DO VALUE CREATION MECHANISMS MEDIATE THE RELATIONSHIP BETWEEN BIG DATA ANALYTICS CAPABILITIES AND INNOVATION? A COMPANY GOVERNANCE IMPLICATION

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Abstract

Telecommunication Service Providers (TSPs) in Sri Lanka are seeking guidance on innovation strategies due to rapid shifts in technology, user behaviour, and market trends. Achieving successful innovation through big data analytics capabilities (BDACs) requires insight into the mediating processes and Value Creation Mechanisms (VCMs) (Grover et al., 2018). Accordingly, this study investigates the impact of BDACs on innovation, with a focus on the mediating role of VCMs. Despite the potential of big data, gaps remain in understanding the connections between the capabilities of big data and firm-level innovation outcomes (Appio et al., 2021). This study employs the positivistic research paradigm with a deductive approach. Ninety-one (91) executive-level employees were selected using the snowball sampling technique. Correlation and regression analyses were used to evaluate the data in the Statistical Package for the Social Sciences (SPSS). The findings revealed that there is a strong positive interrelationship among BDACs, innovation, and VCMs, and further, it was proved that BDACs have a significant impact on innovation, and this effect is partially mediated by VCMs. Consequently, the study concludes that BDACs empower TSPs to generate insights that activate or enhance their VCMs, thereby fostering greater innovation.

Keywords: Big Data Analytics Capabilities (BDACs), Innovation, Value Creation Mechanisms (VCMs)

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1. INTRODUCTION

In recent years, the telecommunications industry has a rapid growth in Sri Lanka. The telecommunications industry has grown quite competitive in Sri Lanka, particularly in the fields of data transmission, wired and wireless fixed access, and cellular mobile services. The industry has been opened up to more and more competition. Hence, Telecommunication Service Providers (TSPs) need to retain their subscribers, and also, they need to attract customers from other operators and expand their business. Businesses nowadays are operating in unpredictable contexts, and marketplaces are growing more diversified and volatile, necessitating the introduction of innovations in order to maintain and grow market

shares and business operations (Ferraris et al., 2019). In this context, data analysis or data management plays a major role in firms' survival.

As a new innovation tool, big data analytics (BDA) was crucial in assisting companies in thriving through major disruptions and crisis situations (Alsmadi et al., 2024). The rapid development in the mobile market, higher usage of mobile broadband, improved international connectivity, higher improvement in video-based services and higher usage of social media, such as WhatsApp, Twitter, Instagram and Facebook all have contributed to the generation of a higher level of data in the form of structured and unstructured data and is obtained from within and outside of the companies. This ease of access is becoming a great threat to the telecommunications industry.

Big data is an unavoidable matter in today's business world. Many communication service providers face terabytes of datasets that are spread across their organization and network, and this creates many difficulties in capturing, integrating, analyzing, and abstracting meaningful insights from them, as highlighted by Gandomi and Haider (2015). When building big data analytics capabilities (BDACs), TSPs need to understand the possibilities of what they can do with it. Because of the increasing highlights of big data, TSPs are eager to take advantage of new prospects and fully comprehend the hidden value (Raguseo, 2018). Knowing that the intermediary process and VCMs are required for BDACs to be successful in driving innovation (Grover et al., 2018). In this setting, TSPs must understand the mechanisms by which data-based insight is translated into action (Sheng et al., 2017). Hence, this study focuses on the relationships among intention to adopt BDACs, VCMs, and innovation in selected TSPs from twelve districts of Sri Lanka.

This study is highly relevant to Sri Lanka as it addresses the critical need for innovation in the country's telecommunications sector, a key enabler of economic growth and digital transformation. Atapattu et al. (2023) highlight the need for countries like Sri Lanka to adopt advanced management tools to enhance organizational performance. The scholars stress the importance of addressing the challenges involved in implementing BDACs as a crucial step in this process. Globally, TSPs in various countries face similar challenges related to technological disruption and market demands. Studies conducted in emerging and developing nations like China, Pakistan, India, and Jordan, as well as in developed countries like the US, France, and Italy, highlight the growing recognition of BDACs' role in driving innovation (Huynh et al., 2023). Therefore, the study's conclusions provide a strategic framework that can be adapted to improve innovation outcomes in different sectors worldwide.

But in Sri Lanka, especially in the telecommunications industry, firms manually analyze their structured data to get insights about their customers through marketing surveys, analyze customers' complaints, and analyze customers' feedback, etc. Thus, the studies of importance and practices of BDACs are lacking in the Sri Lankan organizational context. McAfee et al. (2012) emphasize the need to cultivate a data-driven decision-making culture in which managers act on insight rather than impulse. According to Vidgen et al. (2017), entering the industry as data-driven is more than just a technological challenge; it also requires organizations to manage their business analytics system and connect their analytics capacity with their business strategies.

The field of big data research has recently gained traction. However, the research field on BDACs remains relatively unexplored, and significant gaps in the literature need to be addressed (Munir et al., 2023; Zhang et al., 2022). The prevailing literature also highlighted that there is a limited body of literature that indicates unknown links or associations among the capabilities of big data and firm innovation and creativity (Appio et al., 2021; Ghasemaghaei & Calic, 2020), which motivates the researchers to conduct a study in this field. Anyhow, the scholars who have examined the link or association between BDACs and innovation in the telecommunications industry have not attempted to discover the inner mechanism (Xiao et al., 2020). The literature gives an overview of emerging and prospective developments in the BDA field of study (Chang et al., 2014; Kambatla et al., 2014; Munir et al., 2023).

Mikalef et al. (2019) claimed that further empirical study is needed to understand the methods by which BDA effects disperse and value is achieved. There is currently limited knowledge of the methods by which BDACs might result in value realization. Several authors argue that in order to corroborate their findings, further study including other nations, different industries, geographical areas, and cultures is necessary to obtain further implications (Bertello et al., 2021; Jha et al., 2020; Wamba et al., 2020). Furthermore, since a lot of studies have been done on the manufacturing sector, it is crucial to include other industries and sectors with a lot of big data, such as services and transportation (Munir et al., 2023). However, research on this view remains scarce and especially in Sri Lanka, which has fewer attempts in the service sector. This indicates there are clear empirical and population gaps that exist in this topic and that need to be addressed.

To address these critical gaps in the literature, the researcher grounded this study on the notion of BDACs. Thus, the current research aims to conduct an investigation into the effect of BDACs on innovation in selected TSPs from 12 districts of Sri Lanka, with the mediating role of VCMs, and to help the TSPs to be continuously innovative. Thus, the research objectives of the research underline the mediation of VCMs in the relationship between BDACs and innovation in selected TSPs in Sri Lanka.

This paper is structured to systematically achieve the study's objectives. Section 2 presents a comprehensive literature review, providing insights into existing research and frameworks. Section 3 details the methodology employed to conduct the empirical analysis on BDACs. Section 4 presents the findings, followed by a discussion of the implications and interpretations of the results. Finally, Section 5 concludes the study by outlining major findings and suggesting avenues for future investigations.

2. LITERATURE REVIEW

2.1. Big data analytics capabilities

Big data is a word coined to differentiate between traditional structured data and this new type of data (Al-Jaafreh & Fayoumi, 2017). In general, the term "big data" refers to extraordinarily massive data sets that can be computationally processed to uncover

patterns, trends, and relationships, particularly those related to human behavior and interactions. Big data is described as a large volume of varied data kinds combined with refined analysis techniques (Bany Mohammad et al., 2022). In the telecommunications business, big data refers to the massive volume of data types in numerous formats that typical database software tools cannot collect, store, manage, or analyze. When TSPs have large datasets, they need to implement an analytical process (Tan et al., 2015). This technique is referred to as BDA. BDA is defined as a method for managing, processing, and analyzing large datasets to disclose relevant information and provide significant insights for making better decisions, monitoring performance, and generating competitive advantages (Wamba et al., 2015). BDA is described as the activities involved in the specification, capture, storage, access, and analysis of such datasets to comprehend their content and use their value in decision-making (Zhang et al., 2022). Banerjee (2013) defines BDA as the use of software and hardware solutions developed to handle huge amounts of data in order to extract actionable insights. BDA medications are not a substitute for traditional analytical systems; rather, they are an additional strategy that fills in the gaps and creates a collection of data that could deliver a set of valuable findings.

As a result, capability means an individual's capacity to accomplish something. In the literature, BDAC is defined as a company's capacity to successfully use technology and personnel to gather, store, and analyze data in order to provide meaningful insight (Gupta & George, 2016). However, several of the descriptions of BDACs were reported in prior publications. BDAC is characterized as a firm's exceptional capacity to set the ideal pricing, detect quality issues, determine the least number of stocks, or discover loyal and lucrative consumers in massive data contexts (Davenport & Harris, 2007). BDAC refers to a company's ability to obtain, archive, manage, and analyze large amounts of data in multiple formats and give information to customers in a timely manner, allowing enterprises to squeeze worth from big data (Kung et al., 2015). The BDAC refers to a firm's ability to effectively mobilize and deploy BDA resources, employ BDA resources, and align BDA planning with firm strategy in order to obtain a competitive advantage and improve firm performance (Garmaki et al., 2016). Furthermore, BDACs allow businesses to manage massive amounts and types of data, ensure data accuracy, control the rate at which data is generated and disseminated, and extract insightful information to support well-informed decision-making (Bronzo et al., 2024).

2.2. Innovations

Generally, innovation assists TSPs in adjusting to the global market and providing customized or tailored solutions to their consumers. In today's digitalized environment, innovation is essential for long-term success, growth, sustained performance, and survival in the firm's industry (Kyei & Bayoh, 2017). Innovation in manufacturing technology is therefore being driven by shifting market demand and growing competitive pressure (Awan et al., 2022). Most data-savvy firms use analytics to innovate and gradually build a competitive advantage (Kiron et al., 2014). In this big data era, engaging in BDA-based innovation is a distinct trend. However, scholars use varied definitions of the term "innovation" in literature. Innovation is described as the creation, development, innovation, and/or implementation of new or modified products, services, processes, systems, organizational structure, or business model to provide new value to customers and financial returns to the firm (Joshi et al., 2010). Furthermore, innovation is defined as the conception, development, and deployment of a new product, process, or service in order to improve efficiency and effectiveness or gain a competitive advantage (Kyei & Bayoh, 2017).

2.3. Value creation mechanisms

Recently, in Sri Lanka, TSPs are ready to adopt BDA, and some service providers are at the beginning stage. However, BDA can offer actionable insights that can be applied to business practices to speed up innovation, drive optimization, and improve business performance (Grover et al., 2018). There are various approaches to creating value with BDA (Manyika et al., 2011). VCMs differ according to industry and business operations. In today's quickly changing corporate world, the methods to control and make use of BDA to generate useful insights for decision-making are the key factor for advantage in terms of innovation and other value targets (Wong, 2012). In this view, the mechanisms are the VCMs of BDA.

Value creation is explained as a set of actions or processes that provide outputs that are more valuable than their inputs, this is the basis of efficiency and productivity. Pagani (2013) claimed that value creation is what adds to the usability of the final product or service for end customers. Furthermore, the adoption of BDA requires innovative strategies to exploit BDA investment and create value (Braganza et al., 2017). Here, the term "VCMs" is mentioned in the strategy. Based on the above literature, we can say that the VCMs of BDA are the opportunities or ways to implement the particular processes or strategies to create value from the insight generated by BDA. The validity of big data primarily depends on insight generation and its actual use. Based on previous research (Manyika et al., 2011; Banerjee, 2013; Grover et al., 2018) and the current state of the telecommunications industry, the researcher proposes six distinct mechanisms that mediate the linkage between BDACs and innovation, including transparency and access, discovery and experiments, prediction and optimization, customization and targeting, learning and crowdsourcing, and continuous monitoring and proactive adaptation.

2.4. Hypotheses development

2.4.1. Big data analytics capabilities and innovation

Previous research has shown that BDACs provide a platform for businesses to improve their innovation (Wong, 2012; Gupta & George, 2016; Akter et al., 2016; Raptis et al., 2019). BDACs are widely expected to assist enterprises in many industries to develop new goods and services, improve existing ones, and build new business models (Manyika et al., 2011). As a result, BDA has raised anticipation that it will be particularly advantageous to enterprises' innovation processes. Bhatti et al. (2024) hypothesized that innovations in

the supply chain are dependent on enterprises' BDACs. According to Niebel et al. (2019), the use of BDAC is connected with a higher tendency and intensity of innovation. BDACs contribute to the generation of important insights, understanding of customer demands, and identification of innovation potential (Chandy et al., 2017). According to Loukis et al. (2016), cloud computing and BDACs can lead to organizational innovation. Recent research has begun to empirically demonstrate the impact of big data and business analytics on organizational outcomes such as agility (Ashrafi et al., 2019), innovation (Lehrer et al., 2018), and competitive performance (Mikalef et al., 2019; Côrte-Real et al., 2020). Munir et al. (2023) looked into the effects and implications of big data for firms aiming for innovation performance in the artificial intelligence (AI) era. Software for data mining and analysis enables businesses to repurpose current information and data to gain fresh perspectives and insights that they can utilize to develop new goods and services (Al-Jaafreh & Fayoumi, 2017). The BDACs have been linked to the next frontier for productivity, competition, and innovation, according to Manyika et al. (2011). According to Bhatti et al. (2024), supply chain innovation is reliant on businesses' BDACs. According to an *MIT Sloan Management Review* analysis, businesses that lead the way in BDA adoption are far more likely to develop new goods and services than those that lag behind (Ransbotham & Kiron, 2017). In this context, the study examines the link between BDAC and innovations in business models, as BDAC are essential instruments for corporate competitiveness in extremely dynamic marketplaces (Ciampi et al., 2021). Based on the above empirical evidence, the researcher hypothesized as follows:

H1: There is a significant positive relationship between BDACs and innovation.

2.4.2. Big data analytics capabilities and value creation mechanisms

To influence valued targets with regard to breakthroughs, the capabilities in each BDA instance produce outcomes that must then be converted into useful mechanisms (VCMs) (Grover et al., 2018). In general, businesses are constantly searching for methods to become more efficient. Businesses strive to better understand their changing environment using data analytics, which will impact their ability to recognize new business opportunities and maintain a competitive edge (Al-Jaafreh & Fayoumi, 2017). BDACs provide different types of opportunities to create tremendous value (Nwanga et al., 2015). It means, making use of BDACs may lead to the appropriate use of VCMs. BDACs provide a wealth of information to TSPs about their customers' behaviors, preferences, and movements (Tata Tele Business Services, 2019). Thus, BDACs give space to use that information through potential VCMs. Mikalef et al. (2019) claimed that big data and business analytics capabilities provide opportunities to practice different value creation streams. The opportunities associated with BDACs that evaluate significant business information in order to help a company better understand its market and business, and to generate value. These opportunities are redirected as VCMs of big data analytics. Sharma et al. (2014) whatsoever has been proved that BDA can create value through the use of different types of mechanisms. Ultimately, the biggest success of any BDA initiative towards innovation primarily relies on the usage of VCMs, which gives a competitive advantage to those firms. Service providers want to concentrate on big data initiatives' return on investment and value-creating potential (Grover et al., 2018). Data is the only input that generates valuable knowledge and insights for decision making. The creation of insights and the practical application of data combine to produce its value. Thus, the study hypothesized the second hypothesis as follows:

H2: There is a positive relationship between BDACs and VCMs.

2.4.3. Value creation mechanisms and innovation

The VCMs of BDA can be utilized to enhance the creation of the upcoming generation of intelligent goods and services, and they are essential components of creative and sustainable business models (Grover et al., 2018). The purpose of BDA's VCMs is to positively influence choices, clients, procedures, innovation, and other goals (Grover et al., 2018). Big data and other emerging technologies can help business models find or generate possibilities to leverage VCMs to offer disruptive and discontinuous innovations (Wan et al., 2015). Kariuki and Kagiri (2018) state that the strategic role of BDA technologies, such as product development, market segmentation, fraud detection, and precision marketing, positively impacts innovation to retain their customer. Mikalef et al. (2019) demonstrate that when the organization has big data and utilization of several value creation streams and business advanced analytics to gain a competitive edge in terms of performance and innovation. Thus, the study hypothesized the third hypothesis as follows:

H3: There is a positive relationship between VCMs and innovation.

2.4.4. Mediation of value creation mechanisms between the relationship of big data analytics capabilities and innovation

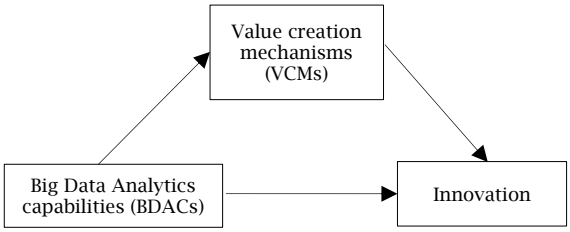
One or more VCMs, such as discovery, access, experimentation, monitoring, targeting, adapting, prediction, and customization characteristics, will mediate the relationship between BDACs and organizations' ability to meet value targets (innovations in production, process improvement, services and better decisions) (Grover et al., 2018). In order to improve real-time decisions, make more decisions, succeed with innovation, and boost a company's performance, whereby revealing many unexplored links in BDA (Manyika et al., 2011). In this view, BDACs can provide valuable, previously unknown, meaningful insights that can be converted to actions. However, when used properly, VCMs only aid in the development of business initiatives, the improvement of business processes, the prediction of market trends, the delivery of new goods and services, and the improvement of customer knowledge (Grover et al., 2018). Various value creation streams mediate the interaction between big data and business analytics skills (Mikalef et al., 2019). TSPs are able to provide their clients with more precisely appealing goods and

services. In this example, BDA technologies analyze the big data sets and deliver information about their customer usage patterns, behavior, and expectations. In this situation, the information is not a final benefit or is not a value target. This information is the only output of the BDA. Therefore, TSPs are required to implement any processes or mechanisms or strategies to reach value targets such as innovation by using the results of BDA. Based on the above evidence, this study hypothesized as follows:

H4: VCMs mediate the relationship between BDACs and innovation.

The conceptual model of the current study has been developed with the support of literature and previous findings of the authors as follows:

Figure 1. Conceptual framework



Source: Adapted from Grover et al. (2018).

3. RESEARCH METHODOLOGY

The researchers followed the survey methods as the strategy of the research work to reach the study objectives. To meet the study's objectives, a quantitative approach was applied. According to a systematic literature review, Huynh et al. (2023) stated that most studies in the BDACs field have used quantitative methods, and within those studies, the majority rely on cross-sectional data. Thus, the current study also deploys a quantitative approach in line with previous studies to achieve the research objectives in a different context. The study mainly focuses on the influence of BDACs on innovation with the mediating role of VCMs in selected TSPs from 12 districts of Sri Lanka. In which 12 districts, such as Batticaloa, Trincomalee, Ampara, Kandy, Kurunegala, Colombo, Gampaha, Kalutara, Matale, Galle, Polonnaruwa, Mannar. The target population for this research includes the executive-level employees, such as higher-level managers, middle-level managers, network engineers, and technical officers, who are working in selected TSPs in Sri Lanka. The researchers had to use an exponential non-discriminative snowball sampling technique to select the respondents. The population stood at 135 employees, and only 91 employees responded successfully. In this context, the researchers used two ways to distribute the questionnaire. The first one is to distribute the self-administered questionnaires directly to those who are coming under the directly accessible population in their organizations, and through online as well.

Correlation analysis was utilized to determine the associations between the variables in the obtained data, and the mediation effect was determined utilizing a four-step process. According to Baron and Kenny (1986), Steps 1 through 3 are meant to demonstrate that there is a zero-order relationship between the variables. One moves on to Step 4 if there are meaningful connections between Steps 1 and 3. If the effect of *X* is still significant after adjusting for *M*, then the Step 4 model supports mediation in some way. The result suggests full mediation if, after controlling for *M*, *X* no longer has significance. The result supports partial mediation if *X* remains substantial (that is, if both *X* and *M* significantly predict *Y*).

The research instrument was adapted and developed from Okcu et al. (2019) and Lin et al. (2009) to measure the innovation, and further, the researchers have developed the instrument to measure the BDACs and VCMs of BDA based on past studies of Banerjee (2013) and Grover et al. (2018). The researchers conducted a pilot study to identify the potential problems and deficiencies in the research instruments before the implementation of the full study. In this study, the Cronbach's alpha coefficient value is calculated to ensure the quality of the instrument and test the internal consistency reliability of the instrument. This model analyses the internal consistency of the BDACs, VCMs, and innovation as 0.828, 0.867, and 0.919, respectively, and based on the alpha value above 0.7, is considered a good, reliable instrument.

4. RESULTS AND DISCUSSION

The first objective of this study is to identify the interrelationship among BDACs, VCMs, and innovation among selected TSPs in Sri Lanka.

The results show that the correlation coefficient (r) value is 0.546 between BDACs and innovation. The significance level is 0.000, which is below 0.05 ($p < 0.05$), where the value falls under the coefficient range of 0.5 to 1. Thus, there is enough evidence to reject the null hypothesis (H_0), and it is proven that there is a strong positive relationship between BDACs and innovation. There are some findings that empirically support the relationship between BDACs and innovation. According to prevailing studies, using BDAC is linked to both a greater inclination to innovate and a higher intensity of innovation. It is generally anticipated that BDACs will help businesses across all sectors develop new business models, enhance current ones, and produce new goods and services (Manyika et al., 2011; Mikalef et al., 2019; Niebel et al., 2019). BDACs offer a platform for businesses to enhance their creativity and are linked to the next frontier in terms of productivity, competition, and innovation (Akter et al., 2016).

Furthermore, the data demonstrate a correlation coefficient (r) of 0.587 between BDACs and VCMs. The significance level is 0.001, which is less than 0.05 ($p < 0.05$). Furthermore, the result falls within the coefficient range of 0.5 to 1. Thus, there is sufficient evidence to reject the null hypothesis (H_0), and the researchers conclude that there is a significant positive association between BDACs and VCMs. Some findings provide empirical support for the link between BDACs along VCMs. Sharma et al. (2014) contend that there is limited proof that BDA can generate value through the employment of various methods. According to Mikalef et al. (2019), the combination of big data and business analytics capabilities enables the implementation of several VCMs.

Finally, the data demonstrate a correlation coefficient (r) of 0.609 between VCMs and innovation. The significance threshold is 0.000, which is less than 0.05 ($p < 0.05$). Furthermore,

the result falls within the coefficient range of 0.5 to 1. Thus, there is sufficient data to reject the null hypothesis (H_0), and the researchers conclude that there is a significant positive link between VCMs and innovation. The VCMs of BDA are intended to have a positive impact on decisions, customers, processes, innovation, and other objectives (Grover et al. 2018). Kariuki and Kagiri (2018) state that the strategic role of BDA technologies, such as product development, market segmentation, fraud detection, and precision marketing, positively impacts innovation to retain their customer. Recent developments, such as big data, can help business models identify or create opportunities for using VCMs to offer radical and disjointed innovations (Wan et al., 2015).

All the relationships between BDACs and innovation (*H1*), BDACs and VCMs (*H2*), and VCMs and innovation (*H3*) reveal a significant positive relationship (Table 1). As a result, the findings support the acceptability of *H1*, *H2*, and *H3*.

Table 1. Relationships among BDACs, VCMs, and innovation

Variables		***BDACs***	***VCMs***
Innovation	Pearson correlation	0.546	0.609
	Sig. value	0.000	0.000
VCMs	Pearson correlation	0.587	
	Sig. value	0.001	

Source: Survey data.

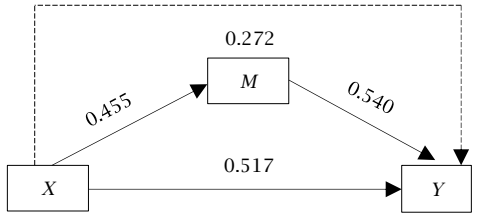
The second objective of this study is to examine whether VCMs mediate the relationship between BDACs and innovation in selected TSPs. The prime objective of this study has been achieved through the four-step approach, and results are depicted in Table 2. Findings and results of the simple regression analysis revealed that at Step 1, 29.8% of variability in innovation is accounted for by the BDACs, at Step 2, 34.5% of variability in VCMs is accounted for by the BDACs, and Step 3, 37.1% of variability in innovation is accounted by the VCMs. Further, as Step 4, the results of the multiple regression analysis highlighted that 42.5% of variability in innovation is accounted for by the BDACs and VCMs, while the *B* coefficient value for BDACs is 0.272 and 0.540 for VCMs.

Table 2. Regression analysis results

Relationship	***R^2***	***Adj. R^2***	***Std. Error***	***Sig.***
BDACs → Innovation	0.298	0.290	0.41731	0.000
BDACs → VCMs	0.345	0.337	0.32921	0.000
VCMs → Innovation	0.371	0.364	0.39489	0.000
BDACs, VCMs → Innovation	0.425	0.412	0.37974	0.000

Source: Survey data.

Figure 2. Statistical model of mediation analysis



Source: Survey data.

The effect of *X* (BDACs) remains significant after controlling for *M* (VCMs). However, the strength of the relationship has reduced from 0.517 to 0.272. It indicates that the VCMs partially mediate the relationships between BDACs and innovation.

Statistical significance of the mediation has been tested through the equation proposed by Sobel (1982) as well. Hence, based on the Sobel test, the Z-score (Z = 3.465) is greater than 1.96, which depicts that the mediation effect is statistically significant at the 5% level. Therefore, there is enough evidence to reject the null hypothesis (H_0), and *H4* of the present study is accepted. Consequently, it can be concluded that VCMs mediate the relationship between BDACs and innovation.

Few empirical findings in the literature support the findings of the present study. Sharma et al. (2014) suggest that BDA can generate value through various mechanisms. In each application of BDA, its capabilities produce outcomes that must be converted into VCMs to influence value targets related to innovation (Grover et al., 2018). BDACs empower organizations to achieve these value targets, such as enhanced decision-making, process improvements, and product innovation, through the mediation of one or more VCMs. These VCMs include transparency, access, discovery, experimentation, prediction, optimization, customization, targeting, learning, monitoring, and adaptation (Grover et al., 2018). Furthermore, Mikalef et al. (2019) highlight that the connection between big data and business analytics capabilities is facilitated by different value creation pathways.

5. CONCLUSION

The findings of the study demonstrate that BDACs and VCMs are essential for driving business innovation. The results of correlation analysis proved that there are significant, strong positive relationships among BDACs and innovation ($r = 0.546$, $p < 0.000$), BDACs and VCMs ($r = 0.587$, $p < 0.000$), and VCMs and innovation ($r = 0.609$, $p < 0.000$). These results confirm that BDACs significantly enhance both VCMs and innovation. Additionally, the study concludes that VCMs partially mediate the link between BDACs and innovation, where VCMs play a mediating role in translating capabilities into innovation outcomes. Identifying and nurturing these varieties of VCMs can thus advance innovation in areas like product, market, and process development. This evidence highlights the value of VCMs for TSPs striving to become more innovative.

This study empirically investigates how BDACs influence innovation. The researchers aim to contribute both theoretically and practically by validating a value-creation framework for BDACs, offering insights relevant to both academic research and industry practice. BDACs are conceptualized as a distinct type of capability that can drive innovation within the modern digital landscape. This connection between BDA and innovation explains why some organizations outperform others in detecting and responding to changes in their environment. The study builds on the theoretical foundation established by Grover et al. (2018) and employs a quantitative approach to empirically analyze how the relationship between BDACs and innovation is mediated by VCMs. While the benefits of BDA are well-recognized, the strategic path to value creation remains underexplored. To address this, the study's framework illustrates how organizations can manage data analytics resources to foster innovation through VCMs. This approach offers guidance to TSPs struggling to utilize their vast data reserves effectively. The findings emphasize the need for TSPs to prioritize BDACs before focusing on VCMs, as this strategy can help channel large datasets toward achieving operational goals rather than solely pursuing innovation. The study also recommends that TSPs cultivate a data-driven culture and establish effective data governance structures to support BDACs. Additionally, it highlights the importance of addressing weak links in the value-creation process, ensuring that employees possess the necessary analytical skills and have access to advanced analytical tools. Such measures are essential for achieving value targets and optimizing the use of big data.

This study has certain limitations that should be acknowledged. The use of a snowball sampling technique to select a small number of executive-level employees may introduce bias, limiting the generalizability of the findings. The geographical focus on Sri Lankan TSPs restricts the applicability of the results to other regions with different socio-economic and regulatory contexts. Additionally, reliance on survey-based data collection may be subject to self-reporting bias, which could influence the accuracy of the responses. These limitations highlight the need for further research with larger, more diverse samples and cross-country comparisons.

Strangely, survey studies predominate in such a new area, whereas there are relatively few case studies or expert interviews, no secondary data, exploratory investigations, or replications. In the future, the research might concentrate on qualitative investigations (Huynh et al., 2023). To support future research, it is recommended to incorporate additional research tools, such as focused group discussions, or adopt a triangulation approach that combines multiple instruments and research methods. This approach can enhance the depth and reliability of findings. As shown by some important studies in the sample, further longitudinal investigations and well-structured surveys are required to properly examine the dynamics and complex nature of BDAC research (Wamba et al., 2020). Future research could be expanded through longitudinal studies to capture how BDA's solutions impact firm performance over time. Additionally, case studies of companies utilizing BDACs could provide richer insights and further validate the findings of this study. The researchers believe this study has contributed to the BDA literature and will serve as a valuable reference for future BDA-related research. At a minimum, the study's framework offers a foundation for broadening research in this critical area and establishing an ambitious research agenda. Future studies are encouraged to extend this framework to explore value creation and co-creation across various industries.

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