modification the name of organization
31	Ethio Telecom has enough technology expertise to deal with Big Data analytics.	Mokgadi 2016	Adopted with modification the name of organization
32	Ethio Telecom IT employees have IT skills, and ability to use the following programs, languages, technologies, and software such as SQL, noSQL Hadoop, R programming, java, machine learning, python, map reduce and so on.	TDWI	Adopted with modification the name of organization
33	Ethio Telecom has a budget to invest in big data technology projects.	Mokgadi 2016	Adopted with modification the name of organization
34	Ethio Telecom have well defined budget for Big Data and Analytics initiatives.	Mokgadi 2016	Adopted with modification the name of organization

35	Given the necessary resources, opportunities, and knowledge to use Big Data, Ethio Telecom will be ready to adopt it.	Mokgadi 2016	Adopted and change the name of organization
36	Ethio Telecom has begun to focus on big data opportunities, and plan to implement.	Mokgadi 2016	Adopted and change the name of organization

Table 3.1. questionary information

The Questionnaire contains 40 Likert scale questions, where the meanings of the options are indicated below, and question items are grouped in five dimensions. The questions were created on Google Form and distributed directly to 235 members of the IS division and security division working with low-level management and employees under them, via their Gmail, SMS, and telegram.

Options Clarification	
Options	Meaning
Strongly Disagree	Not presented or practiced in the organization at all
Disagree	The organization is not performed or practiced
Neutral	Does not have the information or no certainty about it
Agree	The organization is performed or practiced at some level
Strongly Agree	The organization has performed or practiced it fully

Table 3.2. Likert scale option meaning

Interview

Interviews are an important data collecting technique involving verbal communication between the researcher and the subject. Interviews are usually used in survey designs and in exploratory and descriptive studies (Mathers, N. et al., 2002). According to Walliman (2011) there are three types of interviews: these are structured, unstructured, and semi structured. Semi-structure interview method is selected because it is most suitable considering the nature of the subject. Semi-structured interviews give the researcher flexibility to establish their own style of conversation depending on the direction of the interview.

3.7 Piloting the Study

A pilot study has been done to test the reliability and validity of the questionnaire, and to make sure that the instrument is relatively free of ambiguity, avoid bias and to make it applicable to the objective of the study. In the Pilot study, the questionnaire was distributed to seventeen employees selected from information system division and security division and to the advisor, and then their sound feedback and comments are included in the final version of the questionnaire. These seventeen employees are not included in final data collection.

3.8 Data analysis and interpretation

The researcher in this study, data analysis is done after collecting all required data from the respondents. Therefore, the analysis of the study followed the objective of the research.

Qualitative and quantitative data analysis are included in Mixed method data analysis. Quantitative data naturally collected through survey questionnaires and analyzed using descriptive statistics techniques. The analysis was done using the Statistical Package for the Social Sciences (SPSS) version 25. Frequency, average, and percentage values are used for discussion of the data collected from the survey. The data gathered through interview are analyzed and interpreted thematically based on the objective of the study.

3.9 Validity and Reliability of the Research

Kotari stated that "validity and reliability are the two important elements in the evaluation of a measurement instrument. Validity shows the degree to which an instrument measures what it is intended to assess" (Kotari, 2004). In this study, conducted a content validity test, and it evaluates the degree to which a measuring instrument provides acceptable coverage of the topic under study. After developing the data collection instrument, it was forwarded to research advisor and BICP expert to modify unclear/ambiguous questions, get rid of unnecessary questions and to include additional questions if any. Based on the reviewers' comments, some unclear questions were rephrased, the order of some questions was rearranged, three questions were removed from the list and two additional new questions were added. For the interview, the interviewer tried to be open minded and to avoid showing any possible feelings or reactions and most importantly, to not express any opinion to not mislead the interviewees. The interviewer was also prevented from asking the questions in a way that would drive the interviewee towards specific answers. The

meetings were scheduled whenever it was appropriate for the interviewees, to prevent any feelings of pressure and for the interviewee to be comfortable. Finally, the transcripts were sent back to the interviewees to prevent any potential misinterpretation or misunderstanding of their statements by the interviewer which can in turn affect biased data**.** Reliability is concerned with the ability of the data collection instrument to provide consistent results (Kotari, 2004). Once the final data collection instrument was approved by the advisor, a pilot test was conducted using 17 respondents. The value of alpha normally ranges between 0 and 1. The closer the Cronbach's alpha coefficient is to 1 the greater the internal consistency of the items. According to George and Mallery (2003) alpha coefficients above 0.70 are considered acceptable. As shown in Table 2, the internal reliability analysis of the test produces Cronbach's alpha coefficients of each dimension is presented and the total item Cronbach's alpha coefficient is .897 which confirms that the survey instrument was reliable and can produce consistent results.

Reliability Statistics

No.	Items	Cronbach's Alpha
1	Organization specification	.760
2	Data management	.719
3	Data governance	.809
4	Resources	.765
5	Data environment	.712

Table 3.3. reliability statistic

3.10 Ethical Issues

The study was in line with the organization's policy in relation to any intellectual property rights of the organization. Concerning the privacy of the respondents, their responses are truly confidential and only used for academic purposes. It would not be ethical to access some confidential documents of the organization. So, the organization's code of ethics was considered without significantly compromising the findings of the study. Regarding references, all the materials and sources are properly acknowledged.

CHAPTER FOUR

Data Analysis

The focus of this chapter deals with data gathering, which was accomplished by survey questionnaire, interview, and observation. To verify or support the validity of the responses, qualitative and quantitative data has also been triangulated with their corresponding conceptual and empirical data. Lastly, a summary of the results will be presented

4.1 Overview

Data was collected through various instruments from 19 April – 19 May 2021. Questionnaire part of the data collection, low level management members and staff at all levels of, expert, specialist, and supervisor, administrator, analyst, were engaged. Google online Form was used to hold the survey, and the questionnaire was sent to a total of two hundred thirty-five employees of Ethio Telecom who is currently working in the Information System division and security division. The tool is very convenient and user friendly to distribute the questionnaire, manage and follow the response process. Thirty-six question items were created as a mandatory field for the next part. Four general questions were created without mandatory fields.

Out of 235 participants, 225(95.7%) completed and submitted the online questionnaire successfully and 10 (4.3%) failed to respond. Out of 225 questionnaires, 220 were usable, the remaining five had missing values in general question and discarded. A better effort has been applied to maximize the response rate by sending reminders through and giving physically reminder. Another great feature of the Google online form is its ability to present the response, both in a summary of all and individual responses, in a tabulated and/or comma separate version (.csv) format, which is a good data representation to further carry out analysis and discussion of the findings. Once the online survey data is collected, it is downloaded and further processed using Statistical Package for the Social Sciences (SPSS) version 25 tool to make analysis complete. Interview questions were also prepared by adopting from literature and modified according to the

researcher's case. The main objective of the interview session is to supplement and increase the validity and reliability of the information obtained through the questionnaire.

4.2 Quantitative Data Analysis and results

As per the distributed questionnaires, feedback from respondents is presented below. The frequency response is represented as percentage distribution and descriptive statistics for big data analytic readiness in Ethio Telecom is shown in the tables below for each item.

4.2.1 Demographic Characteristics

This portion of the survey is concerned with background of the respondents to understand the employees or respondents who participate in filling the questionnaire for this research. Respondents are requested to fill their gender, their work experience education level, and company role in the organization. Among 220 respondent 85 (38.6%) were female and 135 (61.4%) were male. The result showed that most of the respondents were males.

In terms of working experience 85 (38.6%) of the respondent have 4-8 years' experience, 57(25.9%) of the respondent have 8-12 years' experience, 41(18.6%) of the respondents have 12_16 years' experience and 37 (16.8%) respondents have more than 16 years of experience.

Out of the total respondents, 141 (64.1 %) had first degree and 79 (35.9 %) had master's degree. In terms of company role there were 23 (10.5 %) managers, 31 (14.1 %) of them were experts, 30 (13.6%) of them were administrator, 31 (14.1%) of them were analyst, 80(36.4%) of them were specialist and 25 (11.4%) of them were supervisor. 96.4% of participants are aware of big data while 3.6% of participants are still not aware of big data.

Characteristics	Frequency	Percent	Cumulative %
Working experience			
4-8 years	85	38.6	38.6
8-12 years	57	25.9	64.5
12-16 years	41	18.6	83.2
More than 16 years	37	16.8	100.0
Gender			
Male	135	61.4	61.4
Female	85	38.6	100.0
Education level			
Degree	141	64.1	64.1
Master's degree	79	35.9	100.0
Company role			
Manager	23	10.5	10.5
Expert	31	14.1	24.5
Administrator	30	13.6	38.2
Analyst	31	14.1	52.3
Specialist	80	36.4	88.6
supervisor	25	11.4	100.0
Big data awareness			
Yes	212	94.6	94.6
No	8	3.6	100.0

Table 4.1. Demographic characteristics of the respondent in Ethio Telecom 2021 n=220

4.2.2 Organizational specifications

The aim of this dimension is assessing the readiness of big data analytics in Ethio Telecom in terms of top management support, data driven decision making culture, business, and IT alignment.

As shown in table 4.2., 78.2% of participants respond that, the strategic plan of the Ethio Telecom includes IT investment for Big Data, 47.7% of the respondents agree, 30.5% strongly agree and 12.7% of respondent have no idea about where the strategic plan includes investment for big data analytics.

Regarding decision making culture 73.6 % (54.5% agree, 19.1% strongly agree) of respondents confirm that Ethio Telecom makes decisions based on data that currently have. 12.7% respondents were no information about how Ethio Telecom makes decisions.

67.7% of respondents approved that the top manager of Ethio Telecom have a plan to use Big Data for analytics, dicision making, and business model. 20.9% of respondent were neutral, this show that the respondents have no information on this organization plan.

Regarding business and IT alignment, 81.3% of respondents approved that there is strong alignment between IT and business strategy whereas12.3% respondents were no idea about this alignment. 83.2% of respondent confirmed that there is good collaboration between IT department and another operational department in Ethio Telecom. This alignment facilitates big data adoption.

Organizational specification		strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean score
		N (%)	N (%)	N (%)	N (%)	N (%)	
Management Support	Ethio Telecom Strategic plan includes IT investments for Big Data.	9 (4.1%)	11 (5.0%)	28 (12.7%)	105 (47.7 %)	67 (30.5%)	3.94
	Top managers in Ethio Telecom believe that big data analytics has potential strategic value, and they support Big Data initiatives.	5 (2.3%)	13 (5.9%)	30 (13.6%)	117 (53.2 %)	55 (25%)	
Data Driven decision making culture.	Ethio Telecom makes decisions based on data.	4 (1.8%)	26 (11.8%)	28 (12.7%)	120 (54.5 %)	42 (19.1%)	3.75
	Top managers in Ethio Telecom plan to use big data for analytics and business models.	5 (2.3%)	20 (9.1%)	46 (20.9%)	110 (50%)	39 (17.7%)	
Business & IT alignment	There is strong alignment between IT and business strategy in Ethio Telecom.	2 (0.9%)	12 (5.5%)	27 (12.3%)	92 (41.8 %)	87 (39.5%)	4.15
	In Ethio Telecom there is good collaboration between IT department and another operational department.	2 (0.9%)	15 (6.8%)	20 (9.1%)	90 (40.9 %)	93 (42.3%)	
					Total mean score		3.95

Table 4. 2. Organizational specification aspect towards big data readiness in Ethio Telecom. n=220

For this research their mean value as showed based on e- Learning Readiness Survey instrument. The mean score from 3.41 up to 4.20 represents agree group. The result shows from table 4.2., mean result of factors under organizational specification dimension top management support, data driven decision making culture and business IT alignment are found to be 3.94, 3.75, and 4.15 respectively which is rated in the "Agree" group. Majority of the respondents agreed that Ethio Telecom is ready to adopt big data in terms of organizational specification, with mean score of 3.95.

4.2.3 Data ecosystem

The focus of these questions was assessed factors under data ecosystem. These are vendor support for this technology and the competitive advantage of big data.

Regarding vender support, 59.1% of respondent approved that there were vendors that sell big data analytics to Ethio Telecom. Also 74.6% of the respondent confirmed that there is vendor in the market that provides training to Ethio Telecom. 15.9% of respondents had no information about a vendor that sell and provide training in big data technology.

94.6% of respondents approved that adoption of Big Data give a competitive advantage to Ethio Telecom and 83.2% of respondents confirmed that Ethio Telecom would lose their customer, if not adopt this technology. 12.3% of participants have no information about this idea.

Data Ecosystem		strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean score
		N (%)	N (%)	N (%)	N (%)	N (%)	
Vendor support	There are vendors that sell Big Data Analytics innovations to Ethio Telecom.	4 (1.8%)	36 (16.4%)	50 (22.7%)	118 (53.6%)	12 (5.5%)	3.61
	There are vendors in the market who provide training on this technology.	3 (1.4%)	18 (8.2%)	35 (15.9%)	135 (61.4%)	29 (13.2%)	
Competition	Adoption of Big Data will give a competitive advantage to Ethio Telecom.	2 (0.9%)	3 (1.4%)	7 (3.2%)	53 (24.1%)	155 (70.5%)	4.45
	Ethio Telecom believes that, lose their customers to competitors if they do not adopt this technology.	2 (0.9%)	10 (4.5%)	27 (12.3%)	68 (30.9%)	113 (51.4%)	
					Total mean score		4.03

Table 4.3. Data ecosystem aspect towards big data readiness in Ethio Telecom. n=220

The mean score from 3.41 up to 4.20 represents agree group and from 4.21 up to 5.0 represent strongly agree group. From table 4.3., the mean result of components under data ecosystem dimension, vendor support and computation are found to be 3.61 and 4.45 respectively, which is rated in the “Agree” and “Strongly Agree” group. Majority of the respondents agreed with Ethio Telecom is ready to adopt big data in terms of data ecosystem, with mean of 4.03.

4.2.4 Data governance

The aim of this component is to assess the readiness of big data in terms of security and privacy, data integration and policy.

70.5% of respondents confirmed that Ethio Telecom control access to confidential data, also 14.6% strongly agreed on this access control.15.5% of respondent disagreed on Ethio Telecom do not control accesses to confidential data and 4.5 % neutral, they have no information on this idea.

Respondents approved (42.7%) that Ethio Telecom has no adequate tools and mechanisms to provide effective data protection when using this technology. 5.9% also strongly disagreed that Ethio Telecom has adequate tools and mechanisms. 11.4% of the respondents have no information about adequate tools and mechanisms in Ethio Telecom.

Regarding policy 71.8% of the respondent approved that Ethio Telecom have data ownership and access policies are clearly in place. 10% of the respondents have no information on data ownership and accesses policy in Ethio Telecom.

64.1% of respondents confirmed (31.8% strongly disagree, 32.3% disagree) that in Ethio Telecom there is no big data management and analytics policies and not documented. 14.1% respondents have no information on big data management and analytics policies.

A defined data source integration architecture helps to adopt big data analytics into the organization. 55.5% of respondents disagreed on Ethio Telecom has defined data source integration architecture, and 7.7% of respondents strongly disagree on this idea. 22.7% (20.9% agree, 1.8% strongly agree) of respondents believed that Ethio Telecom has defined data source integration architecture. 14.1% respondents have no information on this idea.

Integrating big data technologies into its existing ecosystem is not an easy task. 52.7% of the respondents disagreed that Ethio Telecom integrates big data technologies into its existing

ecosystem easily. And 15.5% of the respondents also strongly disagreed on this idea. 18.6% of the respondents have information on this idea.

Data governance		strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean score
		N (%)	N (%)	N (%)	N (%)	N (%)	
Security & privacy	Ethio Telecom controls access to confidential data through various system function channels.	2 (0.9%)	34 (15.5%)	10 (4.5%)	155 (70.5%)	19 (8.6%)	3.29
	Ethio Telecom has adequate tools and mechanisms to provide effective data-protection when using this technology.	13 (5.9%)	94 (42.7%)	25 (11.4%)	81 (36.8%)	7 (3.2%)	
Policy	Ethio Telecom has security policies that suit the different types of data in the company when using this technology	3 (1.4%)	89 (40.5%)	22 (10%)	90 (40.9%)	16 (7.3%)	3
	Data ownership and access policies are clearly in place in Ethio Telecom.	5 (2.3%)	35 (15.9%)	22 (10%)	134 (60.9%)	24 (10.9%)	
	Big data management and analytics policies are in place and documented in Ethio Telecom.	70 (31.8%)	71 (32.3%)	31 (14.1%)	44 (20%)	4 (1.8%)	
Data integration	Ethio Telecom has defined data source integration architecture.	17 (7.7%)	122 (55.5%)	31 (14.1%)	46 (20.9%)	4 (1.8%)	2.43
	Ethio Telecom integrates big data technologies into its existing ecosystem easily.	34 (15.5%)	116 (52.7%)	41 (18.6%)	24 (10.9%)	5 (2.3%)	
					Total mean score		2.91

Table 4.4. Data governance aspect towards big data readiness in Ethio Telecom. n=220

From table 4.4., the mean result of components under data governance Security & privacy, and Policy is found to be 3.29 and 3.00 respectively, which is rated in the "Neutral" category. Majority of the respondents believed that Ethio Telecom is ready to adopt big data in terms of these two factors in some extent. The mean of Data integration found to be 2.43 which is rated in the "disagree" group. Most of the respondents considered that Ethio Telecom is not ready to adopt big data in terms of this factor. The aggregated mean (mean of mean) of data governance 2.91 shows that Ethio Telecom work on data governance before adopting big data analytics.

4.2.5 Data Management

The focus of this dimension is to evaluate Ethio Telecom readiness in terms of data quality, data access, data storage and processing, and business and BD strategy alignments.

Data quality and integrity are vital to decision making. If the data have not quality this leads to wrong decision making. 62.7% of the respondents disagreed that Ethio Telecom has good practice in gathering and processing all kinds of data, and 8.6% of the respondents also strongly disagree on this idea.13.6% of the respondents was neutral. As shown in blew table for process dealing with data quality,39.5% of the respondents had agreed on Ethio Telecom has a process in place for dealing with data quality, and 2.3% of them are strongly agreed however 38.6% of the respondents believe that Ethio Telecom has no process that deals with data quality. 15% of the respondents were neutral which means, they are in middle on this idea.

Aligning big data and business increases organization's business value.89.5% (47.7% agree, 41.8 strongly agree) of respondent approved that Ethio Telecom business value increase by aligning big data and business.

32.3% of the respondents disagreed that Ethio Telecom can store and process all structured, semi structured, and unstructured data. And 32.7% respondents also strongly disagreed. 10.5% of the respondents have no information on this idea.

76.4% of the respondents (70% agree, 6.4% strongly agree) confirmed that Ethio Telecom understands the annual growth rates of their storage requirements and the cost of their data. 10.5% of the respondents were neutral, meaning they have no information on this idea.

Data Management		strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean score
		N (%)	N (%)	N (%)	N (%)	N (%)	
Data Quality & integrity	Ethio Telecom feels there is good practice in gathering and processing all data. They are not overwhelmed by it at all.	19 (8.6%)	138 (62.7%)	30 (13.6%)	33 (15%)	0 (0%)	2.63
	Ethio Telecom has a process in place for dealing with data quality. It's a multi-level process depending on how we're making use of the data.	10 (4.5%)	85 (38.6%)	33 (15%)	87 (39.5%)	5 (2.3%)	
	Ethio Telecom has a process in place for dealing with data quality that is dependent on the kind of data that we are dealing with.	9 (4.1%)	129 (58.6%)	29 (13.2%)	48 (21.8%)	5 (2.3%)	
Business & BD strategy alignment	Ethio Telecom believes aligning big data and business increases its business value.	2 (0.9%)	5 (2.3%)	17 (7.7%)	105 (47.7%)	91 (41.8%)	4.03
	Ethio Telecom has a specific big data strategy that helps you utilize data records to get the perfect business plan.	5 (2.3%)	28 (12.7%)	31 (14.1%)	98 (44.5%)	58 (26.4%)	
Data access	If people want to access data, they can generally get at it, if they meet the access criteria.	7 (3.2%)	19 (8.6%)	23 (10.5%)	131 (59.5%)	40 (18.2%)	3.76
	Ethio Telecom shares data across your company.	4 (1.8%)	25 (11.4%)	40 (18.2%)	111 (50.5%)	40 (18.2%)	
Data storage	Ethio Telecom can store and process all structured, semi structured, and unstructured data.	72 (32.7%)	71 (32.3%)	23 (10.5%)	44 (20%)	10 (4.5%)	2.98
	Ethio Telecom understands the annual growth rates of their storage requirements and the cost of their data.	10 (4.5%)	19 (8.6%)	23 (10.5%)	154 (70%)	14 (6.4%)	
					Total mean score		3.35

Table 4.5. Data management aspect towards big data readiness in Ethio Telecom. n=220

From table 4.5., the mean result of components under data management dimensions, Data Quality & integrity and Data storage & processing are found to be 2.63 and 2.98 respectively, which is rated in the "Neutral" category. Majority of the respondents believed that Ethio Telecom invest more effort on these two factors before adopting big data analytics. The mean of Data access and Business & BD strategy alignment found to be 3.76 and 4.03, respectively. Majority of the respondents believed that Ethio Telecom is ready to adopt big data in terms of these two factors. The aggregated mean (mean of mean) of data management 3.35 show that Ethio Telecom must be work on this dimension before adopting big data analytic.

4.2.6 Resources

This component includes technology, human resource, and finical resource to evaluate Ethio Telecom's readiness for big data analytics.

Respondents that account for 66.4% (20.5% strongly disagree, 45.9% disagree) not confirmed that Ethio Telecom can store, and process structured, unstructured, and semi-structured data as well as real-time data and data from external sources. 48.6% of respondent were not believed that Ethio Telecom has dedicated analytics resources for big data. And 16.8% of the respondents were strongly disagree on this question. 45.9% of the respondents disagreed that Ethio Telecom has big data specific hardware infrastructure, also 5.9% of respondents strongly disagreed that Ethio Telecom has big data specific infrastructure. Whereas 12.7% of the respondents are neutral on this question.

Respondents account for 60% not confirmed that Ethio Telecom employee has enough technology expertise to deal with Big Data analytics. Whereas 13.6% of the were neutral on this question. From the table below, Ethio Telecom employee programming and analytical skills, 57.3% of the respondents approved that they have not programing skill, and 6.4% of the respondents strongly disagree on this question. However, 20.5% of respondents agreed that Ethio Telecom employee have programing skill, and 3.2% of the respondents strongly agree. 12.75% of them were neutral.

Regarding finance, most respondents 80.9 % approved that Ethio Telecom has a budget to invest in this technology. 62.3% of the respondents confirmed that Ethio Telecom has a well-defined budget for Big Data and Analytics initiatives whereas 21.8% of the respondents have no information about well-defined budget for Big Data and Analytics initiatives.

Resources		strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean score
		N (%)	N (%)	N (%)	N (%)	N (%)	
Technological resource	Ethio Telecom can store and process structured, unstructured, and semi-structured data as well as real-time data and data from external sources.	45 (20.5%)	101 (45.9%)	28 (12.7%)	37 (16.8%)	9 (4.1%)	2.54
	Ethio Telecom has dedicated analytics resources.	37 (16.8%)	107 (48.6%)	28 (12.7%)	40 (18.2%)	8 (3.6%)	
	Ethio Telecom has a big data specific hardware infrastructure in place.	13 (5.9%)	101 (45.9%)	28 (12.7%)	69 (31.4%)	9 (4.1%)	
Human resource	Ethio Telecom has enough technology expertise to deal with Big Data analytics.	21 (9.5%)	132 (60%)	30 (13.6%)	29 (13.2%)	8 (3.6%)	2.49
	Ethio Telecom IT employees have IT skills, and ability to use the following programs, languages, technologies, and software such as SQL, noSQL Hadoop, R programming, java, machine learning, python, map reduce and so on.	14 (6.4%)	126 (57.3%)	28 (12.7%)	45 (20.5%)	7 (3.2%)	
Financial resource	Ethio Telecom has a budget to invest in big data technology projects.	2 (0.9%)	12 (5.5%)	28 (12.7%)	153 (69.5%)	25 (11.4%)	3.73
	Ethio Telecom have well defined budget for Big Data and Analytics initiatives.	4 (1.8%)	19 (8.6%)	48 (21.8%)	137 (62.3%)	12 (5.5%)	
					Total mean score		2.92

Table 4.6. Resource aspect towards big data readiness in Ethio Telecom. n=220

From table 4.6., the mean result of resources in terms of technological resource and human resource is found to be 2.54 and 2.49, which is rated in the "disagree" category and finical resource found to be 3.73 which is rated in the "agree" category. Majority of the respondents believed that Ethio Telecom give more attention to resource (technological resource and human resource) to adopt big data. The aggregated mean (mean of mean) of resource 2.92 show that Ethio Telecom must be invest some effort on resource before adopting big data analytics.

4.2.7 Big Data readiness

Most of the respondents 84.1% approved that given the necessary resources, opportunities, and knowledge to use Big Data, Ethio Telecom is ready to adopt it. 70.5% of the respondents confirmed that Ethio Telecom started to focus on big data opportunities, and plan to implement whereas 30.8% of the respondents had no information on this question.

BIG DATA READINESS	**strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean score**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	
Given the necessary resources, opportunities, and knowledge to use Big Data, your organization will be ready to adopt it.	2 (0.9%)	8 (3.6%)	25 (11.4%)	90 (40.9%)	95 (43.2%)	4.22
Your organization has begun to focus on big data opportunities, and plan to implement	4 (1.8%)	21 (9.5%)	40 (18.2%)	84 (38.2%)	71 (32.3%)	3.9
				Total Mean Score		4.06

Table 4.7. Big data readiness aspect towards big data readiness in Ethio Telecom. n=220

Assessment model of "e- Learning Readiness Survey "were designed in a way that provides easy coding and assessment for the users. The alternatives can easily be coded as 1, 2, 3, 4, and 5, as in a five-point Likert type scale. Therefore, the 3.41 mean score can be identified as the expected level of readiness with the item, while other responses enable organizations to show higher or lower levels of readiness.

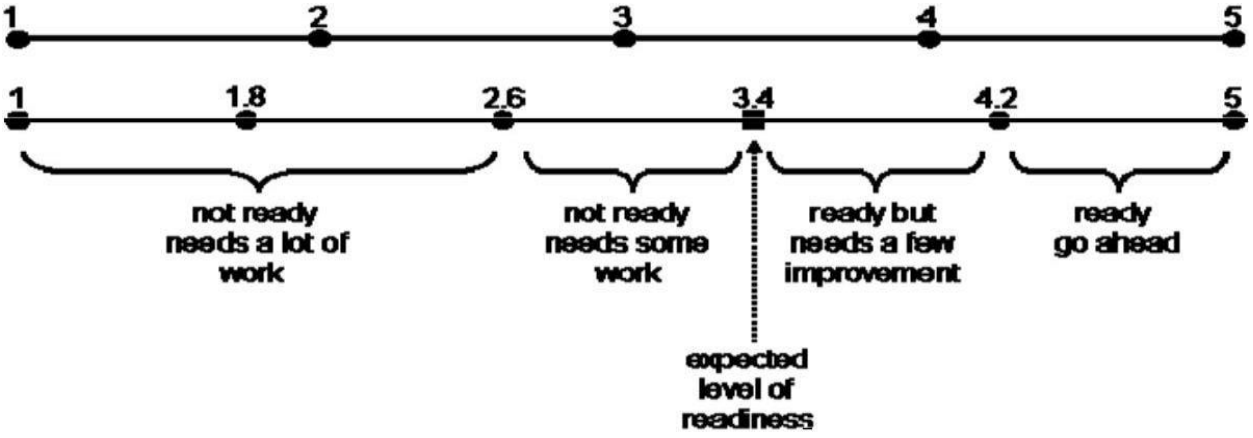

Figure 4-1 Assessment model of the e-LRS (Aydin, C. & Tasci, D. 2005).

Dimension	**Mean**	**Readiness level**
Organization specification	3.95	Ready but needs a few improvement
Data ecosystem	4.03	Ready but needs a few improvement
Data governance	2.91	Need some work
Data management	3.35	Need some work
Resources	2.92	Need some work

Table 4.8. Big data readiness level

For this research the mean score in the table 4.8 show that Ethio Telecom is ready with few improvements for big data analytics in terms of organization specification and data ecosystem. Mean score of data governance, data management, and resources shows that need some work before adopting big data analytics.

4.3 Qualitative data analysis

Qualitative data analysis is the method in which we move from the raw data that have been collected as part of the research study and use it to provide clarifications, understanding and interpretation of the phenomena which we are studying. Therefore, interviews have been done with one security officer,

two information system director, one Database manager, one BI expert, one security director, and one infrastructure managers to collect data concerning big data analytics readiness in Ethio Telecom. The questions were framed based on the research model provided and their factors in chapter two which has five dimensions organizational specifications, data ecosystem, data governance, data management and resources. Additionally, it also helped to discuss the status of Ethio Telecom on big data analytics adoption readiness and what preparation is needed before adopting big data technology.

4.3.1 qualitative data analysis process

The five dimensions are taken as themes and the factors are sub themes for assessing big data analytics readiness. A general question was asked to those interviewees which is checking awareness levels of big data analytics. All interviewees have a good understanding of big data analytics. Some of them are defined big data like this "big data is a lot of data that generates from different systems and may not be handled by legacy system". Others said, "big data is a lot of data that used for decision making purpose".

Organizational specifications

Top management support and data driven decision making culture.

Mission of Ethio Telecom is to provide world-class, modern, and high-quality telecom service for all citizens rightfully to transform the multifaceted development of the country to the highest level. Vision of Ethio Telecom is to become a world class provider of Telecom services. To accomplish their mission and vision, Ethio Telecom must adopt emerging technology. As big data analytics is one of the top ten emerging technologies, Ethio Telecom must be included in their strategic plan. All interviewees have similar perspectives, Ethio Telecom has a clearly articulated mission and vision for implementing big data analytics initiatives. Some of the interviewee replies as follow: "Ethio Telecom have strategic plan to implement big data analytics. And they believe that through emerging technology like big data analytics and AI Ethio Telecom improves quality of service, reducing costs, minimizing churn rates, personalized offerings, network optimization, increases competitive advantage and modernizes itself". Some of the interviewers said that: "Ethio Telecom have not only a strategic plan to implement big data analytics but also, we are in the pipeline to implement

this technology and we prepared a requirement for proposal". Some of the interviewees responded that: "implementing big data in Ethio Telecom support to meet its mission and vision by deploying a central data repository. So that Ethio Telecom implements big data analytics soon".

Regarding the data decision making culture, organization must be made decision-based data generated from different systems. This culture helps organizations to gain maximum profit, competitive advantage and improve customer experience. According to one interviewee "Data driven decision making culture is highly practiced in Ethio Telecom, there is CEO dashboard and CIO dashboard that provide reports, like network performance, quality of service and so on from separate systems. The other participants said: "When implementing big data these decision makers culture will continue their practice by get better report and make decisions based on the data, they get". As per some interviewees, "currently Ethio Telecom top managements make decision based the data that comes from separate system reports. Due to this data usage practice may not be full, only to some extent. When Ethio Telecom adopted big data, data came from one place which is come from central repository, which facilitates decision making by providing full data from central data repository that aggregated from different system". Based on the interviewee response Ethio Telecom is ready to adopt big data analytics in terms of organization specification.

Data Ecosystem

Data ecosystem dimension includes vender support and computation. Having committed vendors to facilitate big data analytics adoption and helping to successfully implement. The interviewee said that "We believe that there is a vendor in the market that sells this solution to Ethio Telecom". Some of the participant said: ''as we in pipeline to implement this technology, the current network solution provider of Ethio Telecom may participate in announced big data solution bids."

Regarding competition, having commutation pressure organizations increase their effort to become the best one. Participants mention that: "As Ethiopian government provides permission to other telecom operators in Ethiopia, compotators of Ethio Telecom are coming

soon. Due to this, Ethio Telecom must implement big data analytic with best readiness to get maximum profit, control the market and reduce churn''. Therefor regarding data ecosystem Ethio Telecom is ready to adopt big data analytics.

Data Management

This component includes data quality, access, storage and processing tools, and techniques. Having quality data, data access control, adequate storage and processing tools and techniques facilitates big data adoption processes. As per all interviewees, "Currently in Ethio Telecom there is poor data management practice". According to one of the interviews understanding "data management in terms of quality, current practice of Ethio Telecom has many issues". Other interviewee stated that "Data management in terms of access, the current practice of Ethio Telecom staff have access based on their level and the system that is working on it". Another participant said that: "if one staff member wants to access one system, they must submit a signed access request form the security team. The security team will check the access request and create account to the requested staff if they fill the requirement".

The interviewees mention that: "currently Ethio Telecom has not sufficient tool to store all kinds of data for a certain period. There are data retention policies, if data storage becomes full, there must be archive data due to lack of storage". For the processing tool, all interviewees confirmed that: "currently Ethio Telecom have processing tools only for structured data, for other data it has no processing tool and mechanism".

Data governance

This data governance dimension of big data readiness, data security and privacy, policy, and data integration are included. Protecting data from unauthorized access requires adequate security mechanisms. As per interviewee mention that: "Ethio Telecom has control access for confidential data, but it is not perfect. Still, we need adequate tools to protect confidential data". Relate to adequate tools and mechanisms to provide effective data-protection when using this technology in Ethio Telecom, interviewee mentioned that: "currently we have no satisfactory tool and mechanism for protecting all kinds of data, it need start working on this tool and techniques."

According to interviewee, “policy is in place for security, privacy and data retention and data access in Ethio Telecom." Regarding data integration most interviewee said that: “currently Ethio Telecom has no central data repository, and due to lack of data integration architecture all systems work separately in Ethio Telecom.”

All the interviewees said that: “the current Ethio Telecom data governance strategy is not support of its big data analytics adoption . Need extra data governance strategy to fully support big data analytics program”.

Resources

This dimension mainly focuses on Ethio Telecom's existing infrastructure, human resource and fainance will still fit with Big Data analytics technology. Regarding human power, some of the interviewee mentiond that: “current Ethio Telecom staffs has capeblelity for big data analytics with providing littel training for them”. Other interviews said that: “current ethiotelcom staff may have IT background but it is not enough for big data technology. Ethio Telecom has to invest in staff for continuous big data skill improvement and to become big data analytics domain experts”.

Regarding big data techonolgy, some interviewee mention that: "Ethio Telecom has no infrastructure or analytics tool for big data analytics." Some interviewees state that “Ethio Telecom has techological resourse in small amounts but current infrastructure does not fit for big data analytics. Therefore need extra effort and planning on technolocal tool”.

Adopting big data requires a huge amount of budget. Regarding this all interviewee mentiond that: “as Ethio Telecom is big campany, financialy it is well matured. Therefore, Ethio Telecom is capable to adopt big data technology in terms of finance”.

The remaining two question concern about the level of Ethio Telecom to adopt big data analytics and what preparation was in place before adopting this technology. All interviewee said that: “the current readiness level of Ethio Telecom is satisfactory to some extent. There is good top mangment support, mangemnt belived adopting big data gives compitative advantage, practice on decisions making based on data, grasp good expreiance from prevouse

project, good IT background staff, and financialy capable." Some of the interivewees state that: "Ethio Telecom has to be prepared before adopting big data analytics, invests more effort on data management, data governance, big data technology infrastrcture, anlytics tools, and domain experties".

4.4 Discussions of the result

The main emphasis of this section is discussing the results and give the interpretation and implications of the findings.

This study used survey questionnaires to assess major factors that may facilitate implementation of Big data analytics in Ethio Telecom. Factors such as Management support, human resources, business IT alignment, vendor support, competition, integration, data access, data security and privacy, data quality and integrity, technological resources, data policy, decision making culture, business and big data strategy alignment, data storage and processing, and financial resources were selected through those literature and grouped into five dimensions: organization specifications, data ecosystem, data governance, data management, and resources. This and similar studies on readiness are expected to provide key readiness indicators for big data analytics adoption and for implementing new work processes and systems. As known, big data analytics implementation requires a significant investment because various backbone and support technologies and facilitating systems are prerequisites for their successful implementation and use.

Ethio Telecom has initiatives to implementing big data analytics. Based on researcher observation and the result from data analysis Ethio Telecom have financially it is capable, top management of Ethio Telecom support big data initiative, good practice in data driven decision making culture, there is energized and IT skilled employees, managements believe on implementing big data analytics give competitive advantage to implement big data analytics but Ethio Telecom must improve their data management practices in terms of quality, purchase and enhance new technologies, invest in more training for their IT staff, and prepare, documented, and apply genuine data governance policies for big data.

From the result of the study Ethio Telecom has invest effort on data governance, data management and resource dimension before adopting big data analytics.

There is limited study on big data analytics, those study limited to accommodate significant dimensions and factors. This study used five-dimensional model which includes the necessary dimensions and factors to assess big data readiness in Ethio Telecom.

Summary

This chapter covers the analysis of data. Generally, this chapter covered the analysis of the frequency and demographics of participants as well as descriptive statistics of constructs. The graphical representation of demographics was used to analyze the level of education, as well as company role of participants. Graphical representation was used to represent big data awareness of participants. From the analysis, many participants were aware of Big Data.

CHAPTER FIVE

Conclusion and Recommendation

This chapter introduces conclusions derived from the study, some recommendations based on the data presented during the study and suggestions for future research.

5.1 Conclusion

Organizations get new opportunities from big data analytics to serve customers and markets, while also creating and extracting value in new ways. Technological improvement speed and complexity are increasing in today's world and the new tactics of doing business are changing fast and the future success of any organizations depends on how successfully to respond to these changes and being able to deal with these changes. So, to keep pace with the market, organizations must be creative and proactive about the ongoing changes.

In today's world, big data analytics is one of the recent developments in technology. The effective use of big data in telecom can enhance customer experience, delivering a new personalized product, fraud detection, and network optimization. As we have seen through the course of the study, big data utilization will impact the business of a telecom in many beneficiary ways.

Using big data, organizations will become a key basis of competitor and will create new ways of attracting employees that have the critical skills for a big data world. The top manager of telecom distinguishes the possible opportunities as well as the strategic threats that big data denotes and should assess, and then handle any gap between their present IT capabilities and their data strategy and what is necessary to capture big data opportunities relevant to their organization.

The implementation of big data technologies is becoming increasingly essential for the telecom company. With the vastly competitive market that we live in today, growth and alignment of the emerging information technology with business is very crucial. Big data analytics can be an add value for the organization, and it helps them to be in the competition. Hence, investigating and addressing big data analytics issues is essential.

Conventional system is not capable to accommodate the velocity, variety, and volume of Big Data. Due to this the organization could implement technology to handle this data. To implement

successfully and get maximum value from the technology, organizations must be evaluating their readiness. The focus of the study was to evaluate Big Data Readiness in Ethio Telecom. Based on the literature reviewed, organizational specification, data ecosystem, data governance, data management, and resource factors were identified which influenced Big Data Analytics readiness in an organization.

This study was taken to investigate Ethio Telecom's readiness for Big Data analytics. Ethio Telecom handle big volumes of data daily that is generated from legacy system, network infrastructure social media, and email exchanges. Hence, being ready for Big Data analytics is essential for generating new opportunities for Ethio Telecom while creating and extracting value in the voluminous collected data.

This research was used five-dimension research model to assess Big Data analytics readiness in Ethio Telecom. The model was combined from organization big data readiness model by Farzaneh and his colleague with TDWI big data maturity model. The model was good for acuminated all key factors of big data analytics component.

Primary and secondary data was used. Primary data was collected through survey questionnaire and interview. Secondary data was collected from document analysis and observation. The collected quantitative data was analyzed with the use of Statistical Package for Social Scientist (SPSS) and qualitative data was analyzed using theme.

There were two research questions designed from the problem statement to have a solution. The research questions were answered by collecting data from Ethio Telecom information system and security division staffs by using questionnaire, interview, and observation. Both general and specific objectives were addressed.

The first research question was ‘To what extent Ethio Telecom is ready to adopt big data analytics?’. From the result of study which data collected from Ethio Telecom IS and security division staff and management, through questionary and interview, Ethio Telecom is ready to adopt big data initiatives. financially it is capable, top management of Ethio Telecom support big data initiative, good practice in data driven decision making culture, there is energized and IT skilled employees, managements believe on implementing big data analytics give competitive advantage. Therefore, Ethio Telecom is ready in terms organization specification dimension, data

ecosystem dimension, and resource dimension with some efforts on data governance dimension and data management dimension to adopt big data.

From the result the readiness level of Ethio Telecom is 3.43 (ready but needs few improvements). This value show that Ethio Telecom is ready to adopt big data analytics but need some improve on data management data governance, human resource, and technological resource.

The second research question was 'What change must Ethio Telecom embrace before adopting big data analytics?'. From the finding Ethio Telecom must improve their data management practices in terms of quality, purchase and enhance new technologies, invest in more training for their IT staff, and prepare, documented, and apply genuine data governance policies for big data. By maintaining the current capabilities and working with the gaps that we have identified through this study, Ethio Telecom will successfully implement big data analytics.

5.2 Recommendations

The technology readiness assessment basically involves two main inputs: strategic planning and business area plans as well as technology monitoring insights from which the identification of critical technology elements is done. This research was developed using five-dimensional models which are organizational specifications, data ecosystem, data governance, data management, and resources (technology, human and finance).

Ethio Telecom utilizes this model (five-dimensional model which consists of data ecosystem, data ecosystem, data governance, data management and resources) and uses it as a guide to determine and improve their level of big data readiness; it will improve their chances of successfully implementing big data analytics. Once an organization has attained sufficient big data readiness levels, it is important to make the right choice for a big data solution provider.

The study shows that Ethio Telecom is capable and ready to adopt and implement Big Data, however, more effort needs to be placed from the data management perspective, data governance perspective, big data related expertise and Big Data technology resources to enable realization of more benefits of Big Data.

Since big data analytics is in early stages, there is a wide range of research areas in this area. In future, Researchers could use this five-dimensional model to evaluate organization readiness levels and observe and document any improvements in their big data readiness levels.

This study used information system division and security division for data collection to get business perspective data, and future researchers may gather data from other department of Ethio Telecom in addition to these two divisions.

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APPENDIX

Appendix one: questionnaire

Dear Sir/Madam, I am a graduate student in the School of Information Science, Addis Ababa University. Currently I am conducting a research on “Readiness of Ethio Telecom for Big Data Analytics Adoption”. The research is undertaken as academic requirements of partial fulfillment of the requirements for the Degree of Master of Science in Information system.

Please support me in giving correct and complete information to present a representative finding. This questionnaire may take 10-15 minutes of your time. Finally, I confirm to you that your response will be kept confidential and only used for academic purposes. Thank you in advance for your kind cooperation and dedicating your time.

If you have any inquiry, please feel free to contact me at wujbest1980@gmail.com

Yours sincerely,

Wujira Teka.

Email: wujbest1980@gmail.com

Tel: +251911519365

SECTION A: GENERAL INFORMATION

1. For how long have you been working with this organization?
   - ☐ less than 4 years
   - ☐ 4-8 years
   - ☐ 8-12 years
   - ☐ 12-16 years
   - ☐ mora than 16 years
2. Gender?
   - ☐ Male
   - ☐ Female
3. What is your qualification
   - ☐ Diploma
   - ☐ Degree
   - ☐ Master's degree
   - ☐ Doctorate degree
4. What is your role in this company?
   - ☐ Manager
   - ☐ Expert
   - ☐ Administrator
   - ☐ Analyst
   - ☐ Specialist
5. Have you ever heard of Big Data or big data analytics?
   - ☐ yes
   - ☐ no

SECTION B: CONSTRUCTS TO MEASURE BIG DATA READINESS

By using the rating scale from 1-5 where; 1 = **strongly disagree**, 2 =**Disagree**, 3 = **Neutral**, 4= **Agree**, 5 = **Strongly agree**. Indicate your level of agreement or disagreement on the following statements

Organizational specifications	**Questionnaire Item**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
6.	Ethio Telecom Strategic plan includes IT investments for Big Data.					
7.	Top managers of Ethio Telecom believe that big data analytics has potential strategic value, and they support Big Data initiatives.					
8.	Ethio Telecom makes decisions based on data.					
9.	Top managers in Ethio Telecom plan to use big data for analytics and business models.					
10.	There is strong alignment between IT and business strategy in Ethio Telecom.					
11.	In Ethio Telecom there is good collaboration between IT department and another operational department.					

Data Ecosystem	Questionnaire Item	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
12.	There are vendors that sell Big Data Analytics innovations to Ethio Telecom.					
13.	There are vendors in the market who provide training on this technology.					
14.	Adoption of Big Data will give a competitive advantage to Ethio Telecom.					
15.	Ethio Telecom believes that, lose their customers to competitors if they do not adopt this technology.					

Data governance	Questionnaire Item	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
16.	Ethio Telecom controls access to confidential data through various system function channels.					
17.	Ethio Telecom has adequate tools and mechanisms to provide effective data-protection when using this technology.					
18.	Ethio Telecom has security policies that suit the different types of data in the company when using this technology					
19.	data ownership and access policies are clearly in place in Ethio Telecom.					
20.	Big data management and analytics policies are in place and documented in Ethio Telecom.					
21.	Ethio Telecom has defined data source integration architecture.					

22.	Ethio Telecom integrates big data technologies into its existing ecosystem easily.					

Data Management	Questionnaire Item	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**strongly agree**
23.	Ethio Telecom feels there is good practice in gathering and processing all data. They are not overcome by it at all.					
24.	Ethio Telecom has a process in place for dealing with data quality. It's a multi-level process depending on how we're making use of the data.					
25.	Ethio Telecom has a process in place for dealing with data quality that is dependent on the kind of data that we are dealing with.					
26.	Ethio Telecom believes aligning big data and business increases its business value					
27.	Ethio Telecom has a specific big data strategy that helps you utilize data records to get the perfect business plan.					
28.	If people want to access data, they can generally get at it, if they meet the access criteria.					
29.	Ethio Telecom shares data across your company.					
30.	Ethio Telecom can store and process all structured, semi structured, and unstructured data.					
31.	Ethio Telecom understands the annual growth rates of their storage requirements and the cost of their data.					

Resources	Questionnaire Item	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
32.	Ethio Telecom can store and process structured, unstructured, and semi-structured data as well as real-time data and data from external sources.					
33.	Ethio Telecom has dedicated analytics resources.					
34.	Ethio Telecom has a big data specific hardware infrastructure in place.					
35.	Ethio Telecom has enough technology expertise to deal with Big Data analytics.					
36.	Ethio Telecom IT employees have IT skills, and ability to use the following programs, languages, technologies, and software such as SQL, noSQL Hadoop, R programming, java, machine learning, python, map reduce and so on.					
37.	Ethio Telecom has a budget to invest in big data technology projects.					
38.	Ethio Telecom have well defined budget for Big Data and Analytics initiatives.					

Big data analytics readiness	Questionnaire Item	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
39.	Given the necessary resources, opportunities, and knowledge to use Big Data, Ethio Telecom will be ready to adopt it.					
40.	40. Ethio Telecom has begun to focus on big data opportunities, and plan to implement.					

Appendix Two: Interview question

Dear Sir/Madam, I am a graduate student in the School of Information Science, Addis Ababa University. Currently I am conducting research on "Readiness of Ethio Telecom for Big Data Analytics Adoption". The research is undertaken as an academic requirement of partial fulfillment of the requirements for the Degree of Master of Science in Information Systems.

As part of the research, you need to evaluate the company's readiness in the study, and you are selected as one of the interviewees. The interview will take approximately 30-40 minutes to complete. Please answer each question as carefully as possible. You may decline to answer any specific questions if you wish to. If you feel that you are not able to answer a question, then you can proceed to the next one. If you agree, the interview will be recorded, for the only purpose of not losing any or part of to your responses. Finally, I confirm to you that your response will be kept confidential and only used for academic purposes. Thank you in advance for your kind cooperation and dedicating your time.

Wujbest1980@gmail.com

Telephone: +251911519365

Yours sincerely,

Wujira Teka.

Interview question

1. What is your understanding of big data?
2. Does Ethio Telecom have a clearly articulated mission and vision for implementing big data analytics? If yes, do you think implementing big data would contribute to achieving your mission and vision in improving quality service to customers, reducing costs, minimizing churn rates, network optimization, increasing competitive advantage and modernizing your company?
3. Does Ethio Telecom have a data driven decision making culture? If yes, where does the data come from?
4. What do you think about vendors that provide big data technology to Ethio Telecom? Is it easy to get committed vendors that provide this technology and training?
5. What do you think Ethio Telecom data management practices, in terms of quality, access, storage, and processing tools and techniques for all kinds of data?
6. Does Ethio Telecom have data governance i.e., security, privacy, policy, and data source integration?
7. Do you think Ethio Telecom have resource, in terms of skilled human power, finance, and technological resources to adopt big data technology?
8. As an Ethio Telecom manager and technical person, what is readiness level of Ethio Telecom to adopt big data analytics?
9. What kind of preparation will Ethio Telecom embrace before adopting big data analytics?