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The Value of Big Data Analytics Pillars in Telecommunication Industry

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Abstract: In the Big Data age, businesses in every industry must deal with vast volumes of data. Several experts and practitioners have lately emphasized the need of understanding how, why, and when Big Data Analytics (BDA) applications may be a valuable resource for businesses seeking a competitive edge. However, BDA pays off for some firms while failing to pay off for others due to the fact that investment in Big Data continues to present significant challenges due to the missing link between analytics capabilities and firm performance. According to a recent survey, many businesses spend the bulk of their time analyzing data, with only a tiny fraction employing Big Data Analytics to forecast outcomes and even fewer utilizing analytics apps to enhance processes and strategies. As a result, BDA is not widely used, and only a few companies have seen any benefit from it. To address this issue in the telecommunications domain and in light of the paucity of research on the subject, this study focused on the BDA Pillars (BDAP) in order to achieve benefits through increased revenues and cost savings. For the purpose of this research we have adopted qualitative approach with case study method, and technique of data collection includes semi-structure interview and document analysis. The Delphi technique and in-depth interviews conducted confirmed the existence of five critical elements that contribute to the sustainability of BDAPs and their impact on firm performance.

Keywords: big data analytics pillars; firm performance; business value; innovations and sustainability in telecom; business sustainability

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1. Introduction

Every governmental and private sector requires a massive amount of data, which when combined with the appropriate organizational resources, technological support, and timing can provide invaluable insights and competitive advantages. Recently, several academics and healthcare professionals expressed an interest in comprehending the usefulness of Big Data Analytics (BDA) applications for achieving competitive advantages. Additionally, BDA combines a diverse set of capabilities with a large volume of data to deliver a beneficial outcome in terms of optimizing competitor performance. While BDA has increased profitability for some firms, increasing investment for others has proven difficult due to a disconnection between analytics capabilities and firm performance. Recent studies revealed that many businesses devote the majority of their time to data analysis and BDA application processes. As a result, BDA has not been widely adopted by other businesses to track differences in accomplishments that have a positive effect on their performance. This study focused on the Big Data Analytics Pillar (BDAP), which addresses BDA challenges in the telecommunications industry. This study took a qualitative approach, employing the case study method, and data collection is through semi-structured interviews and document analysis. Our findings confirmed that the Big Data Analytics Pillar (BDAP) model, which consists of five primary pillars and several sub-dimensions, is critical. Additionally, the Delphi technique and interview results confirm the critical elements that contribute to the BDAP model's sustainability as a critical dimension with a significant impact on firm performance.

The Big Data concept has been successfully applied in business by well-known internet platforms in order to manage real-time data in the billions of bytes [1,2]. One of the best classical examples of Big Data use is the sports industry, which became well-known following the publication of Michael Lewis' book *Moneyball* [3], was adopted in a drama movie later. According to various analyses, the sport technology market in the United States grew at a rate greater than 50% annually. The other industry which benefited from Big Data is telecommunication industry. Telecommunications companies have long had access to massive amounts of data and a large number of subscribers who connect to their services and networks on a daily basis. By expanding their voice business into broadband, these companies are now generating large amounts of data (subscribers make more calls and connect to the internet in greater numbers); and benefiting from a diverse set of sources (heavy usage of multiple internet broadband applications) and also from high data velocity levels (for instance, users of smartphones in UK are supposed to perform 220 tasks each day and also using use their phones for 1500 times weekly in opposite of just short messages and few calls recently) However, a comprehensive study of how Big Data technologies are being used, how and what returns are generated from them in the telecommunications domain is still required. This research seeks to address these gaps through an investigation of telecommunications companies' digitalization and adoption of Big Data in this industry [1].

Big Data Analytics (BDA) is described as "holistic process in order to managing, processing and analyzing 4Vs including variety, volume, veracity and velocity for providing actionable points of view to have sustained competitive advantages" [4]. BDA is a well-known method of gaining a competitive edge for a large number of businesses in the digital economy. In recent years, organizations such as American Airlines (electronic reservations), Amazon (recommendation systems), United Parcel Service (usage patterns), and also Netflix (consumer choice modelling) have become highly competitive and efficient due to their cutting-edge analytics systems. Through various digital platforms such as social media, the Internet of Things (IoT), and mobile devices, the data economy generates a large amount of new data exabytes. As noted by Davenport [5], "Big Data is totally different from small data since it was not purely provided by internal transaction systems of companies. Externally, it has been sourced too, generating from internet, different types of sensors, and initiatives of public data for example human genome project and also video and audio recordings captures." BDA can assist businesses in reducing costs, managing risks, and increasing supply chain visibility [6–8]. Co-created value between customers and businesses [9], product innovation, and process development [10,11] can help businesses improve their decision-making processes [10,12,13] as well as their overall performance [14] and achieve a competitive advantage by enabling the supply chain's innovation capability to be improved [12]. While many businesses use analytics, only a few achieve an efficient level of performance [15]. However, there are numerous challenges associated with evaluating the Big Data Analytics Pillars' (BDAP) firm performance (FPER) and also inter-firm performance [16].

Investing in Big Data technology presents numerous challenges due to the lack of a correlation between firm performance and analytics capabilities [17]. Even though analytics has become more pervasive in business, the steep growth curve of performance enhanced by analytics flattens out [18]. According to some experts, investing in Big Data Analytics Capabilities (BDAC) is a myth that should demonstrate productivity via improved firm performance and innovative capability [19]. On the basis of this debate, the current study examines the Big Data Analytics Pillar (BDAP) in the context of Big Data. Indeed, the BDAC concept demonstrates the critical importance of leveraging management, talent, and technological capabilities. The primary business challenge is to understand how to use data to improve targeting, profitability, and firm performance. Firms are confronted with this challenge as they assist their clients in making sense of data. Indeed, Big Data analytics, management, tracking, and mining solutions provide valuable attributes and ideas for strategic decision-making and improved profitability. According to evidence, utilizing data analytics tools enables businesses to respond more effectively and efficiently to market changes [20]. Recent studies revealed that many businesses that invested in BDA were unable to improve their overall performance, and that only 25% were able to improve their performance significantly [21]. There are a variety of possible reasons why firms may not realize the full benefit of their investment in data analytics. To address this gap, the current study will examine the Big Data Analytics Technology pillars that may motivate businesses to implement Big Data technologies in a variety of areas. The Delphi technique and interviews with industry professionals confirm the critical elements that contribute to the sustainability of BDAP as an essential model, as well as its impact on increasing revenue, improving decision-making, delivering productivity, real-time analysis, reducing operational costs, reducing risk in businesses, and identifying all hidden facts to provide innovative solutions. (FPER).

The remainder of this paper is structured as follows: First, definitions of big data analytics and introduction of BDA are provided. This is followed by the presentation of selected studies on IT capabilities and big data analytics capabilities. Then, material and methods are presented, followed by theory and research model. The subsequent sections present the results and discussion and findings of the study, the discussion, and the conclusion and implications for research and practice.

2. Literature Review

This section conducts a comprehensive review of the literature to investigate and explain the relationship between BDA and firm performance in this study. This exhaustive review addresses issues concerning the conceptualization of each construct, its sources, scope, and consequences. Additionally, this review of the literature will con-sider the efficacy of the constructs discussed in previous studies.

BDA's significant strategic and operational potential has catapulted it to the forefront of business, where it has the potential to be a game changer that enables increased business efficacy. Recent research on BDA indicates a positive correlation between firm performance and BDA [22–29]. For instance, BDA enables businesses to analyze and execute strategies using data-driven lenses [30]. Indeed, BDA is rapidly gaining traction as a critical component of business decision-making processes [31–33]. Today, BDA is a major difference between high- and low-performing businesses since it allows enterprises to boost revenues by 8% while decreasing client acquisition expenses by 47% by providing businesses with the tools to be proactive and inventive [34]. Target Corporation is an excellent example of an organization that leverages BDA to monitor and forecast customer purchasing trends via a reward card program [35]. Amazon.com is another organization that leverages BDA by providing personalized recommendations to customers via BDA. This strategy accounts for nearly 35% of Amazon's revenue. GE is another example that has been raised in the BDA literature. GE is in the early stages of implementing BDA to optimize software and improve service dispatching and management in the gas and power industries. This will increase the efficiency of the 1500 gas turbines under its management. If GE succeeds, it will result in approximately $66 billion in fuel savings over the next decade [36].

BDA is expected to have a significant influence on a wide variety of sectors. BDA is being used by a number of significant retailers to give suggestions, improve the consumer experience, and decrease fraud [32,37]. Within the healthcare industry, BDA has improved both quality of life and operational costs. Within operations management and manufacturing, BDA is a standout as a facilitator of business and asset process monitoring [38,39], a facilitator of business transformations [31,40], a facilitator of supply chain visibility, and a facilitator of industrial automation [41,42].

2.1. Big Data Analytics Capability and Firm Performance

There is strong consensus that having a capability for big data analytics has a significant positive impact on organizational performance [22,43]. Profitability, market share [44,45], sales, price optimization [19] and Return On Investment (ROI) are all indicators of this positive relationship [7,46,47]. Srinivasan and Arunasalam [48] demonstrate how analytics capabilities have helped healthcare organizations reduce costs by reducing wastage and fraud, while also improving care quality through more effective treatment and stricter safety standards. According to another study conducted by Woerner and Wixom [43], analytics capabilities can help organizations improve their performance by increasing efficiency and productivity. This was accomplished in the study by reducing paper reports, a tangible improvement, and improving the company's reputation, an intangible benefit. As a result, organizations with a stronger Big Data Analytic Capability will gain extensive insights, resulting in the best possible organizational performance [46,49]. As IT is a critical component of Big Data analytic capability, it is argued that the ability to effectively activate and utilize resources associated with analytic capabilities has a positive effect on organizational performance and results in a competitive advantage [22,50,51].

Previous research has established a positive correlation between organizational outcomes and IT capability. For example a significant positive relationship between IT capability and organizational agility, specifically in terms of market capitalization and operational adjustment, was discovered through a survey of information systems and business executives from 128 companies using a matched-pair design sampling [52]. A similar study [53] surveyed 214 Chinese business and information technology executives from manufacturing firms and concluded that IT capabilities aided organizational performance. They continued by stating that an adaptable capability embedded in business processes facilitates the connection between IT capability and organizational performance.

2.2. Big Data Analytics Management Capability

The Big Data Analytic Management Capability is a critical component of Big Data Analytic capabilities because it ensures that the best decisions are made with a sound management framework (BDAMAC). Perceptions of this management capability are shaped by four guiding themes: BDA planning, Investment, Coordination, and Control. The first step in managing Big Data analytics is the BDA planning process, which identifies business opportunities and develops strategies for Big Data models that enhance company performance [46]. For example, Amazon planned to use a predictive modelling technique called collaborative filtering to generate personalized customer recommendations for each item visited or purchased. At its peak, this recommendation engine accounted for 30% of Amazon's sales [19].

Investment decisions are also critical for management capability because they encompass the cost-benefit analysis of each decision. For example, by investing in over a billion online movie review data points across multiple categories such as liked, disliked, and more, Netflix transformed its analytics capability, optimizing movie recommendations to better match customer preferences [44] concludes that organizations that have made significant investments in Big Data have realized significant returns and gained significant competitive advantages, posing a risk to businesses that have not made similar investments. As a result, it is critical to manage this capability in order to drive growth and boost revenue-generating activities such as Amazon and Netflix.

Coordination is the third core theme that is gaining traction in Big Data analytics. Coordination is a routine capability that organizes the cross-functional and cross-organizational synchronization of analytics activities [18]. Analysts at Proctor and Gamble work to coordinate various business functions such as consumer research, sales, marketing, operations, and supply chain in order to improve the company's overall performance [44].

Finally, control in the context of Big Data analytics management entails ensuring proper resource utilization and committing to prudent projects via tools such as human resources and budgets. Returning to our example of Amazon, the company implements control measures by comparing analytics proposals to plans and defining the roles and responsibilities of each analytics unit. Additionally, Amazon develops performance criteria for analytics projects and continuously monitors the analytics unit's performance [45].

2.3. Big Data Analytics Technology Capability

Technology capability in Big Data analytics indicates the platforms flexibility, for example, its compatibility with other platforms, connectivity of diverse data, and modularity in model building and so on, with relation to empowering data scientists to utilize and support a company's resources. With technology capability, there are there underlying themes which are, modularity, connectivity, and compatibility. Volatile business environments, such as fluid market conditions, evolving competition and customer behavior, must be managed and aligned with the company's resources and short- and long-term strategies. For example, if it wants to develop new product or diversify its portfolio. A flexible technology capability in Big Data allows companies to acquire and connect multiple data points from various locations, be it remote or branch offices. Furthermore, it allows the development of data sharing channels that compatible with each other, and it allows for the creation of application and models to tackle changing needs. Therefore, analytics' capability's flexibility is dependent on two factors. The first is the connectivity in gathering and analyzing multiple data types among different business units like customer relations and supply chain management. For instances, banks employing Big Data analytics can improve customer service if they combined the data collected from social media, ATM transactions, customer complaints and online queries [46]. The second factor is compatibility which ensures a steady stream of information so that decisions can be made in real-time. Compatibility also allows data organization as it helps streamline and merge data that is duplicated while filing in missing information. Amazon, for example, uses could technology for enhance compatibility [44]. This helps them experiment, analysis and collaborate faster. Modularity is the embodiment of a flexible platform as it allows the modification, removal and addition of features of a model as requires. This helps in improving organizational performance and capitalizing business opportunities.

2.4. Big Data Analytics Talent Capability

Talent capability in the context of analytics refers to the expertise of data analyst or scientists in executing tasks related to Big Data analytics. This capability is one of the defining components in creating and sustaining a competitive advantage [54]. The Delphi studies suggest that analysts must grasp four significant yet distinct skillsets. Technical knowledge, the name states, denotes the knowledge of technical elements including the basics like statistics, operational and database management systems, and even programming languages. Yahoo was an innovator when their data scientists created Apache Hadoop. Facebook then developed Hive which is a language for Hadoop projects. That path then paved the way for companies such as Amazon, Twitter, Google, LinkedIn, and eBay to transform their analytics capabilities [39]. The second skillset, technology management knowledge, indicates analytics management knowledge that is crucial in supporting business goals. They could include techniques deployment and management, and visualization tools. Netflix did a good job of this when their analysts utilized a visualization analytics tool and a demand analytics tool to get a better idea of viewers' preferences and behavior. This knowledge of technology management led them to great success with their show 'House of Cards' in America [55]. Next, is business knowledge. This is the knowledge of business functions with an organization and the knowledge of the business environment at large such as opportunity costs and long- and short-term business goals. For example, data scientists at Intuit are encouraged to gain an empathetic understanding of customers while also getting a feel for business issues. Lastly, relational knowledge is a data analysts' ability to work and communicate with colleagues from other business units. A close relationship between data scientists and other people within the organization can be very important. This was the inspiration for LinkedIn's 'People You May Know" feature which helped them achieve 30% more click throughs. All in all, a good of these skillsets need to continually be developed through coaching and training with all projects [46].

2.5. Big Data Analytics Innovation Capability

The innovative capabilities of an organization and its impact on its success may be seen from a range of viewpoints [56,57]. We shall discuss a multi-layer examination of an organizational unit's creative potential in this section. According to Akman and Yilmaz [58], innovative capabilities is also a vital component in fostering an innovative company culture and defining internal promotional efforts. The capacity of a business to continually develop in response to a changing environment is referred to as innovation [57]. Tuominen and Hyvönen [59] and Martinez-Roman, Gamero [60] for example, differentiate innovation capabilities into management and technological innovation. Another research classified innovation capabilities into three categories: innovation management, technology factors, and human factors of innovation management [61]. Human factors, which include two aspects such as people and social behaviors, are important elements in organizational performance. Furthermore, the terms "business innovation capability" and "critical innovation process success factors" have been used to define the crucial innovation process success elements as discussed by [62]. These crucial factors may be regarded as the cornerstones of corporate innovation capability; consequently, the capability may be measured using the elements. Although it has a distinct stamp, organizational innovation may be defined as a combination of direct and indirect worker engagement, cooperative industrial relations, and smart managerial efforts [63]. These defining factors shared by innovative enterprises have been identified in the literature [62,64–66]. According to Saunila, Pekkola [67], earlier research, there are seven variables of innovation capability: (1) Participatory leadership culture as managerial conditions and actions driving and facilitating innovation, (2) Ideation as organizational structures motivating generation, development, and implementation of innovation, (3) work climate and employee well-being, (4) development of employee skills and knowledge base, and (5) regeneration as operational maturity based on prior experience. (6) Appropriate use of external knowledge-based networks, and (7) individual behavior as an inescapable variable in shaping the organization's total innovation capabilities. According to several research, an organization's innovativeness is a significant component in determining its performance [68,69]. Thus, organizational performance may be improved by technological and administrative innovation, as well as other components [70]. Previous research has determined the impacts of innovation and innovativeness on organizational performance [71,72]. Higher levels of productivity and performance, as well as economic growth and enhanced company value, have all been identified as factors influenced by organizational capacity to innovate [73]. Technical and organizational innovations are two essential components for improving performance and boosting the firm's value [73,74]. Organizational innovations create a conducive atmosphere for other forms of innovation and have a substantial and direct influence on inventive performance [75]. Furthermore, the overall success of the business and organizational innovations are inextricably linked [63]. As a result, managers need to find and manage innovations in order to improve operational performance and reduce corporate costs [63,76].

2.6. Big Data Analytics Domain Knowledge Capability

In economically and volatile times, professionals who have a grasp on industry and business dynamics will be the ones to hold a competitive advantage. Throughout a professional's career, it is expected that the individual will provide consultation and strategic advice to the business. Unless these professionals have an acute understanding of the environmental and operational realities of their industry, however, they will be unable to effectively transition to a consolatory role and please their employers and customers. Every industry encompasses its own unique challenges, competitive landscape, distribution and supply chain, inscrutable acronyms, sectors, business model, and expectations. By enhancing the domain knowledge of the respective industry, the individual can obtain significant competitive advantage in their own careers. Experts are highlighted that mainly the BDA personnel should have a good knowledge on Big Data Analytics and also Domain Knowledge and Functional knowledge to achieve the business goal.

Knowledge of the environment that organizations operate in is known as domain knowledge. It entails a comprehension of industry particular strategies and challenges of the business, knowledge of the supply chain, customers, value chain, competitive landscape, business model, segments and sectors, history, and dynamics. In other words, knowledge of a specific industry is domain knowledge. Understanding and handling any situation in business that may arise with swift and decisive action which leads to a positive outcome is known as business acumen. This term also encompasses an understanding and knowledge of other functions in the organization, such as its operational, marketing, accounting, and financial functions. From the same perspective some respondent highlighted that in BDA, knowledge is strength and the various stakeholder coordination and collaboration, continues technical and domain knowledge upgrade are the key to get that strength. Also, he expressed that success of the BDA is only achieved through the continuous Inter and Intra team coordination and extensive sharing of domain and technical knowledge.

Particular variances and best practices exist for each of these functions in their own industries. Making quick decisions, well-informed judgements, and empowering leaders to handle challenging business circumstances is aided by obtaining domain expertise and business acumen. A performance management that is more disciplined, increasing attention to operation and implementation's main dimensions, business decisions underlined with concrete logic, and a more mindful analysis can be achieved by having a greater understanding of the industry. Some expertise mentioned that Big Data is one of the technical knowledges that can help in succeeding the organization mission to understand the business needs. Having the domain knowledge of that practice business would be helpful for them to contribute better. For example, our business is in telecommunication, so if that person has knowledge on the Telecom domain, that would be a value added.

Working for these companies and providing the necessary solutions that are aligned directly with the targeted industry's unique dynamics and demands are the talents and professionals. The future and present industry dynamics must be kept in perspective in order for the designed solutions to be effective and sustainable. This is only achieved by comprehending the business and domain of the specific business/ industry. through the same lens, some respondent proposed that domain knowledge is a one of the BDA capabilities. Individuals who are working in Big Data filed need to know about the domain knowledge to capture relevant information. So, they can conduct the required logic to assist the business.

3. Materials and Methods

A Big Data Analytics Pillars model was created by gathering a wide array of expert's knowledge and opinions, as well as through document analysis. In theoretically considering the process, a structure based on Resource-Based Theory (RBT) was achieved as well. The study consisted of two phases that the main theme for phase one was model development, and the theme for phase two was model validation. As a strategy, this study used the qualitative approach and case study method and technique of data collection include semi-structure interview and document analysis. To understand the current situation in the domain, this research conducted document analysis from printed and electronic (computer-based and Internet-transmitted) material. we came up with four criteria when selecting the experts: (i) at least five years' experience in Telcom domain, (ii) experts and managerial level, and (iii) should be technically qualified. Respectively, for second phase, the above items remained plus respondent should be Ph.D. holder as well. To identify the critical elements of BDA Pillar Model in the domain, semi-structured interview session was conducted with expert panel. For the interview session, industry experts were identified and selected to participate. They are C-level, Head of Departments, and technical consultant in the Telecom domain. Interview has been conducted for almost two hours in each round. The outcomes were recorded by electronic devices such as mobile and computer. Then the transcript has been done in details (Appendix A). In the next step, the coding has been done and based on the coding and theme, the model has been produced. The scope of the BDA and firm performance was decided based on the previous research. In the next step, data collected from previous phase has been analyzed, and the results incorporated into study. Finally, the Big Data Analytics Pillar (BDAP) for Telecom was created based on the result from the experiment. In the second phase, we came up with model validation to assess the proposed model. Respectively, for second phase, there are some inclusion criteria of respondents such as at least five years' experience in Telcom and data domain, experts and managerial level, should be technically qualified, and respondents should be Ph.D holder as well. In the second phase, this research used Delphi techniques. In the second phase of this research, the Delphi technique was used, according to which participants are presented with regular reports on the findings during each questionnaire round. All rounds were completed in total twelve months. According to Delphi approach, after interview stage, the transcript reports was sent to the participant experts to receive their potential feedback face-to-face, and telephone communications. Following the panel of experts' academic consensus, it was deemed necessary to conduct professional feedback in order to adequately validate the contents (Appendix B). This procedure increases the items' reliability and validity [77].

4. Theory

The conceptual framework of current study provides a relationship between Resource-Based Theory (RBT) as illustrated in Figure 1. The key goal of this research is developing and suggesting a feasible model according to Big Data Analytics in Telecom domain. According to RBT, a business's competency is dependent on quality in order to efficiently manage its vital resources (human, technology, and management) and gain a competitive advantage, which may be converted into enhanced firm performance(FPER) [78]. It is necessary to make difference between capabilities and resources of a company. In fact, resources are owned productive assets by the company; on the other side, capabilities are what a company is able to do. The resources alone cannot provide competitive advantage, they should contribute together in order to generate organizational capability. So, capability is considered as the essence of better performance; Figure 2 demonstrates the relationship between capabilities, resources, firm performance and competitive advantage. Thus, through considering the resources of a firm, we can define three key categories of resources including human resources, tangible and intangible. Two core presumptions for the RBT theory regarding resources that are firm based in order to boost firm performance and demonstrate why a handful of organizations perform more efficiently than others. First, a significantly large range of resources exist even for firms that conduct a similar business in the same sector. The variety of resources assumed shows the potential of organizations to perform specific functions with their provided unique resources. Second, the challenge of maneuvering resources across firms only enhances the differences. This presumption articulates the immobility of the resources, which is further emphasized by the resources' sustainable synergistic benefits. Additionally, based on the previous two assumptions, RBT logic includes VRIO framework. This framework affirms that an organization's performance is reliant on the extent to which a company is able to simultaneously maintain resources which are properly organized (O), imperfectly imitable (I), rare (R), and valuable (V). Furthermore, the element of the resources that facilitates a firm's ability to minimize net costs and improve upon net revenue is the valuable dimension [79]. The first indicator, organization, works to manage appropriately the three subsequent indicators as well as push them to reach their complete potential. The imperfectly imitable indicator proves that substitutes or duplicates of resources are not possible as the cost to reproduce is too high. It is, therefore, proposed by researchers that complementary resources within an organization will make it challenging for the competition to duplicate [80]. The rare indicator demonstrates that the resources had to be searched for and are only possessed by a limited number of organizations, which enhances the company's competitive advantage. The final indicator, valuable, works to deliver productivity, increase loyalty, enhance profit, reduce the cost of serving customers over time, minimize threat, and build on opportunity. Capability and resources are the two primary components of RBT. Though resources hold both intangible and tangible assets, like organization, human, and technology, the "capabilities" are a subset of organizational resources. These are non-transferable resources and their goal is to advance other resource's productivity. Capabilities can also be considered a process, either intangible or tangible, that delivers productivity and simplifies the deployment of additional resources. In total, they are a unique resource whose goal is to enhance the outcomes provided by the firm's other resources. The RBT dictates that the abilities of a firm are dependent upon its capability to manage effectively its crucial resources in order to accomplish successful firm performance (FPER). Ground-breaking capabilities usually translate to sustainable, long-term advantages via social duplicate [80]. The rare indicator demonstrates that the resources had to be searched for and are only possessed by a limited number of organizations, which enhances the company's competitive advantage. The final indicator, valuable, works to deliver productivity, increase loyalty, enhance profit, minimize the cost of customer service over time, minimize threat, and build on opportunity. 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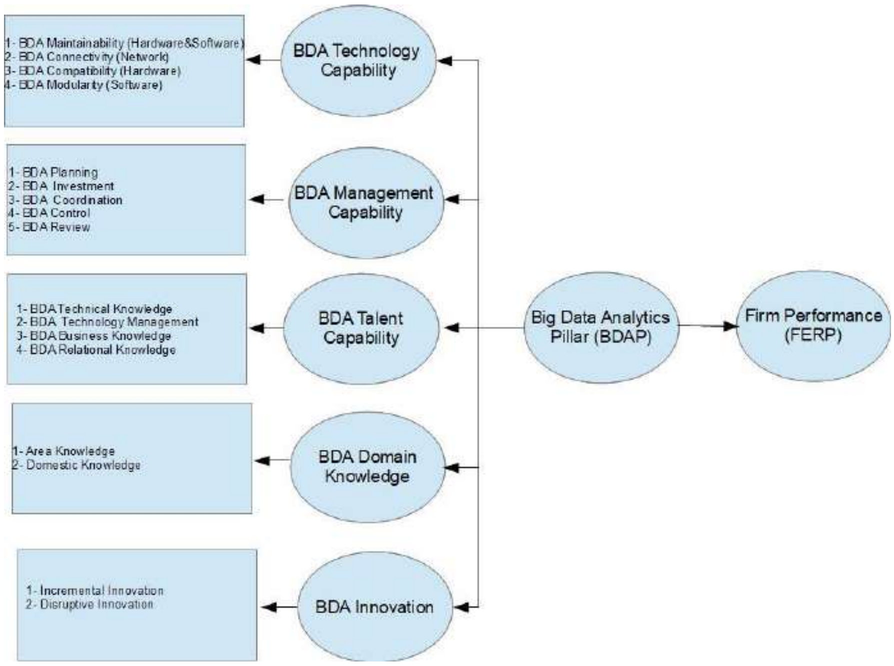

Figure 1. Research model.

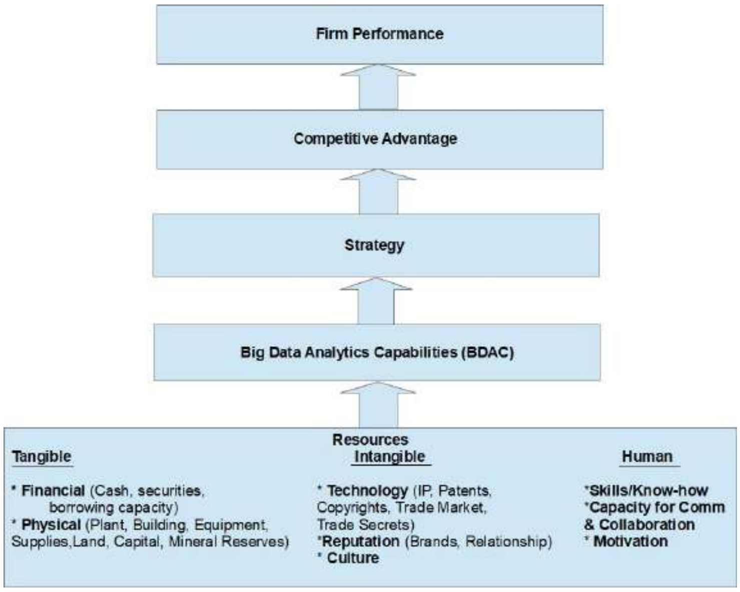

Figure 2. Conceptual framework of big data analytics capabilities and firm performance.

5. Results and Discussion

5.1. Big Data Analytics Technology Pillar

In Big Data analytics, the technology pillar refers to a platform's flexibility, such as its compatibility with other platforms, connectivity of diverse data, and modularity in model building, among other characteristics, in relation to empowering data scientists to leverage and support a company's resources. There are several underlying themes associated with technological capability. These include modularity, connectivity, maintainability, and compatibility (Figure 3). Volatile business environments, such as changing market conditions, competitive landscapes, and customer behavior, must be managed and aligned with the company's resources and short- and long-term strategies. For instance, if the company wishes to launch a new product or diversify its portfolio. A nimble technology capability in Big Data enables businesses to acquire and connect multiple data points from a variety of locations, including remote and branch offices. Additionally, it enables the development of data sharing channels that are compatible with one another, as well as the development of applications and models that adapt to changing needs. Thus, the adaptability of analytics is contingent upon two factors. The first is the connectivity required for the collection and analysis of multiple data types across various business units such as customer relations and supply chain management. Banks, for example, can improve customer service by combining data from social media, ATM transactions, customer complaints, and online inquiries [46]. The second factor is compatibility, which ensures a continuous flow of information that enables real-time decision-making. Compatibility also aids in data organization by streamlining and merging duplicated data while also filling in missing information. Amazon, for instance, makes use of could technology to increase compatibility [44]. This enables them to experiment, analyze, and collaborate more quickly. Modularity exemplifies a flexible platform because it enables the modification, removal, and addition of model features as required. This contributes to organizational performance improvement and capitalization of business opportunities. Maintainability is a design and installation characteristic used in telecommunications and several other engineering fields. It is defined as the likelihood of an item being in or being restored to a specific state during a specific time period when maintenance is conducted in accordance with predefined processes and resources, as well as the simplicity with which the maintenance of a functional unit may be carried out in compliance with stipulated specifications. BDATech, in reference to assisting data scientists in rapidly supporting, deploying, and developing a firm's resources, refers to the overall flexibility of the BDA platform in terms of model modularity, platform compatibility, and connectivity of cross-functional data. There are four primary underlying themes that underpin BDATech perceptions: modularity, compatibility, maintainability, and connectivity. Aligning resources with both short- and long-term business strategies such as diversification, new product development, and so on, as well as addressing volatile business conditions such as changing consumer behavior, market dynamics, or competition, is critical. With flexible BDATech, businesses can connect and source numerous data points from mobile, branch, and remote offices. Additionally, they can develop applications and models to meet changing needs and design data-sharing channels that are compatible across multiple functions. Thus, two factors determine an organization's BDAC's flexibility: connectivity and compatibility. The first component is connectivity among various business units in terms of analyzing and sourcing a plethora of data from various functions (i.e., customer relations management, supply chain management, etc.). For example, when it comes to customer complaints, social media comments, online inquiries, and automated teller machine (ATM) transactions, banks operating in a big data environment can improve customer service operations by combining data from the aforementioned sources [46]. The second element, compatibility, ensures a continuous flow of information, enabling real-time decision-making. Additionally, this element works to clean operations by merging and synchronizing data that overlaps and rectifying missing information. According to Davenport and Harris [44], Amazon leverages compatibility through the BDAC platforms could technologies, which enable rapid analysis, experimentation, and collaboration. The modularity of the platform enables the model's features to be removed, modified, or added as needed. Additionally, it aids in identifying new business opportunities and improving FPER. Figure 3 illustrates the BDA Technology sub-dimension in detail, which will be discussed in greater detail in the following sections. It enables the synchronization of data that overlaps and the correction of missing information. According to Davenport and Harris [44], Amazon leverages compatibility through the BDAC platforms could technologies, which enable rapid analysis, experimentation, and collaboration. The modularity of the platform enables the model to be developed in a flexible manner, allowing for the removal, modification, or addition of features as needed. Additionally, it aids in identifying new business opportunities and improving FPER. Figure 3 illustrates in detail the BDA Technology dimension and sub-dimension, which will be discussed in greater detail in the following sections.

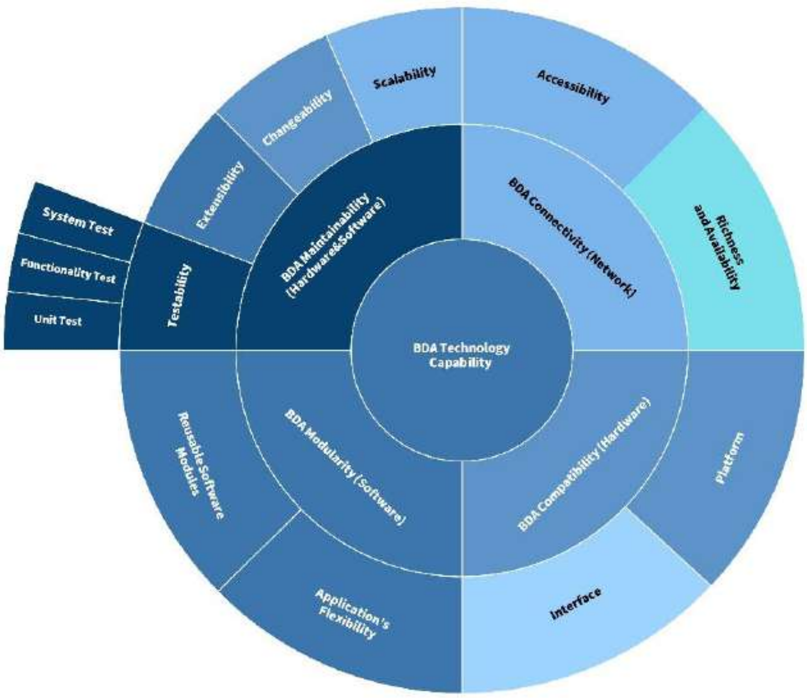

Figure 3. Big data analytics technology capability pillar.

(a) BDA Connectivity—Network
(b) BDA Compatibility—Hardware
(c) BDA Maintainability—Hardware and Software
(d) BDA Modularity—Software

5.1.1. BDA Connectivity

Increased accessibility of technology such as platforms and analytics, cloud, artificial intelligence, and mobile has fundamentally altered how we interact, work, and live in what has been dubbed the Fourth Industrial Revolution. The telecom sector is critical to the digital revolution. The Telecom ecosystem's applications, interconnectivity, and access to fundamental building blocks all contribute to the digital revolution. The digitization of the world over the next decade, and the potential value it brings, is highly dependent on the telecom sector's provision of critical infrastructure and enhancement of productivity and applications. According to this research, three pillars of BDA connectivity have been identified: richness and availability, remote access, and access mechanism.

5.1.2. BDA Compatibility (in Terms of Hardware)

Compatibility is defined as the ability to exchange data and information regardless of the technology components or systems used. Additionally, it is defined as the capacity to work and live in harmony with one another. Compatibility refers to the ability of software applications to run on the same hardware configurations. For example, if Google.com is compatible with all operating systems and browsers, all users should be able to access the site. Thus, compatibility exists when two systems can coexist without requiring modification. The data formats used by compatible software applications are identical. For example, users should be able to open a document file in any compatible word processor application. Compatibility is divided into two categories in this study: platform compatibility and interface compatibility.

5.1.3. BDA Maintainability

According to Galorath [81], a fundamental property of software is maintainability, as maintenance typically consumes a significant portion of the total effort allocated to the software's life cycle. Indeed, current research indicates that software maintenance consumes between 60% and 90% of the total cost of the software, making it the most expensive phase of the software life cycle [82,83]. The ISO/IEC 9126 quality model defines maintainability as the software product's ability to be modified [84]. As software maintenance consumes more time, the amount of work required and overall costs during the software's evolution can be more accurately predicted by understanding the system's maintainability [81,83,85]. Identifying opportunities to improve the modularity of the upfront design can also be predicted by understanding the system's maintainability.

Stability and changeability are two significant software metrics that can be thought of as sub-attributes of maintainability, as defined by ISO/IEC 9126. Coallier [84] defines changeability as the ability of a software product to support the implementation of a specific modification. In a similar vein, stability is defined as a software product's ability to prevent unintended ripple effects following modification [84]. In other words, changeability indicates a software's ability to adapt to change, whereas stability is observed/quantified after a change has been made. According to research, two of the most critical factors of maintainability are stability and changeability. Instability and maintenance costs are increased as a result of poorly initiated and controlled changes, which can account for up to 75% of the total cost of software ownership [83]. Software maintenance issues are frequently caused by a failure to consider the maintainability of software during the initial design stages. By more effectively controlling the design phase of software's life cycle, maintenance costs can be significantly reduced [81]. A higher-quality product can be deployed prior to the maintenance phase if potential unstable modules that require additional attention are identified during the initial stages. According to Norman [85], deferring this step until the implementation stage or later results in a significantly higher cost of correction. As a result, the development stages should include an analysis of stability and changeability. According to the ISO 9127 quality standard, the four elements of maintainability are changeability, stability, testability, and analyzability. Changeability, the subject of this research, is a critical component in telecommunications and other application areas where software systems are rapidly evolving. Certain businesses acquire the software they use rather than developing it. They are more concerned with the software's ability to change, or how well it can withstand ongoing changes, than with its stability, testability, or analyzability. To gain additional insight into the maintainability of the system, the core components can be further broken down into Changeability and Testability.

5.1.4. BDA Modularity

Modularity is a term that refers to the ease with which software components and systems can be removed, modified, and added in module form [86]. According to Bharadwaj [87], IT infrastructure flexibility enables businesses to innovate strategically by making it easier to create common systems that integrate multiple organizational functions, fostering information sharing across business units, and enabling the development of critical applications. As a result, IT infrastructure flexibility serves as a foundation for the development of more efficient business processes and serves as a source of a company's strategic ability [88]. This section may be divided by subheadings such as Reusable Software Modules and Application's Flexibility.

5.2. Big Data Analytics Management Capability

Figure 4 shows the BDA management dimensions and sub-dimensions in detail and will be explained in the following sections:

(a) BDA Planning
(b) BDA Investment
(c) BDA Coordination
(d) BDA Control (Monitoring)
(e) BDA Review (Evaluation)

5.2.1. Big Data Analytics Planning

The planning stage of the BDA process is the first step in developing the Big Data Analytics Management Capability (BDAMAC). This process begins with the identification of business opportunities and the determination of how Big Data-based models can improve firm performance (FPER). Amazon serves as a case study for the aforementioned process in action. The company uses "collaborative filtering," a predictive modelling technique, to generate a "you might also want" prompt for each item visited or purchased on the website. This technique was extremely successful, with approximately 30% of sales originating from this recommendation engine at one point. After consulting with dozens of organizations across six data-rich industries, I've concluded that maximizing the value of analytics and data requires three mutually supportive capabilities. Initially, organizations must be capable of managing, combining, and identifying a diverse set of data sources. Second, a model based on advanced analytics must be developed to optimize and predict outcomes. Most importantly, the third component must be management's ability to restructure the business in accordance with the data and model's recommendations, ensuring that better outcomes actually occur [46]. Two critical characteristics underpin the aforementioned competencies. To begin, they need a clear strategy for utilizing analytics and data effectively to remain competitive. Secondly, the capability to implement the most appropriate technological capabilities and architecture [46].

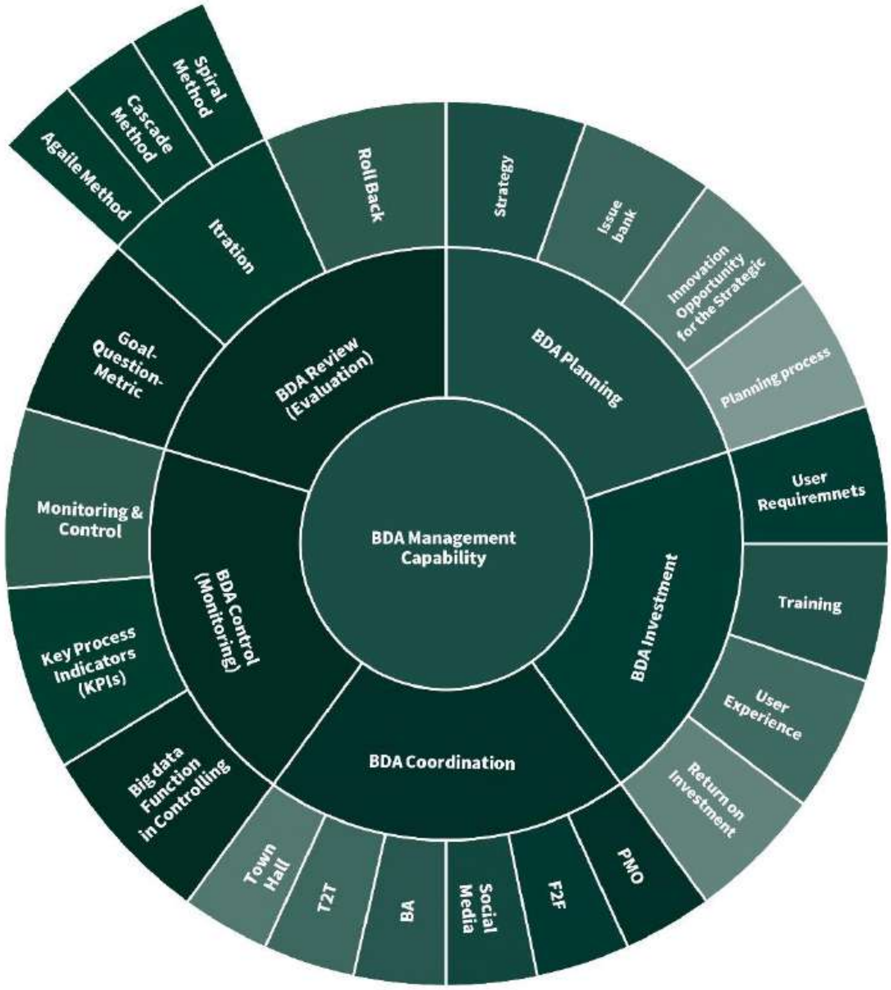

Figure 4. Big data analytics management capability pillar.

- Strategy Planning and the Planning Process

Planning is a powerful tool because it provides a common language for managers, data scientists, technology professionals, and senior executives to discuss where the most rewarding returns could come from and how to begin achieving them. Strategic planning and management history are inextricably linked. Only a few companies developed well-thought-out strategic plans forty years ago. Those who took the time to develop a strategy achieved the majority of notable results. It was only a matter of time before more businesses adopted the same planning frameworks and tools that were novel in the business world at the time. A strategic plan is now an essential component of any business's start-up process. According to this research, the majority of upper-level management will soon incorporate a data and analytics strategy into their initial stages of development in order to fully leverage the power of Big Data.

Big Data and Analytics are rapidly gaining traction on the agendas of the majority of businesses. They have the ability to revolutionise the corporate world and produce the sort of performance increases last witnessed in the 1990s when corporations overhauled their basic processes. Data-driven strategies will become increasingly vital in differentiating oneself from the competition. These strategies are contingent upon the software's quality. It appears as though data-driven strategies will either help a business succeed or will ultimately result in the organization's failure. The quality of the data-driven software application is critical, as the quality of work ultimately defines or breaks a business. If the products they develop in terms of software, communication platforms, or anything else they sell in the market do not meet the expected standard, people will eventually stop using them, and the business will fail. As a result, creating solutions that fulfil the needs and expectations of customers and end users is crucial.

Because of the vast breadth and depth of data acquired during routine company operations, the telecom sector has an edge when it comes to Big Data strategy. A telecoms business with 8 million prepaid mobile users generates about 30 million Call Detail Records (CDRs) every day, for a total of 11 billion records each year [7]. If the same operator also provides post-paid and fixed line services, the volume and variety of data available increases even further. Today, data is unquestionably one of the most strategic assets for a telecommunications company. Telecoms, with a goldmine of data at their fingertips, have an enormous opportunity to capitalise on these valuable data sets. Numerous types of data can be enhanced through the use of a sound Big Data strategy. The question then becomes which strategic actions an operator should take. As a consequence, according to a Telecoms.com industry study (Services), Big Data is positioned to provide the most value to Telecom in the areas of customer retention, customer segmentation, network optimization and planning, and providing upsell/cross sell possibilities. On the basis of the data gathered, four distinct opportunities (Services) emerge: Customer Experience, Network Optimization, Operational Analysis, and Data Monetization.

The primary reason for strategic planning is to connect the organization's mission and vision, as well as to address the following three questions: what do businesses want to accomplish (vision), what is our purpose? (mission), and how are businesses going to accomplish it (plan). Strategic planning at the corporate level provides focus and direction in the form of written documents, making it one of the more obvious methods of increasing efficiency and cohesion. A well-defined vision and mission assist the organization in developing a strategic plan, which serves as a formal road map to its eventual successIf the same operator also provides post-paid and fixed line services, the volume and variety of data available increases even further. Today, data is unquestionably one of the most strategic assets for a telecommunications company. Telecoms, with a goldmine of data at their fingertips, have an enormous opportunity to capitalise on these valuable data sets. Numerous types of data can be enhanced through the use of a sound Big Data strategy. The question then becomes which strategic actions an operator should take. As a consequence, according to a Telecoms.com industry study (Services), Big Data is positioned to provide the most value to Telecom in the areas of customer retention, customer segmentation, network optimization and planning, and providing upsell/cross sell possibilities. On the basis of the data gathered, four distinct opportunities (Services) emerge: Customer Experience, Network Optimization, Operational Analysis, and Data Monetization.

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A strategic plan is more than a tool for keeping the business on track. Strategic planning can be a collaborative effort involving all employees. This process can foster synergy and result in group discussions about the organization's direction. In other words, organisational alignment is facilitated by a strategic plan. Within businesses, there are innovation forums. Four times a year, an open discussion is held in which anyone is welcome to participate and share their vision. The employees' commitment is evident. During the innovation forums, proposals incorporating the BDA element were presented. There is an interest in addressing emerging technology.

Adopting an appropriate strategy and policy would benefit communication companies, as strategic planning is widely recognized as a critical component of many firms' success. However, there is a noticeable lack of strategic planning in the Telecom domain, as respondents highlighted as a current challenge for Telecom companies. They believe that there are two primary perspectives. (1) People do not understand how to use technology effectively, and (2) how to take it to the next level. For example, Data Scientists understand data but not business problems, and business users understand business problems but not the capabilities necessary to solve or view business problems differently. Thus, managers want to move away from solutions that simply provided information to enable them to make decisions and toward solutions that can inform decision makers about the best options, the rationale behind each option, and provide distinctive solution options. However, it appears as though the absence of a strategy is noteworthy.

According to International Data Corporation (IDC), profits from Big Data and Analytics (BDA) are expected to reach $14.7 billion in the Asia/Pacific region (excluding Japan) in 2018 [90]. This represents an increase of 14.4 percent over the prior year's profits. Profit opportunities from the acquisition of BDA-related services, software, and hardware will almost certainly accelerate in the coming years. Indeed, they are expected to reach approximately $22.2 billion by 2021. Between 2016 and 2021, this growth represents a 14.4 percent compound annual growth rate over a five-year period (CAGR). In 2018, the five sectors expected to invest the most in big data and analytics solutions are professional services, central/federal government, discrete manufacturing, telecommunications, and banking. In 2018, these five sectors are expected to invest approximately $8.3 billion in BDA solutions. This will account for more than 55% of total expenditures. They are also expected to be the largest investors in 2021, with an estimated $12.6 billion. However, between 2016 and 2021, resource industries, healthcare providers, and professional services will experience faster growth rates of 15.5 percent, 16.1 percent, and 16.9 percent, respectively.

Without a doubt, a revolution is brewing in the area of Big Data and Analytics Management. The continued success demonstrated by the increase in successful case studies supports more comprehensive studies that indicate that organisations that incorporate analytics and data into their operational structure can achieve a 5–6% advantage over their competitors in terms of profit gains and productivity delivery [91]. The responses from experts illustrate this point particularly well: Big Data Analytics is beneficial for telecommunications companies. The reason for this is to enable them to understand user behaviour in order to increase productivity. Additionally, telecom companies will be able to forecast the market in order to be the domain leader and earn more profit, as well as how to market our products to the end user.

Finally, in today's data-intensive communications environment, social media networks, connected gadgets, consumer behaviour, government portals, call data records, and billing information, among other things, generate massive volumes of data. Telecom operators face significant challenges in dealing with this surge in data volumes. However, by effectively utilising Big Data and Big Data Analytics techniques, this challenge can be transformed into an opportunity. When data is collected wisely and professionally analysed, it can reveal powerful insights. Big Data and advanced analytics equip telecommunications companies with the tools and techniques necessary to harness and integrate new sources and types of data in larger volumes and in real time. Operators can use data analytics to increase the overall value of their business by optimising service delivery, customer satisfaction, delivery productivity, and revenue. The research output acknowledged that deliver / enhance productivity is one of Big Data Analytics' greatest achievements.

5.2.2. Big Data Analytics Investment Decision-Making

To determine whether to invest in a project, particularly one involving Big Data Analytics, a Cost-Benefit Analysis (CBA) can be conducted [92,93]. A cost-benefit analysis is a well-established technique for determining the economic benefit of an investment. As such, it can assist service providers in determining whether or not to proceed with the engineering and implementation of a new data-driven business model [92,93]. Due to the complexity of service [94], it is desirable to capture and analyse CBA-related factors in a systematic manner. The benefits of big data are as follows: improved strategic decision-making (69 percent), increased operational process control (54%), a deeper understanding of customers (52%), and cost savings (29%) (47%). Organizations that leverage big data are also capable of quantifying their gains, with an average cost reduction of 10% and revenue growth of 8% reported [95]. Among the benefits of Big Data Analytics are the ability to improve decision-making efficiency, an increase in productivity, and increased managerial control over environmental monitoring. Organizations, on the other hand, should not minimise or ignore potential disadvantages. Businesses must invest significantly in Operational Expenditure (Opex), Capital Expenditure (Capex), Training Expenses, and Maintenance.

The following components of a Big Data Analytics investment were identified as critical: user requirements, BDA investment, time, user experience, training, and return on investment (ROI). Determination Making in organisations that have already implemented Big Data elements or in organisations that are currently using a legacy approach but intend to migrate to a BDA approach. Innovative and emerging technological tools are facilitating frontline adoption, which is accelerating the need for organisations to adapt in order to achieve results. The excitement surrounding Big Data and advanced analytics stems from the potential for large-scale impact and the massive amount of data collected. According to a recent McKinsey Global Institute (MGI) study, retailers could potentially increase their operating margins by 60% or more by implementing data analytics across all operations [19]. According to the same study, the healthcare sector in the United States could save up to 8% through the use of data analytics quality improvement and streamlining efforts [19]. However, achieving the high levels of potential impact reported in the MGI study has proven difficult. Of course, there are notable exceptions, such as Amazon and Google. However, these two businesses were founded on data analytics. The majority of legacy businesses have had only sporadic success with data analytics in a few areas of their businesses. Only a select few have witnessed accomplishments large enough to qualify as "big impact through Big Data" or "scaled impact."

Similarly, this study's findings confirmed that Return On Investment (ROI) is not a straightforward and visible metric. What you invest in Big Data is not immediately visible. It is not quantifiable, but you can achieve the value through another lens. It is determined by how businesses utilise data to increase productivity. Perhaps it is quantifiable in terms of sales, but from a Big Data perspective, it is indirect and not directly contributed. While these experiments frequently yielded novel and significant insights, the large-scale breakthroughs promised were not realised. For instance, a manager at an automobile manufacturer recently invested in an analysis to gain a better understanding of how social media could be used to improve forecasting and production planning. While the analysis revealed specifics about the automaker's customers' preferences, it did not provide the promised guidance on forecasting or planning for the company. Examples like this are frequently cited by executives as justifications for not increasing their data analytics investments, as the results did not produce actionable results that influenced the business's growth. This translates into management expressing apprehension about funding scale-related investments such as tools, analytics centres of excellence, and training. From the investment in BDATech perspective, the result identified BDA as a critical factor and effective item for increasing firm performance. There are several prerequisites that may require business purchase, but how do business requirements translate into functional requirements? In other words, what are the functional requirements for the system in terms of the features that must be present in the services that you provide? From there, we can determine the appropriate situation in which to build this feature; we can build it in-house or outsource it.

Additionally, from a time perspective, it may be prudent to recommend that the team develop the Big Data Analytics eco-system. However, in some cases where business requires it quickly and time is of the essence, it is preferable to spend a little extra money and purchase the desired tools or solution from the market. Time appears to be negotiable to consider as an item that can be identified based on business requirements. Additionally, BDA investment decision making is always influenced by a few key factors relating to the BDA outcome and objectives, including the contribution of BDA to (1) Business Process Improvement (2) Predictive Power (3) Self Service associated time cost savings (4) Additional revenue generation opportunity (5) Business decision making, and (6) Operational Service Monitoring Improvement.

In this regard, some experts argue that user requirements are another critical factor in making Big Data Analytics investment decisions. The User Requirements Specification documents the business's requirements and what potential users require. These specifications are developed during the initial validation process, typically prior to the formation of the system. The following components of the Big Data Analytics Investment Decision were identified as critical: user requirements, investment in BDA, time, user experience, training, and return on investment (ROI). Decision Making in organizations that have already implemented Big Data elements or in organizations that are currently using a legacy approach but intend to migrate to a BDA approach. Innovative and emerging technological tools are facilitating frontline adoption, which is accelerating the need for organizations to adapt in order to achieve results.

5.2.3. Big Data Analytics Control

By implementing a "coordination-oriented approach to control," it is possible to systematize the functions associated with Big Data management. Concentrating on the composition and coordination of various components of leadership, this approach emphasizes value systems, human resources, organization, controlling, planning, and information. These are the areas of leadership where Big Data could potentially make an inroad into corporate management. Controlling should initiate this process by providing necessary support, structure, and consistency. Big Data has a direct impact on information systems. Utilizing Big Data enables corporate management to take into account non-monetary data in addition to monetary data. While the influence and importance of non-monetary information has grown in recent years, Big Data is working to accelerate that growth. Non-monetary information has become increasingly heterogeneous and complex in terms of type and origin. Taking this into account, a controller must consider two critical tasks. To begin, additional analysis is required to elicit new data that can aid in the promotion of a more comprehensive understanding of business. Additional assessment will be required to determine whether such information could potentially be connected to already-existing data. Second, managers will need to know what information is pertinent to their work from controllers. At this stage, a healthy dose of skepticism on the part of the controllers toward the promised new solutions is a beneficial attitude to adopt. And, as is the case in other fields, new Big Data solutions that have little practical application in the IT industry should be viewed critically. Self-perception also contributes to the definition of the controller's role in these tasks. In general, controllers value numbers highly and place a premium on economic transparency. Controllers also see Big Data as an opportunity to advance into the role of business analyst and to broaden their initial information gathering responsibilities beyond traditional finance systems. As previously stated, their responsibilities are inextricably linked to those of business line and information technology staff. As a result, controllers must demonstrate that their knowledge of traditional finance systems can make a significant contribution to the overall goal. Of course, claiming sole responsibility for Big Data would not be a viable claim. The objective of the BDA control capability is to deploy analytics sufficiently in order to gain sufficient control over operations. The purpose of this section was to investigate the properties of the BDA control. The case study's use of Big Data centered on the performance of indicators such as KPIs, BDA functionality, and monitoring in order to achieve business goals.

5.2.4. Big Data Coordination

To achieve long-term performance, utilizing BDA coordination can result in a synchronization of efforts that results in sustainable results. In other words, the coordination of BDA aims to improve and streamline efforts to synchronize the BDA capabilities of all firms, thereby increasing performance. Businesses will conduct these analyses on a variety of levels. As a result, it is critical to have an effective deployment of BDA capabilities and technologies [17]. These benefits of BDA may also be underutilized if efforts to coordinate among telecom firms fall short. When used correctly, BDA can bolster a firm's coordination efforts in its strategic operations and roadmaps. Without the use of synchronization and coordination, it will be difficult for businesses to develop and implement customized services for tourists [96].

This section makes some practical suggestions for how coordination can be used to improve company performance in the telecommunication industry. Coordination can be defined as the process by which supply chain activities are managed in terms of dependencies [97]. Coordination enables competitive advantage, resource access, and risk mitigation [98]. Coordination is required to improve both cost and value gained. Members may be encouraged to work more coherently through the concept of coordination, which includes identifying interdependencies between them, mutually refining goals, and sharing rewards and risks equally [99]. According to Hamon [100], performance measurement is critical for effective management. It's difficult to improve something that isn't quantifiable. This is why it is critical to first identify and quantify the coordination's impact on organizational performance.

According to surveys and studies on supply chain practices in Indian industries, Indian businesses should align their business strategies with their supply chain strategies in order to achieve the highest possible level of customer satisfaction [101]. To achieve operational excellence, supply chain integration processes must be streamlined, and partnerships should be formed to maximize profits and minimize inventory. Indian firms have been made aware of supply chain practices, as well as the fact that by implementing these practices and coordinating with all supply chain members, they can increase their competitive advantage [102]. Inadequate performance in the supply chain could be a result of a lack of coordination. Several consequences of this lack of coordination include insufficient customer satisfaction, customer focus, quality, order fulfilment response time, time to market, inventory costs, inventory turns, insufficient customer service, excess inventory, low capacity utilization, and inaccurate forecasts [103]. Several potential benefits of effective supply chain coordination include increased revenue, increased customer retention, increased flexibility to deal with increased demand uncertainty, lower manufacturing costs, efficient product development efforts, improved customer service, increased sales, reduced lead times, and elimination of excess inventory [104]. From the interview, the following methods of coordination were identified: Project Manager Office (PMO), Social Media, Town Hall, Business Analytics, and face to face meetings.

To achieve integrated coordination, teams must manage information sharing and accessibility between various teams, such as business analytics and line personnel. To manage information sharing and accessibility within the team, a suitable and collaborative tool must be used. The coordinator should maintain granular access control to ensure that the appropriate permissions on the document are granted to the appropriate person based on their role and function during the project's coordination. i.e., a technical support representative should have written access to the document containing the business requirement specification.

He then discussed the importance of information visibility vs. information confidentiality in achieving coordination goals during the coordination cycle. Without a doubt, there is some type of information that is confidential and cannot be viewed at all levels. On the other hand, managing information-sharing between different teams maintains confidentiality and barriers but also ensures coordination/achievement of the targeted goal. A suitable metric should be developed for categorizing information and its intended audiences. Throughout the coordination process, data can only be released with the business owner's and technical owner's approval. At the most fundamental level, data should be adequately protected and capsulated. Throughout this process, the confidentiality of the information should be maintained.

BDA plays a critical role in the inherently diverse telecom industry by enhancing coordination and ensuring sustainable performance. Existing research identifies three critical capabilities for analytics: personnel expertise, management, and infrastructure adaptability [13]. Though this research has emphasized the critical role of business analytics in performance improvement [105], one could argue that effective Telecom management requires collaboration and coordination enabled by BDA management capabilities. It is possible to coordinate efforts between entities through knowledge sharing and development while also ensuring long-term viability [106,107]. Every business faces organizational challenges, as each organizational strategy has a direct impact on activity results. To boost their firm's performance, leaders must concentrate on coordination components. This means that organization should remain a priority, with an emphasis on productivity growth and flexibility, as well as functionality, effectiveness, and meaningful outcomes. As such, the purpose of this research is to ascertain the effect of coordination on a business's performance.

5.2.5. BDA Success Criteria Review (Evaluation)

Value can be created through the use of Big Data applications and data-driven decisions by putting data sources into operation and discovering new information that drives innovation and improves business processes. Numerous analysts have written about the factors that contribute to the success of analytics-focused projects. Naturally, this includes project management, but it also encompasses a number of other factors. A few of these factors are summarized below:

Applied technology: While technology is a critical component of analytics and Big Data projects, these projects are more than the sum of their parts. Emerging technology stacks, such as columnar databases and Hadoop, as well as visual technology and analytics that parse video and text-based data, are enhancing our ability to generate new information. However, it is critical to note that existing technology can also be used to extract data from databases such as SQL and even open source analytics tools such as R, enabling businesses to ensure their ability to obtain business insights.

People: Identifying the sponsor is critical for any successful project because they will act as the project's champion, provide organizational support, allocate the budget, and remove barriers. Similarly, and equally critical, is the need to identify the business and technical teams, as well as the project manager, and to have a clear outline of each team member's responsibilities and roles. Determining each team member's availability, as each member will almost certainly have other obligations, as well as any resource constraints, must occur during the initial stages.

While the term "data scientist" may conjure up images of highly specialized personnel in high demand, such as those with a Ph.D., teams should be multidisciplinary and diverse. While some projects will undoubtedly require this level of expertise, a significant portion can be effectively handled by staff with business, computational, or quantitative backgrounds. Creativity and tenacity are critical personality traits that will determine the staff's success or failure. Additional training in technologies such as Hadoop (a visual analytics technology) and scripting languages may be required. Organizations are increasingly able to access and utilize these trainings.

Scope and change management: To ensure the success of Big Data projects, they must have a defined scope and a time limit. A well-defined scope will clearly communicate what is and is not included in the project parameters. Additionally, it will assist in establishing the budget and monitoring the project's progress. Establishing a timeline and measurable milestones at two to three-month intervals with a maximum of six months for the delivery of business value is also critical to success. To accomplish the goal, the system must include a facility for conducting reviews using the Goal-Question-Metric (GQM) method [108]. GQM can tailor and integrate goals to quality and product perspectives on interest and software process models based on the unique needs of an organization and specific project [108]. By utilizing the GQM method, programmed measurements are directed toward a defined set of issues and rules for data interpretation. A fundamental principle of the GQM method is that all measurements should be made in relation to objectives. Organizations must therefore align their measurement objectives with their business objectives in order to optimize the process. This overarching goal must then be decomposed into smaller activities that can be monitored throughout the duration of the project. The GQM process begins with defining a specific goal, converting it to a question, and then establishing the metrics that will collect the data necessary to answer the question. By responding to the question, the data collected operationalizes the objectives, which can then be analyzed to determine whether the objectives were met or not. Thus, the GQM establishes metrics from the top-down and then interprets and analyses the obtained measurements from the bottom-up. Several respondents emphasized that their organization evaluates projects solely on the basis of their completion and budget. Additionally, he argued that if a project review goes wrong, the system should be able to iterate on it or have a rollback option. While others believe that based on the project's requirements, user requirements, and timeline for completion, businesses will be able to choose appropriate methodologies such as Cascade, Spiral, or Agile to complete the project. Depending on the circumstances surrounding the project, the business should employ the appropriate method. Different methodologies may have been used in various types of scenarios. For instance, if it is difficult to define the product upfront, the customer frequently changes its mind, or the product can be developed iteratively and incrementally, the Agile method is a good fit. However, if the requirement has been fulfilled previously and it is a commodity project, but the name is high-volume, cascade methodology is an appropriate method. Because the requirement is so specific, we simply need to ensure that whatever requirements were captured or taken into account when developing the test cases, developing the application, or from an infrastructure perspective, going live. In summary, if all stages are completed successfully, no rollback is required.

5.3. Big Data Analytics Talent Capability

Figure 5 shows the BDA talent dimension and sub-dimension in detail and will be explained in the following sections.

(a) BDA Technical Knowledge
(b) BDA Technology Management
(c) BDA Business Knowledge
(d) BDA Relational Knowledge

Business knowledge is a critical strategic asset. This knowledge is made up of expert insights, capabilities, experiences, and skills that are relied upon collectively in business. Due to the fact that business knowledge is a shared resource, it affects and shapes all business activities. In other words, it is the ability to comprehend internal environments and business units. To effectively interpret and solve business problems, data analyst talent must possess a unique set of business skills. According to the findings of this study, business knowledge and technical capability complement one another. For the BDA team, business knowledge is critical. I am a firm believer that without business knowledge and only technical capability, it is impossible to meet the business objectives and goals of BDA. Our BDA development practice has always served as a bridge between business knowledge and technical capability, enabling us to support business goals with data and, on the other hand, enrich the view on data with business knowledge.

Figure 5. Big data analytics talent capability pillar.

In business, it is necessary to possess both problem-solving and decision-making skills, as the two go hand in hand. Indeed, this is the objective of a data analyst's work: to deduce factual information and communicate it to the appropriate leaders for problem-solving and decision-making purposes. Similarly, some respondents believed that all Analytical employees possess the ability to solve problems by developing an appropriate technical solution. Due to the fact that our company is a technology company, whether it is Big Data Analytics or analytics in the form of customer experience understanding, all Big Data Analytics employees are extremely invested. Additionally, some experts stressed the importance of Big Data Analytics staff understanding the organization's standard operating procedures, maintaining operations disease plans at a high level of cost competency, and being capable of interrupting business problems through the development of appropriate solutions. In other words, they should be capable of problem solving. However, some other experts asserted that certain employees possess an exceptional grasp of business knowledge. Business knowledge is the ability to translate what their work contributes to the economic value of the company. Everything individuals do must be quantifiable in terms of the company's economic value. Does it result in increased profit? Does it result in a reduction in our operating expenses and cost of service? Does it improve customer retention? All of these things affect us, and the majority of employees are unaware. However, we are constantly working to ensure that they become more accustomed to their role. Capacity to acquire new knowledge and skills is also a necessary quality, particularly in light of technological advancements. As a data analyst, effective communication skills are critical, as teamwork entails a great deal of conversing and compromising. Additionally, communication with other co-workers and directors will be necessary to provide an explanation for the prepared data. In this scenario, while many respondents believe that

Big Data Analytics personnel have a fundamental understanding, they require tremendous support from all executives and working level personnel to ensure that the BDA objective is met.

Collaboration and communication with regard to business functions are critical responsibilities for IT staff. While the emphasis has been on the strategic opportunities presented by big data thus far, consideration of complications, such as talent, is also necessary for leadership. The maximisation of product and effective interaction between individuals for the mutual benefit of all is referred to as "good people skills." In an office environment, there is a strong desire to connect on a human level, as the alternative is, of course, a low-productivity, sterile environment. Career advancement is typically more rapid the more these communicative abilities are utilised. Corporate leaders who exhibit strength and comprehension are frequently the first to be recognised as office diplomats with a well-balanced emotional intelligence. Respect and diplomacy are at the heart of both corporate productivity and individual success. When it comes to conflict and human interaction, sensitivity and comprehension can yield the best results. An optimistic attitude can be contagious, resulting in a decrease in negative incidents throughout the organisation. Effective communication with staff, colleagues, and superiors is critical in any sector. Additionally, in today's technology-driven world, communicating effectively via social media, email, and phone is a necessary skill.

To summaries, being invisible to the public eye is the state of privacy. Controlling and restricting access to information, as well as maintaining the privacy of data and knowledge, is a fundamental right for every individual. On the other hand, confidentiality is defined as a state in which only specific information and data are withheld. This information may be shared only with authorization, as confidentiality is considered an agreement. For example, information shared between a legal or telecommunications operator and a client is always kept confidential. Operators are not permitted to release customer information without their clients' explicit consent. On this basis, one could argue that confidentiality is a critical component of business stability. As a result, disregarding data confidentiality would jeopardize the business's stability, if not its survival. The telecommunications industry has grown tremendously over the last several decades. Along with the rapid expansion, communication challenges have increased. Client communication in all forms, including messaging or calling an employer about a personal or family matter, must be kept confidential. If the client lacks trust in these professionals, critical information necessary for the business's growth may be withheld. This data is the new oil, and it will ultimately power the business by identifying ways to better serve our customers and provide them with better service. As a result, the relationship between the vendor and the customer should be established. Our business exists because of our customers. Cohesive Team and Confidentiality are identified as sub-dimensions in this study.

BDATLC refers to analytics professional (i.e., an individual who possesses analytics knowledge and skills) who is capable of performing tasks in a Big Data environment. Constantiou and Kallinikos [109] define capabilities as the ability to develop and sustain an advantage over competitors in this context. Capabilities are dependent on "know-how" and other forms of knowledge. According to the Delphi studies and literature findings, analysts are expected to possess four distinct but equally critical skill sets: relational knowledge (i.e., cross-functional collaboration utilising information), business knowledge (i.e., long- and short-term goal comprehension), and technology management knowledge (i.e., technique deployment and management) (i.e., management of the database). To begin, relational knowledge refers to an analytics professional's ability to collaborate and communicate with individuals from other business units. This is especially critical because data scientists' work requires close collaboration with the rest of the business. For instance, LinkedIn's "people you may know" feature makes excellent use of this and consequently receives a 30% higher clickthrough rate. At Intuit, analytics professionals are encouraged and supported in their efforts to develop empathy for their customers and, as a result, a better understanding of business challenges. Second, business knowledge refers to an understanding of the business environment and various business functions. Thirdly, technology management knowledge refers to the management of Big Data resources in support of business objectives. For example, Netflix's remarkable success in the United States with their "House of Cards" programme is largely due to the use of demand and visualisation analytics provided by analytics professionals, which assisted executives in understanding consumer preferences and behaviour. Finally, technical knowledge refers to elements such as database management systems, programming languages, statistics, and operational systems. For example, the development of Apache Hadoop by data scientists at Yahoo and the Hive language for Apache Hadoop projects by Facebook has transformed their Big Data Analytics Capabilities (BDAC), a transformation that has been replicated by Twitter, LinkedIn, eBay, Walmart, Amazon, and other data-driven companies [110]. In total, a balance in proficiency can be achieved through continuous coaching and training throughout the management of the project, knowledge, and infrastructure [46]. According to this study, sub-dimensions include skills, data & network insights, and analytics-driven information & capable DSS.

Technology knowledge refers to an understanding of a company's information technology components, such as networking, database management systems, programming languages, and operating systems. IT resource management functions such as operation, deployment, and planning necessitate knowledge of technology management. To maintain a competitive edge in today's rapidly changing digital landscape, organisations must understand their unique talent requirements and how to meet them. Technology Trends (foresight), Ability & Willingness (capacity for technology absorption), and Organizational Mission Understanding are all recognised as sub-dimensions.

5.4. Big Data Analytics Innovation Capability

What exactly is Big Data? Why is Big Data significant enough to warrant research by professionals and academics? Big Data has numerous definitions, not all of which are universally accepted [111,112]. As the name implies, one of the primary characteristics of Big Data is its size. However, as Gartner Inc. notes, size is not the only criterion for classifying data as "Big Data." Both Gobble [113,114] have emphasised the importance of Big Data in establishing the "fourth paradigm of science." Indeed, McKinsey & Co. has predicted that Big Data will be the "next frontier of innovation, competition, and productivity" [19]. According to McAfee et al., big data is also viewed as a transformative approach to decision-making because it increases the clarity of a business's operations and the efficiency of performance measurement mechanisms [7]. According to this logic, Big Data has the potential to alter the competitive landscape by "transforming processes, altering corporate ecosystems, and facilitating innovation." Not only does Big Data help grow individual businesses and manipulate competition, but it also helps various economies and sectors improve their competitiveness, innovation, and productivity.

Understanding and fully exploiting the potential of Big Data has the potential to transform the entire business process. Indeed, a company's competitive advantage may be contingent on its ability to extract Big Data and properly analyse it in order to derive actionable insights [115] and subsequently outperform competitors [116]. In a similar vein, McKinsey and Company asserts that "collecting, storing, and mining Big Data insights can add significant value to the global economy by increasing the productivity and competitiveness of businesses and the public sector and generating a sizable economic surplus for consumers" [116]. Businesses can ascertain their customers' needs and desires through the use of Big Data derived from social media and loyalty cards [117,118]. SPEC, a leading manufacturer of eyeglasses, collects and analyses Big Data from social media platforms (such as Facebook, Google, and Twitter) in order to generate new product ideas [11]. As Thibeault and Wadsworth [119] report, Facebook boasts staggering daily statistics: 350 million uploaded photos, 4.5 billion "share" button clicks, and 10 billion messages (some of which include videos and photos) sent. Retailers have the potential to increase their operating margins by 60% if Big Data is used properly [120]. While big data requires a significant investment in terms of resources and time, it can provide significant competitive advantage and other long-term benefits [121]. Innovation has been a critical component of data generation and will continue to be so in its management. According to Andreas Weigend, a Stanford professor and former chief scientist of Amazon, as quoted by Virgina Backaitis, a CMSWire blogger, "Big Data is when your data sets become so large that you have to innovate on how to collect, store, organise, analyse, and share them."

Numerous innovators have risen to the occasion when it comes to Big Data. Adding value to existing products and developing new, innovative ones are two projects that innovative professionals are currently investigating with the help of sensors and the data they generate. Of course, the data itself holds a wealth of innovation potential. From this vantage point, a sizable proportion of respondents stated that there are two types of innovation. (1) Incremental Innovation, which refers to small innovation initiatives; and (2) Disruptive Innovation, which refers to the theory that a company with fewer resources and a smaller size can actually overtake a larger, more established organisation by pursuing neglected, overlooked segments of the market. This strategy is generally successful because it focuses on a more lucrative area. While businesses frequently employ both radical and incremental innovation strategies, the latter is the more prevalent. Often, a radical innovation will be introduced to the market while the company uses incremental innovation to maintain and enhance the product's competitive edge. This is a critical reason why the overall success and sustainability of a modern business is frequently determined by its ability to innovate. As a result of this trend, organisations have increased their focus on how to improve their product development through the use of both radical and incremental innovation strategies.

Numerous promising start-ups are developing novel methods for analysing, storing, and collecting data. For example, the Wall Street Journal profiled several of these organisations in 2011 and 2012 as part of a blog post series. Numerous businesses are attempting to improve efficiency, streamline processes, and, at least in the case of Amazon (according to an article published by Fast Company by Sean Madden), customer service. Enhancing the innovation process through the use of Big Data is an area that is still being explored. Numerous experts highlighted that another critical aspect is by making a concerted effort to utilise and comprehend the unknown truths contained within the available data; this unknown truth contained within the available data will result in an innovation that will propel the business toward new prospective goals. Steve Todd details how he integrated analytics techniques into EMC's data innovation in a series of blog posts. As Todd points out, companies that are serious about innovation generate a large amount of data, ranging from informal to formal documentation, from idea repositories to lab notebooks. As more data is gathered and knowledge management becomes more prevalent, data will become accessible for use in the analytics process. However, organisations frequently underutilize or under-analyse the innovative data they collect. Researchers hope that the data collected is meaningful and has the potential to transform business outputs. Analysing Big Data in a useful manner and putting it to work in order to reshape or drive innovation is not an easy task.

The strength of Big Data is in how it is harnessed, not in its sheer volume. There are two distinct types of innovation worth noting: disruptive and incremental (Figure 6.). Disruptive innovation, on the other hand, is often the polar opposite of its counterpart due to its radical nature. This type of innovation occurs when a new strategy, process, service, or product is introduced to the market with the intent of completely replacing an existing method or technology, resulting in a "disruptive" effect. Disruptive innovation requires significant resources and time investments, making incremental innovation less risky. Incremental innovation is defined as a series of minor enhancements or modifications to an organization's existing methods, processes, services, or products. As a result, incremental changes made by innovation are typically aimed at increasing the competitive differentiation, productivity, and development efficiency of an existing product.

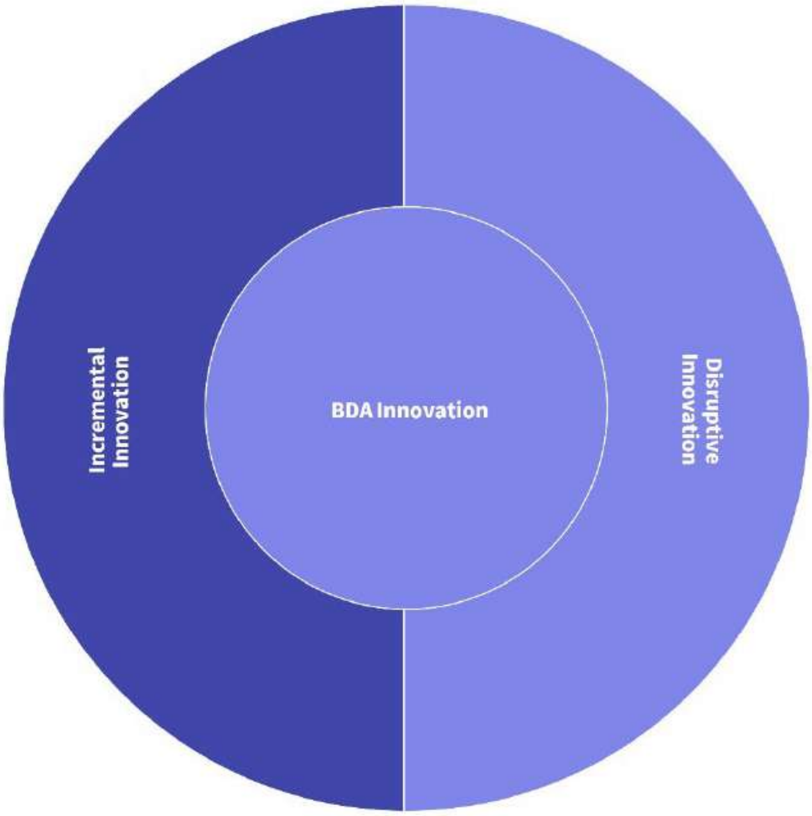

Figure 6. Big data analytics innovation pillar.

5.5. Big Data Analytics Domain Knowledge Capability

The telecommunications industry has been one of the best performers globally over the last several years. Telecom businesses face a unique set of challenges arising from customer demands and technological trends. Converging content, networks, and applications has enabled an integrated user experience and a single point of connectivity in the emerging information superhighway, ushering in a ground-breaking revolution in the mass market of technology. At this stage of development, the telecoms industry is comparable to the central nervous system in the human body in terms of importance to the modern world. The telecom industry is made up of a diverse set of stakeholders and subsectors and sectors. By developing, operating, and maintaining telecommunication networks, the industry enables one of the most fundamental services known to organisations and humans worldwide: international communication. Experts identified domain variable as a critical component of the Telecom domain. Numerous questions raised from the telecom perspective; perhaps you can also consider "how Telecom knowledge can play a different role?" Domain experts classified domain knowledge into two categories: general and specific business model knowledge. Respondents continued by stating that while all telecom companies provide voice and data services, there are some things that are only provided by certain services, such as 4G, and the company does not have a legacy in terms of 2G or 3G. Thus, this business can have a significant impact on the decisions made by individuals within the firm regarding the type of services they wish to provide and the various target segments for which they are looking.

In conclusion, domain knowledge acquisition is critical for every sector of business in order to meet and deliver on business needs. It also includes both area and domestic knowledge (Figure 7). Domain knowledge benefits personnel not only in their day-to-day work but also allows them to change their profile. The majority of respondents agreed that having domain knowledge in practise benefits businesses and that it is beneficial for businesses to contribute reasonably.

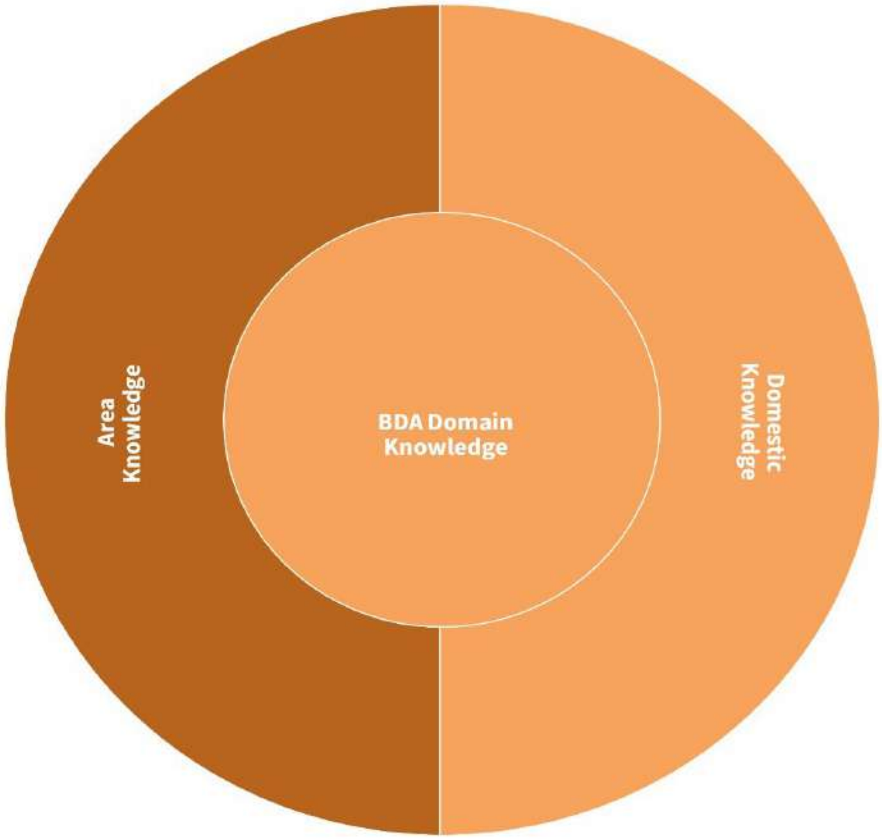

Figure 7. Big data analytics innovation pillar.

6. Discussion

The research accomplished its stated objective of proposing a feasible model for the telecom industry based on the BDA. This research identified key components of Big Data analytics, including big data analytics management, big data analytics technology, big data analytics talent, big data analytics innovation, and big data analytics domain knowledge. To facilitate the application of a practical approach in business, this research attempted to examine all sub-sections from a variety of perspectives. According to respondents' responses and feedback, the proposed model is appropriate for the Telecom domain, is deployable, and is applicable and actionable. Convergence of Big Data in the telecommunications industry is reshaping the future of telecommunications and how it will derive value from data analytics capabilities. The digital era has shifted data accessibility away from batch processing and toward real-time processing. The ability to access large amounts of data contained within a Big Data platform enables data scientists to generate meaningful analytics results.

This research develops a theory of BDAP strategy by demonstrating how to leverage the BDAP dimensions and subdimensions to create a BDAP climate on a macro level. Although numerous studies emphasise the critical nature of management, technology, and talent in a big data environment, this study examined two additional critical pillars under the innovation and domain knowledge pillars. With increasing interest in business analytics across a variety of industries, this study advances the BDAP conceptualization for enhancing firm performance. A distinguishing strength of the current study is that data were collected qualitatively, via semi-structured interviews, which are conducted infrequently. The Big Data Analytics Pillars have enabled businesses to work freely with massive amounts of data. This is why many telecommunications companies have shifted away from hypothesis-based decision-making and toward data-driven decision-making. The Big Data Analytics Pillars create an environment conducive to data discovery. As a result, Telecom is now able to move more quickly, conduct more experiments, and learn more quickly. They can now import all of the data and allow the data to tell the storey. Overall, Big Data Analytics presents a significant opportunity for telecom operators to gain a more holistic view of their operations and customers, as well as to accelerate their innovation efforts. The exponential growth of data generated by mobile and connected devices, as well as social media content, is a significant driver. The discussions in this study are expected to shed some light and inspire additional research on how Big Data Analytics can be applied to and benefit the Telecom industry. In fourth layers, an initial model has been proposed.

Layer one is the fundamental pillar of Big Data Analytics, consisting of five dimensions: Big Data Analytics management, Big Data Analytics technology, Big Data Analytics talent, Big Data Analytics innovation, and Big Data Analytics domain knowledge.

Layer two details the subsections of each pillar. The hidden variable has been explored as the primary character of the second layer. This study can shed light on several of them, including Big Data Analytics Success Criteria Review (Evaluation) and Big Data Analytics Maintainability, which have been overlooked in previous research.

Layers three and four are made up of interior level sub-sections. It is more thoroughly examined and delves deeper into issues that have been overlooked in previous studies. In levels three and four, variables are quantifiable. In other words, this research established sub-sections capable of converting the unmeasurable to the quantifiable. For example, BDA coordination includes some quantifiable items (number of PMOs, BAs, daily/weekly/monthly meetings, and number of social media groups such as skype, what's up, and so on.)

The research contributes to the theory and body of knowledge, to the research methodology, and to the practise of the telecom industry. The role of body knowledge is discussed in terms of theory development and knowledge development. The contribution to research methodology is specifically referring to the foresight methodology. Contribution to practise enables the Telecom telecommunications industry to grow.

- Contribution to the theory and knowledge

The contribution of the research to the body of knowledge is in the area of theory development. A meaningful connection was established between Resource-Base Theory (RBT) and the BDAP model. Earlier research has discussed complexity in terms of emergence, which is a function of synergism. To demonstrate this concept further, this study incorporated RBT theory into the construction of a Telecom model.

Additionally, this research makes several significant theoretical contributions. To begin, we use the RBV model and RBT theory to construct a homological network that connects technological capability, management capability, talent capability, innovation capability, and domain knowledge capability to BDA and firm performance in a Big Data environment. Thus, our study contributes to the growing body of knowledge on BDA by expanding our theoretical understanding of the BDAP-firm performance relationship. Additionally, this study advances prior research on RBT theory by examining key BDAP elements in a BDA environment. Our finding, in particular, validates the critical role of technology capability, management capability, talent capability, innovation capability, and domain knowledge capability in enhancing BDAP in a BDA environment (Figure 8). For instance, the critical nature of talent resources has been recognised as a critical factor in maximising the value of BDA information for competitive advantage realisation. Indeed, Ransbotham [122] acknowledges that firms currently experimenting with BDA have a "strong talent base for developing analytics results." That is likely why [110] state that data scientists have the "sexiest job of the 21st century" in future, different appeaser that data scientists have the "sexiest job of the twenty-first century." In the future, various approaches and tools aimed at facilitating the training of future business analytics professionals can be examined. Second, the study provides empirical evidence on the impact of BDAP on firm performance through a semi-interview approach in the telecommunications industry. As a result, it contributes to overcoming the absence of empirical studies in the context of big data [4].

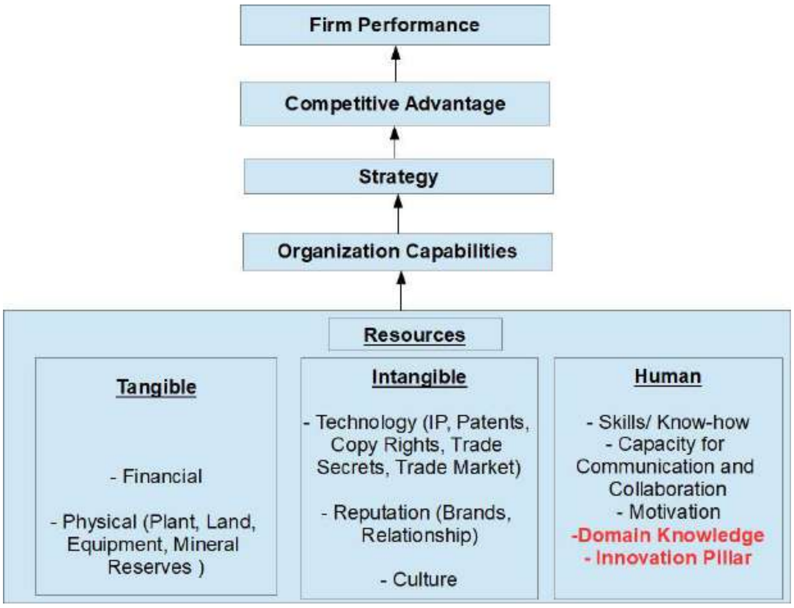

Figure 8. Theoretical contribution.

- Contribution to the Methodology

This research demonstrates that BDAP is effective at proactively and collaboratively generating new knowledge about future industrial common goals and solutions for achieving those goals at the inter-organizational or industrial level through knowledge sharing. BDAP has the potential to generate new knowledge by considering the majority of variables that could affect a strategy and determining which areas create bottlenecks for increasing productivity, revenue, technology trends, and market growth, as well as technological issues and how they should be addressed. This study established the efficacy of the BDAP in the telecommunications industry. The knowledge gained from this research can be applied not only to the telecom industry, but also to other information technology industries as a method of strategic planning for the future. BDAP is typically sampled by an expert panel or key decision makers. However, the Resource-based theory's implication of 'bottom-up' synergies prompted the researcher to include various levels of individuals in data collection in order to provide a more holistic perspective. Thus, RBT theory established a paradigm for general inclusiveness in research sampling. Qualitative research and concurrent data triangulation were extremely effective research strategies for collecting and validating data. Triangulation techniques such as document analysis, interviewing, and Delphi were used in the research. Working in a telecommunications company, enterprise data warehouse department, and as a member of a Big Data Analytics team allows for observation of current trends and industry information. It provides an opportunity to network with industry experts who can provide accurate information. Personal contact was a significant factor in enticing industry experts to participate, but multiple follow-up emails and phone calls could also help increase the response rate for interview participation. It was established that triangulation of data via document analysis and semi-structured interviews was an effective method of collecting information for the Telecom industry. As the transformative potential of Big Data Analytics technologies becomes clear, businesses and countries worldwide are vying for leadership positions. They are doing so because evidence increasingly indicates that Big Data Analytics is a major economic driver of our time, with recent estimates indicating that global Big Data and business analytics spending will reach US$203 billion by 2020. It was discovered that the telecom industry requires a strategy for big data analytics prosperity. Stakeholders, decision-makers, and business owners must share a common vision for how to maximize the economic and social benefits that can be realized through the effective use of big data analytics across the organization.

- Contribution to practice

The industry contribution is the creation of a proposed BDAPs model (Figure 9). To ensure the success of the business, a technology strategy should be developed in conjunction with the business strategy. Telecommunications companies have begun utilizing advanced analytics to correlate, cleanse, and extrapolate customer and network data in order to create a real–time view of customer preferences and network efficiency. They are collaborating with technology vendors to offer business customers analytics solutions in addition to core telecom services, with the goal of increasing revenue. The following is a roadmap for implementing the solution, which aims to add value for telecommunications operators by actively supporting financial and commercial strategies and improving customer understanding through the inclusion of social unstructured data via a big data engine. Today, operators face significant challenges in retaining customers and generating revenue from them. Engaging with customers throughout their life cycles has been critical to long-term success. Real-time analytics enables operators to conduct proactive analyses, correlate, and act on data insights, thereby resolving customer churn and revenue losses. The BDAP was developed as a result of this research to enable businesses to make near-real-time, fact-based decisions and thus foster a forward-thinking, focused, decisive, and action-oriented culture within the organization. Additionally, this study has a number of practical implications, given the operational and strategic potential of BDA across all industries. Second, the proposed model can be used as a baseline for performance assessment during the analysis and design of BDA applications for managers. Third, our study identifies a set of antecedents (i.e., talent, management, technology, innovation, and domain knowledge) and components that may contribute to high-level organizational efficiency and effectiveness through the use of BDA. Fourth, the study proposes not only a set of skills that BDA personnel should possess, but also the conditions under which this combination of skills can result in superior firm performance. Finally, our study provides a list of factors that managers can use as a guide and control mechanism when making BDA tool investments.

Figure 9. Big data analytics pillars at a glance.

7. Conclusions

The study's first objective was to discover and comprehend the critical components of the BDA ecosystem that must be considered for business sustainability. The second objective of this study was to propose and develop a preliminary and workable model for the development of Big Data Analytics in the telecommunications industry. This study examined the critical components of BDAPs in detail and provided detailed information and an overview for each section. Due to the evolutionary nature of markets, technologies, business and customer needs, it is critical to provide a valid model that operates correctly in the domain. We must emphasise that, as a result of our research, new themes have emerged from the interview. We discovered that certain dimensions and sub-dimensions were omitted from previous suggested models. To improve the firm's overall performance, all elements must operate flawlessly. In other words, all of the pieces must function in concert, and a business's competency is dependent on its capacity to successfully manage vital resources (human and talent) and generate competitive advantage, which may be converted into enhanced firm performance (FPER). Additional research could focus on updating the research findings. Increased participation from a diverse range of telecom companies and regions would provide a more complete understanding of BDA. Furthermore, this study has some limitations that present opportunities for further research. First, as this research is based on insights from Telecom organization, it is proposed for future research to explore a new model in other sectors such as healthcare, education, environment, agriculture, and public transportation. Secondly, its scope was limited to exploring BDAP dimensions and modelling the impact of BDAC on FPER. Future research might look at whether the discovered categories are found in different situations, how prevalent they are, and whether there are any more unidentified types. Additionally, future research might investigate if and how more variables such as business process agility and process-oriented dynamic capabilities can effect on BDA. Third, while the current study's small sample size allowed us to develop an empirically rich knowledge of the identified BDA, it hindered our capacity to draw systematic generalizations about the realized results of various forms of BDA. Future study, based on survey methods and archive data, might look at how organizations perceive BDA, how it affects individual outcomes like employee happiness and engagement, and how it affects organizational outcomes like retention rate and organizational success. Fourth, several pressing topics (for example, the analytics climate, privacy, surveillance, and democracy) could not be addressed in this study but may be addressed in future research. Fifth, although the number of respondents is reasonable, but it is not high enough, so, it is recommended to validate the model with larger sample size.

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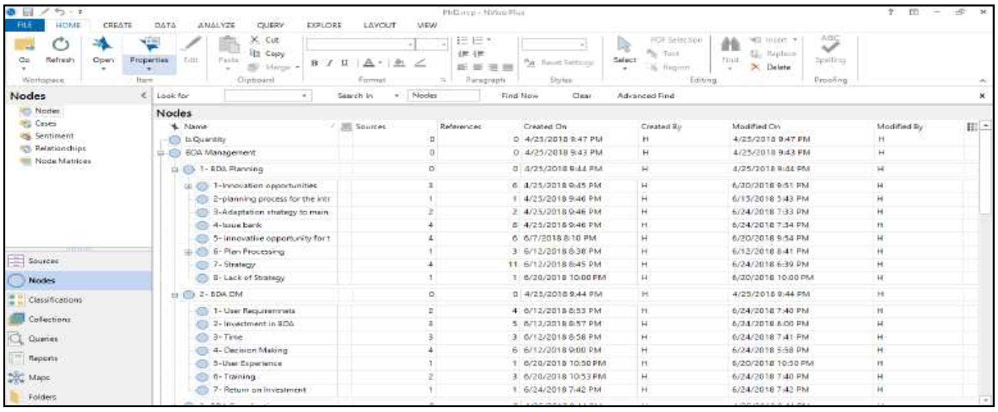
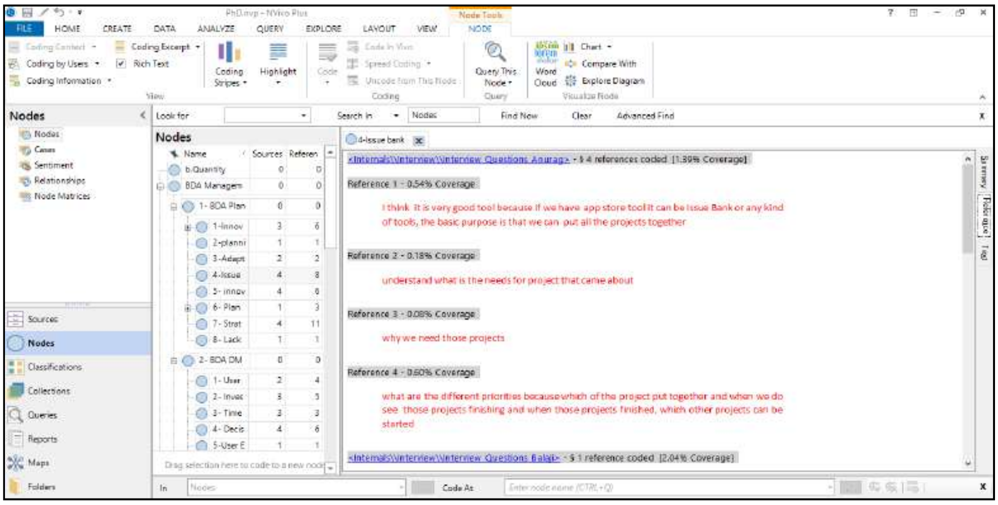
Data Availability Statement: Respect to confidentiality, data is not publicly available.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Interview outcome





Appendix B

To what extent do you agree with the proposed model?

BDA Pillars	Strongly Disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly Agree (5)
Management					
Tecnology					
Domain khowladge					
Talent					
Innovation					

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