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The Leadership of Big Data Analytics Implementation Project Success

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Abstract

This quantitative predictive correlational study aimed to investigate the role of the transformational leadership dimensions in successfully implementing big data analytics (BDA) in data-driven business environments. The sample consists of 175 BDA implementation team members in United States. The project success model (PSM) was used to assess the success of BDA project implementation, and the Multifactor Leadership Questionnaire MLQ (5X-short) was used to determine the perceived transformational leadership style dimensions of team members. The results showed that three transformational leadership dimensions of inspirational motivation, intellectual stimulation, and individualized consideration had a significant and independent effect on the core constructs of the successful implementation of the BDA project. In contrast, idealized influence did not significantly contribute to BDA's successful implementation. Moreover, a further examination of individual transformational leadership dimensions showed that individualized consideration has a considerable impact on the core constructs of the BDA implementation success model when controlling for the other dimensions. These findings suggest that implementing data driven applications, BDA projects, may require a different approach to exert leadership excellence, and a comprehensive approach with consideration of the various dimensions of transformational leadership may be more effective in promoting acceptance and application of BDA technologies.

Keywords: Leadership Styles, Transformational Leadership Style, Idealized Influence, Inspirational Motivation, Intellectual Stimulation, Individualized Consideration, BDA Implementation, Project Success

Introduction

Firms and organizations with a legacy record of success in conventional business operations are searching for new ways to maintain their success level and improve functional performance to compete well in data-driven environments. According to Davenport and Bean (2024), various organizational functions are profoundly impacted by the changes and challenges caused by data-driven business environments and employees' negative attitudes toward these changes. Business functions including marketing, finance, operations, human resources, and supply chain management need revisiting to determine the predecessors' successful performance and to add value within the increasing sizes, variation, rapidity, veracity, and value of data (Dubey et al., 2019; Johnson, 2024; Smith, 2024). Davenport and Bean (2024) asserted that businesses that are seeking to implement new technologies such as artificial intelligence (AI), machine learning (ML), or deep learning (DL) to enhance business functions may require assistance in selecting the proper means for leveraging predictive analytics, utilizing real-time data analytics, benefiting from IoT sensors, and improving forecasting and decision making through advanced big data analytics (BDA) and the means to reduce resistance to these advances.

A data-driven environment and the interest in benefiting from the tremendous amounts of big data available in the business environment created a broad spectrum of advantages of BDA that businesses can use. The acknowledged advantages of BDA implementation include improving agility, innovation, and competitive performance (Côrte-Real et al., 2019; McAfee et al., 2012). Big data analytics (BDA) characterized by the 5 Vs (i.e., volume, variety, velocity, veracity, and value) is reinventing the way businesses extract insights, make better decisions, improve performance, and gain a competitive edge (Duang-Ek-Anong, 2019; McAfee et al., 2012; Moors & Rogiest, 2018). However, the advantages gained through the insights brought forward by big data have added challenges and fear for implementing BDA.

The emergence of big data analytics (BDA) in the contemporary business intelligence landscape is one of the main building blocks for organizational success. Udeh et al. (2024) posited that BDA provides organizations with the capability to harness the full potential of their data assets. However, enjoying BDA advantages is not without challenges and anxiety. Mikalef et al. (2020) highlighted the challenges that the core functions of BDA created in the data-driven business environment. Employees show increasing fear, anxiety, and resistance when required to implement new technology (Khasawneh, 2020).

The sheer volume of data generated daily necessitates new and scalable solutions for how the human side of the organization handles, stores, and processes data. In addition, leadership team members dealing with the velocity at which data is produced and the high demands for real-time analytics capabilities require higher support and motivation. Moreover, the variety of data, including structured and unstructured formats, requires real-time assistance and training in handling flexible processing methods. To overcome the challenges associated with implementing BDA, effective leadership is one of the key success factors that can provide the required role model, care, inspiration, encouragement, support and motivation. Proper leadership can help guide the implementation of BDA projects and ensure their acceptance by the employees (Khasawneh, 2020; Schepers et al., 2005).

Successfully implementing projects in high-performing industries, especially within big data-driven environments, is attracting considerable interest (Grover et al., 2018). The introduction of computers in the 1970s led to changes in the workplace that are estimated to have incurred costs exceeding $4 billion. In the following decades, particularly the 1980s and 1990s, the introduction of new technologies resulted in even greater losses stemming from unsuccessful implementations and the anxiety associated with adopting these innovations (Khasawneh, 2020). Today, the phenomenon known as "dataphobia" is more prevalent than ever, contributing significantly to even larger losses. Addressing the non-technical and human factors within organizations can play a vital role in fostering effective leadership for BDA implementation projects.

Transformational leadership style, more than any other leadership style, is effectively contributing to business resilience, agility, and the development of high-reliability organizations (Jiang et al., 2017; Judge & Piccolo, 2004; Lowe et al.,1996; Wang et al., 2011). Deinert et al. (2015) explained the high impact of transformational leadership as due to the ability to address issues that are relevant in data-driven, risky, changing, and uncertain work environments. Popovič et al. (2018) highlighted the role of transformational leadership support in enabling, facilitating, and enhancing the successful implementation of BDA projects. Despite the growing interest of researchers and practitioners in the effective role of leadership in today's business life, the contributions of the dimensions of the transformational leadership style to data-driven project-related outcomes are still under investigated (Abbas & Ali, 202; Bass & Avolio, 1993). Aga et al. (2016) pointed to the scarcity of empirical testing of the direct and indirect relationships between transformational leadership style dimensions and project success and the crucial need to test such relationships, especially in a data-driven business environment.

Even though prior literature indicated that transformational leadership style contributes positively to employees' engagement level and helps exert higher levels of effort that guarantee more effective performance in risky and less tested business environments, there is scant research explaining the way the four behavioral dimensions of transformational leadership contribute to this success (Avolio et al., 1999; Gandolfi & Stone, 2018; Jiang et al., 2017; Moors & Rogiest, 2019). Several researchers highlighted the need for more efforts to identify how transformational leadership dimensions drive change, especially the successful implementation of BDA projects in the data-driven business environment (Abbasi et al., 2016; Alkordi, 2024; Migliore & Chinta, 2017; Mikalef et al., 2020). Additionally, Dastane (2020) indicated that despite the high demand for investigating transformational leadership style and organizational project success implementation, no known research explains how the individual behaviors of transformational leadership style may contribute to the successful BDA implementation. Moreover, Avolio et al. (2004) emphasize that a more concerted effort is required to explore the process and boundary conditions for transformational leadership leading to effective work outcomes, increased satisfaction, and extra work.

The present study investigates further the underlying contribution of the four dimensions of the transformational leadership style to the successful implementation of BDA projects in the data-driven business environment of the industry.4.0 era in the United States. Bass and Riggio (2006) explained that transformational leadership style as it occurs in practice, i.e., through utilizing followers physical, intellectual, and emotional capabilities to perform

beyond normal expectations, stimulating them to be creative and innovative, and developing their collective leadership capacity to contribute to higher levels of organizational outcomes. Effective leadership fosters innovation by creating an environment that encourages creativity, risk-taking, and collaboration, while providing clear vision, resources, and support for innovative initiatives, adapting leadership styles to different innovation stages, and embracing technological advancements (Oke et al., 2022; Kesting et al., 2021; Hughes et al., 2023).

In today's fast-paced, data-driven world, leaders are required to possess competencies that align with these evolving data-driven business demands. Kane et al. (2019) underscore the critical need to understand the behaviors that enable leaders to excel in high-technology environments, particularly in motivating their teams to adopt new, data-oriented technologies. Furthermore, Prince (2017) argues that the challenges and opportunities of the Industry 4.0 era necessitate a deeper exploration of effective leadership practices in data-centric organizations. Yet, despite this pressing need, there remains a significant gap in research concerning which of the four transformational leadership style dimensions most effectively drives change management within data-driven businesses (Ghadi et al., 2023; Morgan, 2022). Additionally, Bradshaw (2022) highlights that contemporary studies have primarily concentrated on the broader effects of transformational leadership on change management, rather than delving into the specific contributions of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Addressing this gap is essential for harnessing the full potential of leadership in the era of big data.

Understanding the level of influence that individual transformational leadership style dimensions of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration have on the successful implementation of BDA projects adds to the clarity of a better theoretical discourse of this relationship. In addition, a clear understanding of how transformational leadership behavior affects leadership outcomes in a data-driven business environment can provide practical guidance for organizations operating in Industry 4.0 settings interested in adopting BDA and reaching the full potential of transformational leadership behaviors.

In response to the calls for further research, this study takes a focused approach by utilizing a quantitative methodology and a predictive correlational design to investigate how the key dimensions of transformational leadership—idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—impact the successful implementation of Big Data Analytics (BDA) projects in data-driven business environments. This research is essential aiming to answer crucial questions that can guide organizations in effectively harnessing leadership strategies to enhance their BDA initiatives:

1. Do individual transformational leadership dimensions predict the successful implementation of BDA projects?
2. Which transformational leadership dimensions contribute more to the data-driven BDA successful implementation.
3. To what extent can transformational leadership dimensions pave the way for increasing followers' engagement in the activities of BDA implementation?

The remaining structure of this article is arranged as follows. Next, Section 2 presents the theoretical framework, followed by Section 3, research method, hypotheses, and conceptualization followed by a description of research methodology detailed in Section 4. Thereafter, Section 5 presents data analysis with results. After that discussion of the findings and implications is presented in Section 6 followed by the presentation of the conclusion, limitations, and future research scope in Section 7.

Theoretical Framework

This quantitative study intends to expand the evidence regarding the correlates between transformational leadership style dimensions of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration and the successful implementation of BDA projects in companies operating in the United States. Therefore, two outstanding theoretical foundations are identified as most appropriate to support this study: BDA project success model and the full range transformational leadership theory (FRLT).

BDA Project Success

The conceptualization of success in conventional projects (non-data-driven) has historically been established and delineated around tangible triangle criteria of time compliance, cost reduction, and quality improvement (Asree et al., 2019). The Project Management Institute (PMI) advances the project success concept viewing it as the equilibrium achieved among the conflicting requirements of project success combining tangible and non-tangible success criteria. PMI (2017) identified two additional intangible criteria (e.g., quality and stakeholder satisfaction) to measure project success. Within the framework of big data analytics (BDA) projects, stakeholders have not yet reached a unified consensus regarding the criteria defining project success. Jiang et al. (2017) explicated the absence of unanimity in determining project success criteria, attributing it to divergent benchmarks and ambiguous evaluation criteria within the diverse stakeholders involved in the project evaluation. This underscores the imperative for further inquiry into the requirements for success in innovative and data-driven settings.

The criteria for success in data-driven projects were derived from earlier conventional project success factors. In previous studies, several types of project outcomes (time, cost, quality, scope, and results) were suggested (Hwang & Boo, 2018; Jiang et al., 2017; Khan et al., 2013). To confirm this conclusion, Raziq et al. (2018) posited that project success cannot be viewed as completing projects within the defined scope, time, and cost only. It also includes gaining customer acceptance, stakeholder satisfaction, commercialization, and future project opportunities. Khan et al. (2013) developed a success model that achieves symmetry by integrating hard and soft factors and evaluating project success across five dimensions.

Khan et al. (2013) research shows that existing project success factors and success criteria cannot be used without looking at the context in which they were developed, including data-driven contexts and technology-oriented environments. They identified seven dimensions of project success in literature including project efficiency, impact on the project team, impact on customer business success, preparing for the future, project profile, and stakeholder satisfaction. Moreover, Khan et al. (2013) suggested five dimensions to measure project success concentrating on business context. Joslin and Müller (2016) improved Khan

et al.'s (2013) model of project success, and the criteria identified by these researchers include project efficiency, organizational benefit, project impact, future potential, and stakeholder satisfaction. The current study used Joslin and Müller's (2016) unitary five-factor project success criteria to measure the successful implementation of BDA projects.

These unified project success criteria comprise efficiency, organizational benefit, project impact, future potential, and stakeholder satisfaction. Joslin and Müller (2016) defined these constructs in the following way. *Efficiency* is the degree to which the project optimally utilizes the most cost-effective resources to generate outputs of the desired quality. Organizational benefit pertains to the degree to which the project achieves its objectives. Impact encompasses both positive and negative changes instigated by the project, whether intentional or unforeseen, and whether occurring directly or indirectly. As outlined by Shenhar and Dvir (2007), future impact denotes the degree of enhancement, motivation, and improvement in an organization's capacity to undertake project work in subsequent endeavors. Turner and Zolin (2012) defined *Stakeholder satisfaction* as the degree to which the project aligns with the priorities of the target group, sponsor, steering committee, and client. Even though this project success model proved to have high consensus among interested researchers, it needs further investigation to fit BDA projects in data-driven environments and Industry 4.0 requirements.

Transformational Leadership

Describing a high-profile leader, Bass and Stogdill (2006) state that he is someone who catches the interest and imagination of the individual workman, business community, and the general public. For a leader to be viewed as a high-profile leader, particularly in the data-driven, high-tech business context, is the extent of the ability to challenge followers to perform beyond normal expectations, to stimulate them to be creative and innovative, and to develop their collective leadership capacity (Hosen et al., 2024). Maxwell (2022) argues that as businesses and their environments become more complicated, successful leaders distribute leadership all over the organization to do what is needed to get the job done not only at the top level of the organization but at all levels and by any individual. Several theories attempted to describe leadership styles and the different ways to influence followers; however, the transformational leadership style gained the most attention in the field of leadership.

Transformational leadership has emerged as one of the most effective leadership styles contributing to positive outcomes for organizations in rapidly changing business environments (Cao & Le, 2022; Ghadi et al., 2023). Recent research has emphasized the effectiveness of transformational leadership in inspiring and motivating employees to perform in ways that create meaningful change, particularly in today's rapidly evolving digital era (Usman, 2020). Usman (2020) added that this leadership approach has been found to inspire followers, motivate them to achieve change goals beyond expectations, and effectively address the human side of change. Researchers studied transformational leadership style and its positive outcomes as a unitary construct and an increasing number of researchers found it is more relevant to study the individual transformational leadership dimensions and their influence on organizational outcomes including organizational commitment, job satisfaction, perceived extra effort, and weighted effectiveness (Aga, 2016).

Burns (1978) viewed transformational leadership as a two-way process where leaders and followers elevate one another to higher levels of morality and motivation, inspiring change and pursuing collective goals achievement beyond self-interest. Bass (1985) builds on the views of Burns of transformational leadership style concentrating on the leader's ability to motivate their followers to accomplish more than they originally planned to by raising followers' awareness, transcending followers' self-interest to include their team and organization, and meeting followers' needs. According to Bass (1999), transformational leaders use four behavioral components of individualized consideration, intellectual stimulation, inspirational motivation, and idealized influence to achieve higher performance levels. Transformational leadership adds value to business contexts by inspiring and motivating employees to go beyond the norms of previous performance, helping their employees solve problems by challenging them to approach them from new and different angles, and fostering innovation, thus enhancing their engagement, and driving organizational performance, and individual growth, shared vision, and adaptability to change (Buil et al., 2019; Wood, 2019). Buil et al. (2019) study related transformational leadership dimensions to the increased adaptability to change.

While there is a paucity of studies investigating the relationship between transformational leadership dimensions and the successful implementation of BDA projects, several studies investigated only one or more variables (Vorecol, 2024; McKinsey & Company, 2022; Al Qatawneh, 2018). Vorecol (2024) found that transformational leaders have a positive influence on their employees during periods of change including BDA implementation. Transformational leadership continues to be a prominent and influential construct in organizational research (e.g., Al-Husseini et al., 2021; Andoko et al., 2024; Avolio et al., 1999; Bass, 1985; Buil et al., 2021; Cao & Le, 2022; Grošelj et al., 2021), but most researchers focused on investigating transformational leadership as a unitary construct, rarely as a multidimensional construct.

The current study investigates transformational leadership as a multidimensional construct (e.g., idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration) and argues that these leadership behaviors positively contribute to the successful implementation of BDA projects in data-driven contexts. These four dimensions of the transformational leadership style reduce resistance to change, and fear, and increase the level of engagement of employees by elevating influencing, charming, thinking, and caring (Alqatawenh, 2018). The following is a brief description of the four constructs of transformational leadership.

Idealized influence is the degree to which leaders set an example for followers to respect, trust, admire, and identify with due to their self-confidence, vision, and passion as they show persuasive insights into followers' needs, hopes, and values (Anderson & Sun, 2017; Judge & Piccolo, 2004; Lan et al., 2019). Idealized influence contains two aspects: leaders' actual behaviors and attributed behaviors by followers (Bass & Riggio, 2006). Bass and Riggio (2006) described actual leaders' behaviors as showing distinctiveness, trustworthiness, respectfulness, and admirability each time they approached a work setting. On the other hand, followers' observation of recurrent leaders' behaviors contributes to describing leaders as having extraordinary capabilities, persistence, and determination. Therefore, they identify with and want to emulate them (Bass & Riggio, 2006). However, it is

not definitely known whether this tendency contributes to successfully navigating new situations.

Recent research has focused on the relationship between transformational leadership and followers' innovative behavior, which may provide insights into this question. Ghadi et al. (2023) found that transformational leadership indirectly influences employee innovative behavior by increasing employees' commitment to organizational change. This suggests that the imitation of leader behaviors may play a role in adapting to new situations such as BDA implementation projects, but the direct link remains unclear.

The second dimension of transformational leadership is inspirational motivation (IM). IM refers to a leader's ability to communicate in a clear way that unites followers and guides their efforts toward the achievement of organizational goals (Djourova et al., 2022). It is also the degree to which leaders use their charms to convey the goal of the organization and, provide meaning for current tasks and, set a clear vision, communicate aspirations, resulting in follower's optimism and hope for the future of the organization (Anderson & Sun, 2017; Judge & Piccolo, 2004; Lan et al., 2019). Clear communication with followers can pave the way for exerting higher levels of performance that lead to organizational benefits and satisfaction. Recent studies have emphasized the crucial role of effective communication in enhancing organizational performance and employee engagement. Ghadi et al. (2023) found that the clear communication component of inspirational motivation, indirectly influences employee targeted behavior by increasing commitment to organizational change. Additionally, research has shown that inspirational motivation effective internal communication strategies positively impact organizational commitment and engagement in institutions (Avotra et al., 2022).

Leaders using inspirational motivation enthuse followers with challenge and persuasion, providing meaning and understanding for the tasks (Bass & Riggio, 2006). Bass and Riggio (2006) stated that leaders perform their tasks in a way that motivates and affects employees around them. Leaders give meaning and challenge followers to question their long-accepted routines as they can see their tasks differently. This approach is particularly evident in transformational leadership, where leaders inspire and motivate followers to achieve change goals beyond expectations creating higher levels of stakeholder satisfaction. Zhao et al. (2021) found that this dimension is the primary driver of transformational leadership.

Intellectual stimulation (IS) is how leaders encourage subordinates to enhance their knowledge and creativity and ponder deeply about problems (Judge & Piccolo, 2004; Lan et al., 2019). It refers to the leader's ability to bring out the intellectual potential of followers by challenging assumptions, encouraging creativity, and providing innovative ideas (Avolio, Bass, & Jung, 1999). The main goal of a leader using intellectual stimulation is to expand the followers' awareness of their potential and the ability to recognize their competencies (Bass & Riggio, 2006). Bass and Riggio (2006) posited that leaders seek to stimulate their followers' efforts to be innovative and creative. Leaders can help followers reach higher levels of stimulation by questioning assumptions, reframing problems, and approaching old situations in new ways (Bass & Riggio, 2006). This helps followers see their tasks and abilities in an

entirely innovative way and helps them to perform well and add to organizational effectiveness and benefit.

Recent research has highlighted the significant impact of intellectual stimulation on employee creativity, performance, and organizational outcomes. Thuan (2020) found that leader intellectual stimulation positively influences followers' creative performance by developing followers' creative ability and enhancing job autonomy. Furthermore, intellectual stimulation has been shown to foster an environment where employees are encouraged to think critically, challenge assumptions, and develop innovative solutions to problems (Ghadi et al., 2023). This leadership approach not only enhances team learning but also contributes to increased employee commitment and trust in leadership (Thuan, 2020), and thus plays a major role in the successful implementation of BDA projects.

Individualized consideration (IC) is the leader's focus on the individual needs of followers, respecting and listening to their concerns, and monitoring their behaviors extending assistance and help as needed (Judge & Piccolo, 2004; Lan et al., 2019). Leaders pay more attention to each need, behave practically, and consider individual differences when assigning tasks to followers (Zuberbuhler et al., 2024). Roy (2024) indicated that leaders identify employees' needs and provide practical guidance through coaching and mentoring. This is most influential at times of anxiety or when new technologies (e.g., BDA) are being implemented. Leaders also demonstrate acceptance of employees' negative attitudes and deviant behaviors by treating them according to their individual and different needs (e.g., some employees receive more encouragement, some more autonomy, others firmer standards, and still others more task structure) (Bass & Riggio, 2006).

Caring for employees' needs can lead to a stage where all employees are engaged and fully participating in achieving organizational goals. Recent research supports this notion, highlighting the importance of employee well-being and engagement in organizational success. Ghadi et al. (2023) found that transformational leadership, caring for employees' needs, indirectly influences employee innovative behavior by increasing commitment to organizational change including BDA implementation projects. Furthermore, studies have shown that prioritizing employee well-being and creating a positive work environment can significantly enhance employee engagement and alignment with organizational objectives (Avotra et al., 2022).

Research Model and Hypotheses

This section includes the conceptual framework and hypotheses of the study. In addition, it presents the relationships between the variables in the study. Fig. 1 depicts the conceptual framework of the study. The study argues that transformational leadership style dimensions have variable relationships with the successful implementation of BDA project.

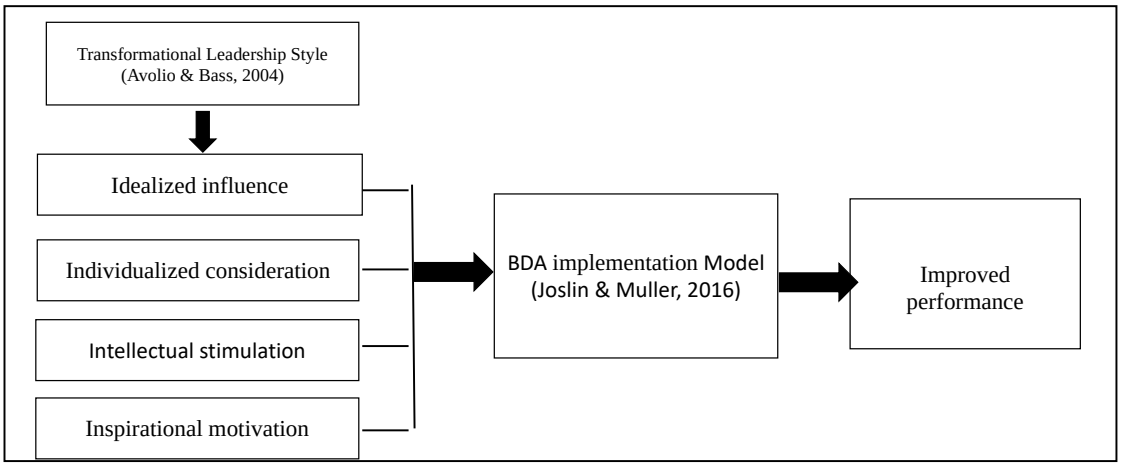

Figure 1. The Conceptual Framework of the Study
Source: Created by the authors based on Alkordi (2024)

Transformational Leadership and BDA Project Success

Even though most studies show that transformational leadership (TL) has a significant impact on the successful implementation of BDA (Judge & Piccolo, 2004; Lowe et al., 1996; Moors & Rogiest, 2019; Wang, et al., 2019), recent research results indicate that this relation is contradictory (Zhao et al., 2021). While the mainstream literature shows a positive relationship between TL and project success, some studies are reckoning that the project's successful realization will be hindered by TL (Langfred, 2004; Tajasom et al., 2015). Moreover, there are apparent conflicts in the strength, direction, and statistical significance of the relationship between transformational leadership and project success in most studies, which creates confusion in theory and practice. As a result, a further investigation of the main constructs of the transformational leadership style may provide the needed answers to this confusion.

Researchers are investigating further transformational leadership style as a unitary construct while conflicting results call for the investigation of individual components of the transformational leadership dimensions of technology implementation. Recent studies have highlighted the complex relationship between transformational leadership and technology integration in various organizational contexts. Ghadi et al. (2023) examined the role of transformational leadership in fostering followers' innovative behavior, which is closely related to technology adoption. Their study emphasized the importance of considering mediating factors such as commitment to change and organizational support for creativity when considering transformation leadership as a unitary construct. However, Mgqibi (2019) noted that while transformational leadership as a whole is associated with organizational change effectiveness, individual components of transformational leadership were not statistically significant in their study, suggesting the need for further investigation of dimensions.This study add to leadership literature by shedding more light on

transformational leadership style dimensions to gain more understanding of this leadership style and its potential.

Viewing the transformational leadership style as it occurs in practice involves accumulating increasing attention to the task at hand, including the innovative and successful implementation of BDA projects. Gandolfi and Stone (2018) pointed out that the concept of leadership styles, the least addressed concept in leadership literature, involves an intentional selection of a certain approach to address employees' physical, emotional, and intellectual abilities to elevate the task at hand to move from the current situation to the future desired situation. Therefore, this study aims to identify how transformational leadership style dimensions are addressed to elevate the task at hand identified as the implementation of BDA projects, and how these leadership style dimensions address employees' physical, intellectual, and emotional abilities to achieve success.

The literature shows that transformational leadership positively correlate with BDA implementation project success (Buckle, 2020; Nji, 2021). Buckle (2020) found that a transformational leadership style correlates positively with a vision for implementing big data analytics. Transformational leadership style elevate the task at hand and transforms employees into being team-centered by transforming their long-established ideals, morals, values, and interests, motivating them to perform better than initially expected (Avolio & Bass, 2004; Bass, 1985). Transformational leaders are both inspired and inspiring, taking a proactive stance as they strive to optimize development and innovation at the individual, group, and organizational levels, rather than merely achieving expected performance outcomes (Avolio & Bass, 2004). Such leadership fosters a long-term relationship between leaders and followers, reflecting strategic orientations and interactions that align with the long-term objectives essential for successful BDA implementation (Moors & Rogiest, 2019). This environment is expected to encourage BDA project team members to exert sustained effort toward achieving project success (Hussain et al., 2017).

Due to the vast changes in the business environment and the uncertainty created by big data, transformational leadership is gaining increasing empirical consensus that it is more effective than any other leadership style (Deinert et al., 2015; Judge & Piccolo, 2004). With this increasing agreement on the superiority of transformational leadership style to achieve results in a changing environment, transformational leadership theory still needs consistent results regarding its four dimensions (Bass & Avolio, 1993). Deinert et al. (2015) highlighted that the usefulness of the concept's four-factor structure has recently been called into question. Bass (1985) identified four transformational leadership dimensions that leaders utilize to elevate task at hand and achieve success through a solid and impactful future strategic vision, inspirational motivation, intellectually challenging employees physical, emotional and intellectual abilities, and caring about their individual needs.

Transformational leadership literature emphasizes the significance of this leadership style in guiding organizations from their current state to a desired future state. Gandolfi and Stone (2018) underscore the importance of intentionally selecting a leadership approach that addresses employees' physical, emotional, and intellectual capabilities, enabling them to successfully perform their tasks. This process is essential for transitioning from the status quo to the desired outcome. However, the specific ways in which each dimension of

transformational leadership contributes to this success remain unclear. This study aims to address this gap and may provide valuable insights into the existing literature in this field.

Idealized influence leadership was found to be positively correlated with organizational outcomes such as organizational commitment project success, and organizational performance (Cavazotte et al., 2012; Farea, 2021; Parr et al., 2013). Farea (2021) studied the relationship between transformational leadership factors and the successful implementation of government projects in Saudi Arabia and found that idealized influence improves progress and ultimately impact project success in the public domain. Cavazotte et al. (2012) found an indirect relationship between idealized influence and organizational performance. Idealized influence leadership thus plays a significant role in anticipating the improvement of organizational outcomes.

In addressing employees' physical, emotional, and intellectual abilities and attempting to move the organization from the current to the future desired situation, idealized influence uses role modeling behaviors and puts the group's values and interests above the leader's values and interests, fostering entrepreneurial and innovative performance (Tajasom et al., 2015). Idealized influence is where the leader becomes a role model, demonstrating the qualities of trust, honesty, enthusiasm and so on (Farea, 2021). According to Bass and Riggio (2006), leaders significant idealized influence or their willingness to take risks and staying consistent rather than arbitrary by demonstrating high ethical and moral conduct standards increase the chances of succeeding in performing the task at hand. Therefore, the following research hypothesis is proposed:

Hypothesis 1. *Idealized influence positively influences the successful implementation of BDA projects.*

Prior research indicates a significant relationship between individualized consideration and various dimensions of project success, innovative behaviors, and overall organizational outcomes (Deinert et al., 2015; Farea, 2021; Gumusburun, 2022). Individualized consideration prioritizes understanding and addressing employee needs—physical, emotional, and intellectual—thereby fostering an environment where employees feel secure and motivated to exert greater effort in their tasks. Judge and Piccolo (2004) noted that leaders who are attuned to their followers' needs, can respond effectively, and possess strong mentoring capabilities tend to enhance overall performance.

In high-tech or data-driven work environments, employees frequently confront a range of psychological challenges and require support to navigate these difficulties. Leaders who acknowledge and actively address their employees' intellectual, emotional, or psychological needs are better positioned to build trust, acceptance, and competence within their teams (Farea, 2021). The individualized consideration component of transformational leadership has been shown to significantly enhance job satisfaction, which is closely linked to project success (Long et al., 2014). Deinert et al. (2015) emphasized the necessity for leaders to be sensitive to the anxieties that employees may experience and to address these concerns on an individual basis, which can lead to improved project outcomes. Therefore, the following research hypothesis is proposed.

Hypothesis 2. *Individualized consideration positively influences the successful implementation of BDA projects.*

Chebon et al. (2019) demonstrated that intellectual stimulation significantly boosts employee performance. Their research indicates that when leaders cultivate creativity and innovation while challenging established work practices, they can drive higher levels of employee performance and productivity. Furthermore, Wagude and Ndiritu (2015) established a positive link between intellectual stimulation and effective conflict resolution, as well as the successful execution of Consultancy Development Fund (CDF) projects. Chang (2021) highlighted the essential role of intellectual stimulation in pushing employees to rethink their ideas and approaches, a practice that is crucial for enhancing their skills and ultimately elevating performance in the public sector. In addition, Ondari et al. (2018) explored the impact of intellectual stimulation leadership on the organizational performance of state corporations in Kenya. The findings revealed that intellectual stimulation is a fundamental driver of performance in public and private organizations. Accordingly, we propose the following research hypothesis. Thus, the following research hypothesis is proposed.

Hypothesis 3. *intellectual stimulation positively influences the successful implementation of BDA projects.*

Nubuor et al. (2014) conducted research to examine the impact of transformational leadership style on strategic projects in large-scale banks in Ghana. The research findings indicated that inspirational motivation is the highest predictor of banking project success, followed by individual consideration, intellectual stimulation, and idealized influence. Heller et al. (2017) studied the moderators of the relationship between leaders' inspirational motivation behaviors and extra effort outcomes. The study found that leaders' use of inspirational motivation behaviors correlates positively with team members' level of extra effort when moderated by other leadership components. Ferozi and Chang (2021) indicated that inspirational motivation or addressing employees' abilities by identifying and articulating a vision and creating a meaningful workload by identifying goals lead to success. Thus, the following research hypothesis is proposed.

Hypothesis 4. *Inspirational motivation positively influences the successful implementation of BDA projects.*

Methods and Measurement

Research Setting and Participants

Projects can be classified into different categories, and this study considers BDA implementation projects. These projects aim to improve the success level of change management for organizations implementing BDA projects in terms of project efficiency, organizational benefit, project impact, future potential, and stakeholder satisfaction (Joslin & Muller, 2016). The deliverables of the successful implementation of BDA projects include accomplishing goals that enhance the effectiveness and efficiency of human efforts and their satisfaction and give firms a competitive edge (Ahmad et al., 2022).

The unit of analysis for this study was leaders. A unit of analysis refers to the entity being studied whether it is a person, collective, or object that is the target of the investigation (Nayak & Singh, 2021). The primary purpose of such investigation is to assess relationships or differences, with individuals being the most frequently used (Lewis-Beck et al., 2004). Sampling criteria for selection included participants based in the United States, working full-

time in a leadership role, participating in one BDA project implementation in the past two years, and being direct supervisors/managers above the project management team.

Research Approach

The research method selected as the most appropriate for conducting this study is the quantitative method. The decision was based on the quantitative method's characteristics and functions, including involving many observations, establishing empirical relationships, and using numerical data and statistical processes to represent and evaluate research observations (Nayak & Singh, 2021). The rationale for using this method was based on the theoretical framework supporting this study. It was also based on addressing the questions and the problem of determining if or to what extent transformational leadership style dimensions of project management team members predict the success of BDA project implementation.

This study could employ either qualitative or quantitative methods. However, a quantitative approach was chosen over the qualitative alternative. While both methodologies aim to examine a phenomenon, quantitative methodology relies on numerical measurements to explore relationships, whereas qualitative methodology focuses on perceptions to understand those relationships (Basias & Pollalis, 2018). The primary goal of the study was not to analyze participants' open-ended responses but rather to investigate statistical evidence to determine whether correlations exist among the quantified variables related to the dimensions of transformational leadership style and the successful implementation of big data analytics (BDA).

This study uses questions, hypotheses, and statistical analysis of responses, central to the quantitative approach. This study obtains data from senior management executives who have implemented big data analytics projects in the last two years or are implementing one. SurveyMonkey, one of the research panel companies, was used to collect data results using both the MLQ and the PSS surveys to examine both transformational leadership style dimensions (Avolio & Bass, 2004) and the successful implementation of big data analytics (Joslin & Müller, 2016). This researcher seeks to identify which transformational leadership dimensions influence the successful implementation of big data analytics. The quantitative methodology uses normal variables, seeks to identify relationships, and uses theories to support the research findings. These characteristics were consistent with the quantitative approach and further justified using a quantitative approach for this study.

Sample

A total of 145 participants from leading companies in the United States contributed to this survey, revealing a diverse and dynamic group: 64.5% of respondents identified as female and 35.5% as male. With ages spanning from 18 to over 65, this sample represents a wealth of perspectives. Notably, the majority of participants possess advanced education, with 23% holding a bachelor's degree and an impressive 28.8% having attained master's or doctorate degrees. This range of qualifications is reflected in the various roles participants occupy, including IT specialists, business development executives, big data engineers, big data analysts, project managers, and operations managers. For a detailed overview, please refer to Table 1, which presents the sample's descriptive data. Importantly, to maintain participant

confidentiality, no names or email addresses were collected, ensuring that responses remain completely anonymous and untraceable to any individual.

Table 1
Respondents Characteristics

AGE	**REQUENCY**	**PERCENTAGE**
18-24	24	14.0 %
25-34	28	16.3%
35-44	38	22.1%
45-54	34	19.8%
55-64	16	9.3%
65+	5	2.9%
Gender		
Male	61	35.5 %
Female	111	64.5 %
EDUCATIONAL QUALIFICATION		
High School Diploma	41	23.8 %
Associate Degree	17	9.9 %
Bachelor's Degree	41	23.8 %
Master's Degree	36	20.9 %
Doctoral Degree	13	7.9 %
65+	5	2.9 %
DESIGNATION		
Business Development Executive	26	15.1 %
IT specialist	17	9.9 %
Big Data Engineer	9	5.2 %
Big data analyst	14	8.1 %
Project manager	18	10.5 %
Operation manager	19	11.0 %
Other Project management Related	65	37.8 %
EXPERIENCE		
1-5	52	30.2 %
6-10	41	23.8%
11-15	17	9.9%
16.20	10	5.8%
21-25	4	2.3%
26 and over	19	11.0%
Total Respondents	145	100%

Study Survey

Primary data were collected anonymously on the SurveyMonkey platform, a well-known online platform panel (OPP), from a random sample of 145 BDA implementation team members, and respondents recruited from the United States. A survey link is created after signing an agreement with SurveyMonkey Platform that includes instructions on how to fill out the survey and there is no time limit to fill it. Participants were informed that their

participation in this study was completely voluntary and they had the right to refuse to participate and/or leave the study at any time without penalty.

Random sampling was used in collecting the data for this study; the sample consisted of leaders in companies who have participated in the BDA project implementation process within the past two years, who are based in the United States, working full-time in a leadership role, participating in one BDA project implementation in the past two years, and being direct supervisors/managers above the project management team (see Table 2, inclusion/exclusion criteria).

Questionnaire Development

Transformational Leadership Scale

To measure transformational leadership dimensions, this study adopted The Multi-Factor Leadership Questionnaire MLQ ((5X Short), a popular and well-validated scale developed and later improved by (Avolio & Bass, 2004). The MLQ (5X Short)-Transformational leadership scale - a 16-item questionnaire- four items to measure each transformational leadership dimension: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Avolio & Bass, 2004). The instrument demonstrates a commendably high Cronbach alpha coefficient of 0.949. This study utilized a five-point Likert-type scale, with scale responses spanning from 1 (not at all) to 5 (frequently, if not always).

Big Data Analytics Implementation Scale

The scale for measuring big data analytics (BDA) implementation was adopted from Joslin and Müller (2016). It consists of a 25-item questionnaire that assesses five dimensions of project implementation success: project efficiency (5 items), organizational benefit (5 items), project impact (5 items), future potential (5 items), and stakeholder satisfaction (5 items).

Responses to the items are rated on a five-point Likert scale, ranging from 5 (strongly agree) to 1 (strongly disagree). The lowest possible score on the BDA implementation scale is 25, while the highest is 125. A higher score indicates a greater level of success in BDA project implementation. The reported internal consistency, measured by Cronbach's Alpha, for this scale is 0.915.

Table 2
Sample Inclusion/Exclusion Criteria

No	Inclusion /Exclusion Criteria
1	The participant must be a leader with a direct line of authority (in the organizational structure) and responsible for implementing the BDA project (functionally).
2	Participants must be working in a company located in the United States.
3	Participants must be working full-time (a minimum of 40 hours weekly) in their leadership roles.
4	Participants must have participated in the BDA and implemented a project within the last two years.
5	Participants' tenure with the company is for at least two years (to understand the company outcomes).
6	Participants must be at least 21 but at most 65.
7	Participants must be willing to answer demographic questions related to age, gender, education, job title, and tenure.

Data Analysis

Pearson bivariate correlation, multiple linear regression, and hierarchical multiple regression were employed to assess the strength and direction of the relationship between the dimensions of transformational leadership and the successful implementation of big data analytics (BDA) projects. All statistical analyses were conducted using SPSS (Version 28). Additionally, the independent influence of transformational leadership was examined. The reliability and internal consistency of the scales used in this study were tested using Cronbach's Alpha coefficient. Any scales that did not meet the established reliability standards were discarded. Furthermore, the dataset was checked for missing variables and outliers.

Results

Data Cleaning

Improving and cleaning data is a necessary step that precedes data analysis. Alita et al. (2021) viewed data cleaning as improving data quality by detecting, modifying, replacing, or deleting duplicate, incomplete, incorrect, or irrelevant data. Cleaning data and preparing it for further analysis went through several steps. First, importing the cleaned and prepared data set into an Excel sheet before running statistical tests. Second, checking for and deleting duplicates. A visual test for duplicates was carried over. Four duplicate answers were identified through this inspection and were deleted. The third step was a visual inspection of the raw data for blank cells in every question that requires an answer. The fourth step comprised searching unusual points and detecting outliers. In steps three and four, zero cases were removed for incompleteness or unusual values. After ensuring the data set was cleaned from duplicates, incomplete, and missing values, it was exported to SPSS version 28 for additional analysis. All duplicate, incomplete, and ineligible cases were removed from the total cases (see Table 3).

Table 3
Cases of Removed Data

Reason for removal	*n*
Did not Agree to Informed Consent	22
Agreed to Informed Consent and Left	1
Duplicate Answers`	4
Total Participants Who Did Not Meet Study Screening Criteria	27

Study Model Overall Fit

Model overall fit is a measure of how well a statistical model represents and explains the observed data, typically assessed through various indices and tests to determine the model's accuracy, reliability, and predictive power. Multicollinearity in regression analysis occurs when independent variables are highly correlated, potentially affecting the interpretation of individual variable effects on the dependent variable. In this study's model that examines transformational leadership dimensions, the Variance Inflation Factor (VIF) and Tolerance values provided insights into the degree of multicollinearity. Idealized Influence shows moderate multicollinearity with a VIF of 3.589 and a Tolerance of 0.295, indicating some correlation with other predictors. Inspirational Motivation exhibits similar levels of multicollinearity (VIF 2.399, Tolerance 0.239), as does Intellectual Stimulation (VIF 2.354, Tolerance 0.279). Interestingly, Individualized Consideration demonstrates the lowest level of multicollinearity among these variables with a VIF of 1.159 and Tolerance of 0.866, suggesting its relative independence from other predictors (see Table 4). While these VIF values are below the critical threshold of 5, they indicate the presence of some correlation between variables, which may slightly inflate standard errors of the regression coefficient (Daoud, 2022; Kim, 2023). Despite this, the model's overall fit and predictive power can remain good, even though the individual contributions of variables with higher VIFs might be less clear due to shared variance (Hair et al., 2021; Vatcheva et al., 2022).

Table 4
Tolerance and Variance Inflation Factor Value

Variables	Tolerance	*VIF*
Idealized Influence	0.295	3.589
Inspirational Motivation	0.239	2.399
Intellectual Stimulation	0.279	2.354
Idealized Influence	0.866	1.159

Validity and Reliability

Study Validity

For the purposes of conducting this study and considering its predictive correlational design, two validated instruments were used to measure the accuracy of predictor variables of the dimensions of the transformational leadership style and the criterion variable of big data analytics implementation success. These two validated scales are used to measure the behaviors of leaders who are involved in implementing BDA projects in data-driven environments. Sürücü and Maslakci (2020) identified two types of validity: external validity (generalizing findings from one research study to other populations in similar contexts) and content validity (the level of representation of the expressions in the measuring instrument

in representing the phenomenon intended to be measured) (Bollen, 1989). The results of validity tests for each of these instruments are included in the following paragraphs.

Validity of Transformational Leadership Dimensions Scale

The transformational leadership dimensions component of the MLQ (5X-Short) has extensively been used in organizational studies, and its construct validity has been examined and explained with factor analyses (Avolio & Bass, 2004). Dimitrov and Darova (2016) reported a correlation between the subscales of transformational leadership styles with a value of $r \geq 0.5$. Ahmad et al. (2022) found that the questionnaire constructs fulfill the criteria for discriminant and convergent validity when the Average Variance Extracted (AVE) is 0.5 (50%) or higher. This is supported by the finding of (Huertas-Valdivia et al., 2019), who confirmed that the questionnaire fulfills the validity requirements since the AVE for the model construct is above 0.5. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are recommended to confirm construct validity (Fareed & Su, 2021). Therefore, the validity of the MLQ (5-X short-45) was proved in these studies.

The Validity of Project Success Questionnaire

The PSQ-25 was initially developed and validated by Khan et al. (2013). Joslin and Müller (2016) reported content validity for the PSQ-25, construct, and discriminant validity. Irfan and Hassan (2019) assessed the validity of PSQ-25 scales through the outer and inner layer measurement model and supported the scale's construct, content, and discriminant validity. They implemented the AVE to identify to what extent the responses in one item correlated with responses on other items for the same construct. They found that the PSQ is valid since the AVE fulfills the acceptance threshold 0.50. Therefore, the use of the PSQ-25 was supported by the strength of the validity showing average variance extracted (AVE of 0.5) in these studies.

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are recommended to confirm construct validity (Fareed & Su, 2021). The applied EFA was used to check the construct's validity, including the transformational leadership style dimensions of MLQ (5X-Short) and project success scales. EFA's results demonstrated that all the constructs have values above 1. Factor loading for all the respective constructs was greater than 0.5. It can be safely concluded that the scales used in this study have a highly variable convergent reliability based on these results. EFA's results state that all items support their respective constructs and are not cross-loading.

Yueh et al. (2010) conducted CFA to validate the dimensions of transformational style scales. The root mean square error indices of approximation (RMSEA), GFI, AGFI, and CFI for the transformational leadership construct were 0.093, 0.0733, 0.0649, and 0.662, respectively. The results of CFA found that all indicators were above 0.50 and related to their specified constructs; therefore, the scale was confirmed as an appropriate instrument (Yueh et al., 2010). Moreover, Yang et al. (2013) used CFA and EFA to validate a model that includes the dimensions of the transformational leadership style and project success. They found that the dimensions of the transformational leadership style and PSQ meet the recommended levels of validity. Several other researchers used the CFA and EFA to validate the dimensions of the transformational leadership style and PSQ scales and found that the measurement model showed a good fit as RMSEA = 0.050 or more (Fareed & Su, 2021; Kazmi et al., 2021;

Mohamad et al., 2015). Therefore, the dimensions of the transformational leadership style component of MLQ (5-X short) and PSQ, according to previous CFA and EFA results, confirm construct validity.

The Reliability

Reliability refers to the measuring instrument's stability and consistency over time. In other words, Reliability is the ability of measure instruments to give similar results when applied at different times (Sürücü & Maslakci, 2020). Reliability can be assessed through test-retest correlation, internal consistency, and across observers (Sürücü & Maslakci, 2020). Cronbach's alpha is calculated to conduct this study and assess the reliability of scales. For correlational cross-sectional research, internal consistency is predominantly used to assess Reliability. Sürücü and Maslakci (2020) indicated that Cronbach Alpha is the preferred measure to test internal consistency. A study that has high Reliability where the alpha coefficient has a value of 0.80 or higher is reliable (Sürücü & Maslakci, 2020).

The reliability of the dimensions of the transformational Leadership Questionnaire (MLQ-5X-short, 16) was tested in several studies. The internal consistency of the scale was high, with a Cronbach's alpha ranging from 0.94 for transformational leadership (Kanat-Maymon et al., 2020). Dastane (2020) reported a Cronbach's alpha for the overall instrument of leadership style at 0.86 for a sample of 211 employees of multinational corporations. The strength of the data's reliability in these studies was supported using the (MLQ-5X-short-45) in the current study.

The reliability of the Joslin and Müller Project Success Questionnaire (PSQ-25) was successfully tested in numerous studies. Liphadzi et al. (2015), in a study investigating project success criteria, indicated that a Cronbach Alpha of above 0.7 for the project success scale meets the minimum standard of acceptability for reliability. Khan et al. (2013) presented high internal consistency scores for the (PSQ-25) showing Cronbach alpha of 0.80 or more for the unitary scale. To ensure that the measures are reliable and give similar tests over time, Sürücü and Maslakci (2020) indicated that test-retest reliability, alternative forms, and internal consistency tests are taken to ensure the reliability of the study's results.

Before hypothesis testing, Cronbach's a coefficient was used to test the reliability of the scale used. As shown in Table 5, the Cronbach's a coefficients of leadership team members was as follows: idealized influence (0.755), inspirational motivation (0.801), intellectual stimulation (0.857), individualized consideration (0.75), and BDA project success (0.97). The reliability coefficients of all independent and dependent scale construct are greater than the acceptable threshold of 0.70 indicating that each scale has high internal consistency and good reliability and is valid and reliable to conduct research (Eisinga et al., 2013). All items in both scales were used in the research and no item was excluded or modified (see Table 5).

Table 5
Reliability and Validity

Variables	Cronbach's Alpha	# Of Items
Idealized influence (II)	0.75	4
Inspirational motivation (IM)	0.80	4
Intellectual stimulation (IS)	0.85	4
Individualized consideration (IC)	0.75	4
BDA Implementation project BDA PS	0.97	25

Multiple Regression Analysis

After controlling for each dimension of transformational leadership, a multiple regression analysis was conducted to predict team members' levels of successful project implementation based on the transformational leadership dimensions of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

The results indicated a significant regression equation ($F(1, 126) = 12.220$, $p < .001$), with an R^2 of 0.765 and an adjusted R^2 of 0.757. Inspirational motivation, intellectual stimulation, and individualized consideration were identified as significant predictors of successful BDA project implementation, with p-values of less than .001, less than .05, and less than .001, respectively. However, idealized influence was not found to be a significant predictor of successful BDA implementation.

Participants' predictions for successful BDA project implementation included an increase of +1.627 for inspirational motivation, +1.150 for intellectual stimulation, and +2.140 for individualized consideration. All transformational leadership dimensions (idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration) were coded on a scale from 5 (frequently, if not always) to 1 (not at all). This means that for each one-unit increase in inspirational motivation and intellectual stimulation, participants' successful BDA project implementation increased by 1.63 and 1.15, respectively. Additionally, for each one-unit increase in individualized consideration, successful BDA project implementation increased by 2.14 (see Table 7).

In summary, the regression analysis revealed that inspirational motivation, intellectual stimulation, and individualized consideration are strong predictors of successful BDA project implementation, while idealized influence alone does not serve as a significant predictor.

Table (7)
Results of Transformational Leadership Dimensions

Independent Variable	*B*	*Std. Error*	*Beta*	*t*	*Sig.*
Idealized Influence	.927	.510	.152	1.819	.071
Inspirational Motivation	1.627	.466	.287	3.496	<.001
Intellectual Stimulation	1.150	.421	.188	2.730	.007
Individualized Consideration	2.140	.519	.334	4.123	<.001

Test of Hypothesis

Hypothesis 1 posits that the idealized influence dimensions of transformational leadership significantly contribute to the successful implementation of big data analytics (BDA) projects. The results from the hierarchical regression analysis are presented in Table 8. In Step 1, the model includes only the control variables: inspirational motivation, intellectual stimulation, and individualized consideration. The R^2 value for the control variables is 0.758, indicating that they collectively account for 75.8% of the variance in the successful implementation of BDA projects. In Step 2, as shown in Table 9, the inclusion of idealized influence does not reveal a significant relationship with project success (β = 0.152, P = 0.071 > 0.005). Therefore, Hypothesis 1 is not supported.

Table 8

Regression Analysis of Idealized Influence as a Predictor of BDA Implementation Project Success, (step 1)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
Idealized Influence									
1	.871[a]	.758	.752	10.43834	.758	132.621	3	127	<.001
2	.874[b]	.764	.757	10.34480	.006	3.307	1	126	.071

Note: a. Predictors: (Constant), Individualized Consideration, Intellectual Stimulation, Inspirational Motivation

b. Predictors: (Constant), Idealized Influence, Intellectual Stimulation, Inspirational Motivation,

Dependent Variable: Project success

Table 9

Regression Analysis of Idealized Influence as a Predictor of BDA Implementation Project Success, (step 2)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	*Std. Error*	*Beta*	*t*	*Sig.*
1	(Constant)	7.921	4.278		1.852	.066
	Inspirational Motivation	1.996	.423	.352	4.721	<.001
	Intellectual Stimulation	1.317	.415	.215	3.174	.002
	Individual Consideration	2.454	.494	.383	4.968	<.001
2	(Constant)	7.159	4.260		1.680	.095
	Inspirational Motivation	1.627	.466	.287	3.496	<.001
	Intellectual Stimulation	1.150	.421	.188	2.730	.007
	Individualized Consideration	2.140	.519	.334	4.123	<.001
	Idealized Influence	.927	.510	.152	1.819	.071

Hypothesis 2 proposes that inspirational motivation is positively related to the successful implementation of BDA projects. The results in step 1 presented in (Table 10) indicate that the control variables had a significant effect on project success. The combined transformational leadership dimensions of intellectual stimulation, individualized consideration, and idealized influence contribute to 74.1% of the change in the successful implementation of BDA projects. Moreover, when inspirational motivation was added to the model in step 2, it uniquely contributed 2.3 % of the variance in project success. The results further show (Table 11) a strong, positive, and highly significant relationship between inspirational motivation and the successful implementation of BDA projects (β = 0.287, P < 0.005). Hypothesis 2 is therefore supported.

Table 10
Regression Analysis Inspirational Motivation as a Predictor of Bda Implementation Project Success, (step 1)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.861[a]	.741	.735	10.79210	.741	121.339	3	127	<.001
2	.874[b]	.764	.757	10.34480	.023	12.220	1	126	<.001

Note: a. Predictors: (Constant), Individualized Consideration, Intellectual Stimulation, Idealized Influence
b. Predictors: (Constant), Individualized Consideration, Intellectual Stimulation, Idealized Influence, Inspirational Motivation

Table 11
Regression Analysis Inspirational Motivation as a Predictor of Bda Implementation Project Success, (step 2)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	*Std. Error*	*Beta*	*t*	*Sig.*
1	(Constant)	7.183	4.444		1.616	.109
	Idealized Influence	1.704	.479	.279	3.558	<.001
	Intellectual Stimulation	1.426	.432	.233	3.304	.001
	Individualized Consideration	2.728	.512	.426	5.327	<.001
2	(Constant)	7.159	4.260		1.680	.095
	Idealized Influence	.927	.510	.152	1.819	.071
	Intellectual Stimulation	1.150	.421	.188	2.730	.007
	Individualized Consideration	2.140	.519	.334	4.123	<.001
	Inspirational Motivation	1.627	.466	.287	3.496	<.001

Hypothesis 3 states that intellectual stimulation is positively related to the successful implementation of BDA project. The results in step 1 of the regression analysis in Table 12 indicate that the control variables contribute to 74.4 % of the change in BDA implementation project success. Moreover, intellectual stimulation uniquely contributed 1.4% of the variance in project success upon its addition to the model in step 2 (Table 13). The results show a strong and highly significant relationship between intellectual stimulation and project success (β = 0.334, $P < 0.005$). Hypothesis 3 is therefore supported.

Table 12
Regression Analysis of Intellectual Stimulation as a Predictor of Bda Implementation Project Success, (step 1)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.866[a]	.750	.744	10.60433	.750	127.187	3	127	<.001
2	.874[b]	.764	.757	10.34480	.014	7.452	1	126	.007

Note: a. Predictors: (Constant), Individualized Consideration, Inspirational Motivation, Idealized Influence
b. Predictors: (Constant), Individualized Consideration, Inspirational Motivation, Idealized Influence, Intellectual Stimulation

Table 13
Regression Analysis of Intellectual Stimulation as a Predictor of BDA Implementation Project Success, (step 2)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	9.469	4.280		2.212	.029
	Idealized Influence	1.230	.510	.202	2.412	.017
	Inspirational Motivation	1.866	.469	.329	3.980	<.001
	Individualized Consideration	2.560	.508	.400	5.040	<.001
2	(Constant)	7.159	4.260		1.680	.095
	Idealized Influence	.927	.510	.152	1.819	.071
	Inspirational Motivation	1.627	.466	.287	3.496	<.001
	Individualized Consideration	2.140	.519	.334	4.123	<.001
	Intellectual Stimulation	1.150	.421	.188	2.730	.007

Hypothesis 4 states that individualized consideration is positively related to the successful implementation of BDA projects. The results in step 1 of the regression in (Table 14) indicate that the control variables contribute to 72.6 % of the change in project success.

Moreover, individualized consideration uniquely contributed 3.2% of the variance in project success upon its addition to the model in step 2 (Table 15). The results show a strong and highly significant relationship between individualized consideration and project success (β = 0.334, $P < 0.005$). Hypothesis 4 is therefore supported.

Table 14
Regression Analysis of Individualized Consideration as a Predictor of BDA Implementation Project Success, (step 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.856[a]	.732	.726	10.97697	.732	115.873	3	127	<.001	
2	.874[b]	.764	.757	10.34480	.032	16.996	1	126	<.001	2.150

Note: a. Predictors: (Constant), Idealized Influence, Intellectual Stimulation, Inspirational Motivation
b. Predictors: (Constant), Idealized Influence, Intellectual Stimulation, Inspirational Motivation, Individualized Consideration
Dependent Variable: Project success

Table 15
Regression Analysis of Individualized Consideration as a Predictor of BDA Implementation Project Success, (step 2).

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	12.337	4.320		2.856	.005
	Inspirational Motivation	2.250	.467	.397	4.815	<.001
	Idealized Influence	1.627	.510	.266	3.188	.002
	Intellectual Stimulation	1.666	.427	.272	3.902	<.001
2	(Constant)	7.159	4.260		1.680	.095
	Inspirational Motivation	1.627	.466	.287	3.496	<.001
	Idealized Influence	.927	.510	.152	1.819	.071
	Intellectual Stimulation	1.150	.421	.188	2.730	.007
	Individualized Consideration	2.140	.519	.334	4.123	<.001

Discussion

Previous studies have utilized various terms, including transformational leadership, transformational leadership factors, transformational leadership behaviors, and transformational leadership sub-dimensions, to describe leadership within organizations. However, these studies often generalize their findings, assuming that these terms can be used interchangeably. It is crucial to understand that each dimension of transformational leadership offers a distinct and valuable contribution to organizational outcomes, and they should not be regarded as a singular construct (Deinert et al., 2015). This study aims to reinforce and further explore this important distinction.

In addition to using a project success scale to assess the implementation of BDA projects, this paper used a multidimensional transformational scale; that measures each transformational dimension, not the whole transformational scale, to measure the contribution of each dimension when controlling for other dimensions and then examine its impact on the successful implementation of BDA projects. The findings of this study can contribute to the scant body of knowledge as pointed out by Avolio et al., 1999; Gandolfi & Stone, 2018; Jiang et al., 2017; Moors & Rogiest, 2019) who asserted that future research in the leadership field should consider how each of the four behavioral dimensions of transformational leadership contribute to change management in data-driven environments.

The findings of this study offer valuable contributions that warrant attention. First, by utilizing a scale that measures transformational dimensions instead of a unitary transformational scale, we provide evidence that different dimensions of transformational leadership make distinct contributions to leadership outcomes. Additionally, this research stands out as one of the few studies to successfully measure BDA project implementation success through Joslin and Muller's (2016) project success scale. While this scale is reliable and valid, it calls for further refinement to enhance its applicability for data-driven project implementations. The advantages presented by this study are compelling:1. The project success scale can be enhanced to better serve data-driven applications, leading to more accurate evaluations. 2. Transformational leadership should be viewed as a multi-dimensional construct, capturing its complexity rather than reducing it to a single unitary construct. 3. Researchers, companies, and organizations can measure individual constructs—such as individualized consideration, inspirational motivation, intellectual stimulation, and idealized influence—through targeted scales (four items each). This approach streamlines the evaluation process, minimizing the burden of lengthy questionnaires and ultimately yielding richer insights.

Second, the data analysis revealed that transformational leadership sub-dimensions are the center of attention of many interested researchers in the leadership field as the major factors contributing to the successful implementation of BDA projects and organizational outcomes (Budur & Demir, 2022; Deiner et al., 2015; Khasawneh, 2020). The findings suggest that one or more of the transformational leaderships might support intentional selection of a distinctive approach to address the workforce's diversified physical, intellectual, and emotional energy to achieve success (Gandolfi & Stone, 2018).

This study concluded that idealized influence does not significantly contribute to the successful implementation of Big Data Analytics (BDA) projects. This finding contradicts

several other studies, including those by Cavazotte et al. (2012), Farea (2021), and Parr et al. (2013), which identified a positive correlation between idealized influence and organizational outcomes such as commitment, project success, and overall performance.

Farea (2021) specifically examined the relationship between transformational leadership factors and the successful implementation of government projects, discovering that idealized influence improves progress and ultimately enhances project success in the public sector. Similarly, Cavazotte et al. (2012) found that idealized influence has an indirect relationship with leadership outcomes.

To explain the discrepancy between this study's findings and those of previous research, Khan et al. (2013) suggested that the criteria being investigated must be analyzed in the context in which they were developed. Unlike earlier studies, this research considered idealized influence within data-driven, non-conventional contexts, leading to a new conclusion that warrants further investigation.

This situation can be further understood through the lens of Bass and Riggio (2006), who highlighted the challenges of risk-taking and consistency. In data-driven environments, the implementation of BDA projects requires new and unforeseen skills and experiences. Consequently, there may be a diminished capacity to uphold high standards of ethical and moral conduct, which could negatively impact the likelihood of successfully completing these tasks.

Furthermore, the long-held belief that idealized influence and inspirational motivation are two aspects of the same charismatic component of transformational leadership is challenged by the findings of this study. Leaders who emphasize idealized influence exhibit two components: their actual behaviors and the behaviors attributed to them by others. Bass and Riggio (2006) defined actual leaders' behaviors as demonstrating distinctiveness, trustworthiness, respectfulness, and admirability whenever they engage in a work environment. In the context of implementing Big Data Analytics (BDA) projects, the risks of failure are significant, and the overwhelming volume of incoming data can make it difficult to act as a role model or to consistently show distinctiveness, trustworthiness, respectfulness, and admirability in a data-driven setting (Bass & Riggio, 2006). Consequently, followers' observations of leaders' recurring behaviors may not lead them to perceive these leaders as possessing extraordinary capabilities, persistence, or determination. This finding contrasts with the study by Ghadi et al. (2023), which suggested that followers emulate leaders' behaviors in innovative situations. This discrepancy can be attributed to the fact that the earlier study describes an indirect relationship between idealized influence and innovative performance, whereas this study identifies a direct relationship.

On the other hand, leaders who emphasize inspirational motivation can significantly impact both their followers and themselves. These leaders possess clear communication skills, the ability to uplift aspirations, and a talent for painting a vivid picture of the future, all of which positively influence organizational commitment and engagement, even in environments dominated by data (Anderson & Sun, 2017; Avotra et al., 2022; Djourova et al., 2022; Judge & Piccolo, 2004; Lan et al., 2019).

The contrast between the effects of idealized influence and inspirational motivation in the context of Big Data Analytics (BDA) implementation projects is particularly noteworthy. These two sub-dimensions are often viewed as closely related and have frequently been combined into a single measure of charismatic leadership (e.g., Bono & Judge, 2004; van Knippenberg & Sitkin, 2013). However, our findings suggest that this practice should be reevaluated, as the results of this study indicate that inspirational motivation has a positive and significant relationship with the success of BDA implementation, whereas idealized influence demonstrated the opposite effect. This indicates that the two sub-dimensions do not consistently produce the same or coherent outcomes.

Third, the analysis of the collected data reveals that the successful implementation of Big Data Analytics (BDA) projects by team members is influenced by both intellectual stimulation and individualized consideration. While other studies, such as Ghadi et al. (2023), support this finding, there are also mixed and contradictory results in the literature. Consequently, there is no consensus on the impact of any transformational dimension variables regarding the successful implementation of BDA projects, as seen in the works of Buckle (2020), Deinert et al. (2015), Mgqibi (2019), Nji (2021), and Zhao et al. (2021).

The current study argues that in data-driven business environments and the implementation of big data analytics (BDA) applications, three key leadership behaviors—individualized consideration, intellectual stimulation, and inspirational motivation—are interconnected. Together, they establish a level of success that makes the implementation of BDA projects feasible. However, when a new BDA project is introduced, it creates a unique situation for both leaders and followers. In this context, leaders may struggle to capture attention, and the effectiveness of idealized influence may diminish.

Finally, this study found that three dimensions of the transformational leadership are significant independent variable that contribute to the successful implementation of big data analytics (BDA) projects. When employees work under a manager who is genuinely invested in their development—who cares, motivates, inspires, and challenges them—success becomes more attainable, allowing the entire organization to move forward and achieve better results. Conversely, if employees are led by a manager who is less invested in enhancing their physical, emotional, and intellectual abilities, success becomes more challenging to achieve, and the benefits of big data may not be fully realized. These findings add to the existing literature on the role of leadership in organizations. For instance, Wallgren, Leijon, and Andersson (2011) examined the role of IT managers as motivators for their employees. Companies that recognize the value of investing in the diverse skills of their workforce and prioritize having managers with a strong transformational leadership style are better positioned to maximize their employees' potential and achieve higher levels of success related to big data. Additionally, this study supports the work of Schmidt and Dierendonck (2022), who highlighted the importance of developing leaders skilled in big data analytics through a leadership competency framework. This insight can assist companies in designing targeted training programs and determining which managers should be involved in their BDA implementation projects.

Theoretical and Practical Implications

The present study contributes to the project leadership literature by integrating transformational leadership theory and project success model. The results of the study show that three of the transformational leadership style dimensions (i.e., individualized consideration, inspirational motivation, and intellectual stimulation) respectively contribute to the successful implementation of BDA. This advances current understanding of which transformational leadership dimensions contribute more to project success in data-driven environments.

As expected, three of the transformational leadership dimensions, individualized consideration, inspirational motivation, and intellectual stimulation, were statistically significant in explaining the successful implementation of BDA project, only idealized influence was not significant in this regard. This research helps to uncover which leadership behaviors has the highest contribution to the successful implementation of BDA project, by using hierarchical regression to identify the individual contribution of each dimension to the dependent variable. Individualized consideration and the attention of the leader to the specific and personal details of individual team members significantly contribute to positive project outcomes.

This implies that the positive effect of individualized consideration on the successful implementation of BDA projects will reach higher levels of contribution when the leaders identifies strengths, abilities, and views employees as effective partners in the process of achieving organizational goals that lead to improving the task at hand.

Moreover, the findings indicate that leaders use of optimistic narratives about the future, enthusiastic tone about needs, clearly express a compelling future vision, and being confident all accrue more success and lead to improving task at hand. In addition, intellectual stimulation behaviors such as questioning taken for granted assumptions and re-examining whether they are right or not, solving problems in a completely new way, encouraging team members to look at problems from different perspectives, open the door for new suggestion to complete the assignment will lead to higher levels of project success. The results of this study are not exhaustive, there are still other behaviors at work that can contribute to the successful implementation of BDA project in the industry 4.0 era. Future studies could investigate these behaviors including, exchange of rewards. This finding suggests that team members exhibiting individualized consideration transformational leadership dimensions can achieve higher levels of success because they are more likely to respond effectively to the data-driven business environment by spending more time addressing individual strength points, their needs, and expectations. They will also work very closely with team members to lower the level of anxiety or to solve problems that individual followers face in the data-driven environment. Individualized consideration leaders will work hand in hand with their followers and provide the emotional, technical, and intellectual help needed. This study also adds to project success model by using a rarely used comprehensive and internally reliable measure for project success based on the works by khan et al. (2013), and Joslin and Muller. (2016). This scale added to and improved more conventional scales that depended heavily on the measure time, cost, and effectiveness.

Several practical implications can be drawn from the finding that transformational leadership dimensions have variable contribution to the successful implementation of BDA projects. It is also implied that the five-dimensional project success scale can provide a more holistic view about the different aspects of project implementation and achieving organizational goals. One implication highlights the importance of giving more attention to individualized consideration behaviors as this behavior has the highest influence on organizational project success and BDA implementation. Gumusburun (2022) highlighted individualized consideration as the importance of adopted leadership that lead to increasing entrepreneurship and thus enhance organizational performance. This implies that there is a higher probability for projects to be successful when leaders adopt individualized consideration and encourage the behaviors associated with. Another practical implication is that providing individualized consideration, inspirational motivation, and intellectual stimulation transformational leadership training to team member responsible for implementing BDA project in a data driven environment (Farea, 2021). This finding is consistent with previous research on the positive relation between individualized consideration and organizational outcomes such as entrepreneurship (Farea, 2021).

Limitations and Future Research Directions

This study has several limitations representing weaknesses within the study that influenced the research's design, outcomes, and conclusions (Ross & Zaidi, 2019). The following anticipated limitations, instances beyond the researcher's control, were identified for this study:

First, using a quantitative method deprived respondents of the opportunity to elaborate on their answers to the survey questions, such as the how and why behind their answers (McCusker & Gunaydin, 2015). Future studies may include more comprehensive qualitative measures to support the results obtained through quantitative methodology.

Second, this study used a cross-sectional correlational research design. This design limits inferences about causal direction. As this study was not experimental, the researcher could only identify that there was a relationship between variables (Schenker & Rumrill, 2004). The impact of one variable on the other or causality was beyond the capacity of this design. One recommendation is to carry out an experimental study be conducted on the causal relationship between transformational leadership dimensions and the successful implementation OF BDA projects

Third, survey or response bias was another limitation of this study. Response bias was viewed considering the influence of circumstances or issues on participants' responses (Lavrakas, 2008). This may lead to invalid or unreliable data responses (Lavrakas, 2008). To mitigate the influence of response bias, validated, reliable instruments were used to collect data and analyzed rigorously using suitable methods, an advantage of quantitative studies (Choy, 2014). The conclusion of these procedures and tests is that common method variance is unlikely to bias the results. Considering the previous limitations of this study there is an implication that findings can likely be generalized beyond the current study population.

Since this is the first study that investigated the individual contribution of transformational leadership dimensions and the successful implementation of BDA projects

and found that individualized consideration, inspirational motivation, and intellectual stimulation significantly influence project, the researcher strongly encourage researchers to further validate and extend this model. In addition, it is important to investigate other leadership dimensions including exchange of rewards with the successful implementation of BDA projects.

Conclusions

Adding to the knowledge of the potential contribution of the dimensions of the transformational leadership style to the successful implementation of BDA projects is of great importance to organizations operating in a data-driven environment. This study demonstrated that within the context of industry 4.0 business environment, individualized consideration has the highest impact on the successful implementation of BDA projects followed by inspirational motivation, and intellectual stimulation respectively. However, the study found insignificant relationship between idealized influence and the successful implementation of BDA projects.

Therefore, organizations operating in data-driven environments need to promote leaders with higher levels of individualized consideration among BDA project team-members, e.g., through recruitment and leadership development and training programs, as indicated by previous empirical studies (Farea, 2021; Kabore et al., 2021; Nubuor et al., 2014). The increased attention to more effective transformational leadership dimensions such as idealized influence and inspirational motivation will create a more sustainable and conducive context for succeeding in implementing BDA projects. It the researcher intention to inspire future research on the relationship between individualized consideration and the BDA implementation projects in the industry 4.0 environment.

Disclosure Statement

The authors declare that there is no conflict of interest.

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