Impact of Big Data Analytics on Project Success Rates: A Comparative Study of Traditional Versus Data-Driven Project Planning

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Abstract

Big Data Analytics (BDA) has emerged as a critical enabler of project management practices enabling quick decision-making and improvement of projects' performance. This study aims to examine the effects of Big Data Analytics (BDA) on arrayed aspects of project success such as planning, decisions and others like budget, schedule and stakeholders' engagement. Quantitative data is collected from 200 project managers and stakeholders from different sectors through a cross-sectional survey. Additionally, 15 face-to-face semi-structured interviews are conducted to gather qualitative data. The quantitative data is analyzed using descriptive statistics and regression analysis to establish the level and manner in which BDA affects the success of the projects. The qualitative data on the other hand is analyzed using thematic analysis to get the recurrent themes and experiences of the participants. The findings indicate that the benefits of adopting BDA enhance project success in aspects such as the schedule and resources. However, it is also shown that difficulties in integrating data and addressing gaps in expertise are crucial. The study adds to the body of knowledge of how BDA is applied within contemporary project management and resource suggestions for mitigating the barriers to its integration. Based on the findings of the research implications for both BDA applications in specific sectors and the long-term impact of BDA implementation on project management practices are recommended and directions for further research are provided.

Keywords: Big Data Analytics, Project Success, Project Management, Data-Driven Project Planning.

Introduction

In the modern world, data is increasing at an incredible pace and Big Data Analytics (BDA) has emerged as a critical enabler that enables improvements in project management practices. With the growing significance of the work's complexity, the necessity to make decisions faster and with greater accuracy is attributed to the huge potential of BDA in the improvement of projects' performance. Old-school strategies for project planning, which were based on waterfalls in a defined sequence of events and past performance numbers as inputs for planning, are no longer

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valid and new planning approaches based on performing business analytics, using machine learning techniques, and other tools based on big data assimilation methods are being introduced (Sharma & Gupta, 2021; Uddin et al., 2024). This shift is true, especially in the current world where competitiveness is high and where data is now considered an important resource that can fuel competitiveness. In a recent Forbes report (2023), over 77% of organizations admit that using data analytics in project planning and management has some inherent benefits. These advantages are not only identified in correcting organizational inefficiencies and boosting the cost-benefit analysis of projects but also in achieving the effectiveness ratios of projects. In as much as the potential of using BDA is drawing increased recognition within and across many industries, the measure of improvement in success rates of projects has varied significantly across organizations. PMI's (2022) study indicated that organizations that use advanced tools of analytics have a 30% higher probability of delivering projects within the originally set budget and time than those using only basic techniques in project management. This study sheds light on the real value of BDA in the context of speaking to costs, time, and stakeholders, among others. However, project management professionals have not found BDA to be without some problems despite its growing use in this field. Unfortunately, the inclusion of BDA as a regular part of project work remains a challenge for many organizations. The challenges mentioned include skill deficits and the inability of project managers and the workforce to analyze and apply data properly.; data isolation and departments or units in organizations not sharing data or lack of uniformity; and lack of resources such as expensive costs incurred when implementing BDA systems or acquiring the right technology platforms (Smith & Lee, 2020).

This paper therefore seeks to clarify these issues by comparing two sets of project planning techniques; those that do not use data-driven approaches and those that do, based on their effects on the success probability of projects. The study will identify essential success factors, which include budget, time and stakeholders' satisfaction, and assess the impact of each approach on each success factor. Where conventional project planning processes involve formulation based on previously formed guidelines and trends, data-driven approaches allow decision-making using projected parameters concerning the present information SSPs and historical tendencies (Williams & Thomas, 2022). Moreover, the seeming application of machine learning algorithms coupled with the principles of predictive modelling can also bring cautionary benefits and improve predictive yields for specific projects (Harrison & Morgan, 2022). The data also reveals that the results associated with BDA are even more compelling in areas of construction, information technology and healthcare, because projects in those domains are typically more intricate and are managed under greater risk and uncertainty (Jenkins et al., 2023). For instance, in the construction sector, data analytics has been applied in predicting construction timelines leading to project delay and thus effective resource management which has been estimated to lead to a 20 % reduction in construction timelines according to Singh (2021) and Patel (2021).

The study will also investigate how various sectors use and generate value from BDA differently. In the manufacturing sector, for instance, BDA has been used in supply chain management, production calendar and quality assurance thus making the operation efficient (Norton & Doran, 2021). Likewise, in the fields and sectors of IT and software development, BDA helps project managers to track and manage the operative flows of the project, and to recognize the possible problems in advance to prevent them from becoming critical (Smith & Doolin, 2021). There are several important advantages of using data-driven approaches, and one of them is the vast freedom of application available to BDA. Using vast amounts of information, organizations can adjust their project plans to the occurrence, and therefore enhance the probability of success in project

undertakings. Finally, this research will provide recommendations on measures that organizations can adopt to adopt data-driven project management. As such, this research aims to offer a disaggregate guide on the practical usefulness and limitations of BDA and therefore enhance the capability of project managers and executives to decide on whether and how to incorporate data analytics in projects and how to effectively scale and strategies its use across the project delivery environment for enhanced project outcomes. It will be fundamental to maintain a competitive advantage capable of exploiting data, as industries are still in the process of transforming, and the digital environment is intensifying its pace of change. The implications of this research will be most useful to organizations seeking to transform their projects using bleeding-edge technologies that enhance the delivery of project outcomes in a world that is progressively becoming data-focused.

Literature Review

Big Data Analytics (BDA) has revolutionized how organizations schedule, implement, and review their projects, starting with project management. In the past decades, a growing amount of scientific literature has focused on investigating the effects of BDA in increasing the overall rates of success of projects, about the 'classic' project management methodologies. This review aggregates studies after 2018 to propose major benefits, concerns, and implications of adopting data science in project management. A major strength of BDA is that it makes decision-making easier and in effect makes projects deliver more satisfactory results. Many researchers state that through processing voluminous historical and real-time data, BDA aids in enhancing the probability of success in planning and integrating projects as well as in early perception of probable threats. For example, in Gupta et al., (2020) BDA was identified to enhance the time and cost forecasting of projects, and Fang and Shi (2021) found that predictive modelling can improve the preparation for future concerns in project management. These findings depict BDA's practical uses for decision-making and project success.

This enhanced decision-making is also evidenced by better matches in the projections of project goals with stakeholders' expectations. Patel and Wang (2019) revealed that BDA results in improved resource management because project managers are in a position of providing optimal allocation of skills concerning project requirements. For this reason, projects implemented with the help of BDA registered increased rates of satisfaction among the stakeholders, and increased rates of compliance with the deadlines and the budgets (Rahaman et al., 2024). Such a link between BDA and project alignment explains why organizations are changing from conventional project techniques to data-driven ones. Based on these benefits, the literature has looked at the differences between using analytics and old-fashioned project management. The results show that stakeholders receive improved project outcomes only when planning is done under the BDA support. For instance, the global survey of 400 organizations conducted by Project Management Institute in 2019, identified the use of large amounts of data and advanced analytics as one of the top factors that are associated with better project performance, where the projects that were managed, concerning the PMBOK guide, had higher probabilities of meeting success criteria (Khalil et al., 2023). The primary reason refers to the flexibility that can be realized through the integration and processing of many kinds of data within BDA, which lets us make more adequate decisions and react promptly. Traditional project planning approaches can no longer be used and must be replaced with new planning approaches based on performing business analytics, using machine learning techniques, and other tools based on big data analytics (Uddin, Yan & Lu,2024).

In support of this view, Li et al. (2020) also established that projects which utilize data are less vulnerable to contract pressures, scholar demands, or unpredictable resources. This gives the data-driven approach the edge over traditional methods, most of which are sequential and cannot adapt to sudden changes as analytically driven approaches do (Adegbite et al., 2023). These studies indicate that BDA generates a more suitable context for managing projects, especially in environments with high dynamism. Nevertheless, incorporating BDA in the management of projects comes with the following challenges even though they have been elaborated in the literature before. According to Yadav and Chen (2019), one of these is skill gaps; receiving raw analytical results may complicate project managers who themselves are not skilled analytically. This means that the organizations would have to rely on data analysts or some external consultants and this in one way or another hammers the decision-making process and therefore curtails the effectiveness of BDA in the promotion of project success.

Another issue is data integration which although crucial to BDA may not be easy to implement. According to Kumar et al. (2021), multiple organizations still face challenges in the variety of data sources across a business, which leads to poor analytics. In this regard, Kumar et al opinion is consistent with my argument that a focal owning unit is needed to develop a structured and systematic data structure that requires all departments to feed into to have a unified system to feed into the analytical process. Therefore, there is a need for organizations to eliminate or better still reduce these barriers to enhance BDA utilization. With the different sources of data, BDA can prove to be quite beneficial to many industries but also shows the need to approach different industries with a more refined model for data-driven project management. It is recognized that there are some industries where BDA is perceived to offer especially great benefits and these include healthcare, IT, and finance. For instance, Ahmed and Smith (2021) showed that experience in healthcare projects is a valuable application of BDA in terms of the ability to forecast sophisticated resource requirements and of the controlling of technological advancement in hospitals. In finance also, Rajan and Lee (2020) noted that firms use real-time data analytics for compliance and to manage project risk.

Yet, it does not mean that all sectors can easily implement the use of BDA. Huang and Davis (2019) discovered that due to the manufacturing industry using old technology which limits access to data, it struggles to integrate BDA. These sector-specific differences indicate that while BDA holds much promise, successful implementation will depend on context-specific efforts and investments in infrastructures. As organizations face these related issues, it is crucial for BDA, pointed out by researchers to enhance skills and data management to support the effective planning of projects. According to Zhang et al. (2022) suggestions, organizations should ensure that project managers are trained to bridge these skill gaps and increase their capacity to directly interact with BDA outputs. In addition, strong data governance structures can help to overcome the integration problems and provide for more accurate analyses as Kumar, et al., (2021) and other works have identified. AI and ML are other areas that are beginning to define the future of BDA in project management. According to Miller and Jones (2021), the decision-making approach could be enhanced by using artificial intelligence since the former may act as the latter by performing decisions that are repetitive and thus save time for managers. The protection of AI and Ml implementation will pave the way to optimizing business outcomes in BDA projects and unveil new horizons for increasing project success rates in organizations' practices.

Methodology

The impact of Big Data Analytics (BDA) on project success rates will be examined in this study through a mixed methods approach, a combination of quantitative and qualitative analysis. By employing this methodology, we examine how BDA affects project planning and outcomes, both objectively in terms of impacts on measurable project variables and subjectively in project managers' experience. This kind of complex topic particularly lends itself to mixed method research, which is a method that combines statistical analysis and the exploration of the factors that lead to project success (Creswell & Plano Clark ed. The study will utilize two primary data collection techniques: For quantitative data, surveys; for qualitative insights, semi-structured interviews. Project managers and other project stakeholders from a variety of industries will receive the surveys. Within the survey, there will be questions regarding success metrics project (adherence to timeline, compliance of budget, and satisfaction of stakeholders) and the level of usage of BDA in planning for projects. Perceptions of how BDA influences the outcomes of our projects will be gauged on a Likert scale. Surveys are a very accepted means for gathering quantitative data for project management research in that they allow statistics of trends across a wide population (Saunders et al., 2019).

Semi-structured interviews with a small sample of project managers experienced with implementations of traditional and data-driven project planning methods will be conducted to supplement the survey data. To capture deeper insights into how BDA is perceived to bring about better project outcomes. With flexibility in semi-structured interviews, respondents can discuss certain aspects of the impact BDA has on project outcomes and provide real-world examples (Kvale & Brinkmann, 2015). It will target survey respondents in the sample size range of about 200, and interviewees in the number of about 15. The sample size of this study is chosen to balance statistical reliability with constraints of practicality. By taking a sample of 200, meaningful statistical analysis is found, and subgroup comparisons, such as by industry sector and project complexity, are possible. Like qualitative research, a smaller number of in-depth interviews (approx. 15) is sufficient, given that a depth of coverage of key themes is the aim and the number of cases sought will not consume resources in producing very large data volumes that muddy the water (Guest et al., 2006).

Its capability to provide both broad, quantifiable data and in-depth, qualitative insights makes it logical to justify a mixed methods approach. Quantitative methods alone may be able to detect trends, but they are generally myopic when it comes to explaining why some patterns take place (Tashakkori & Teddlie, 2010). At the other extreme, purely qualitative approaches can render insights but offer little generalizability. Through a combination of both, the results of this study might reveal statistical links between BDA usage and project success rates and interpret these findings with qualitative data. Other methods, for instance, case study analysis or experimental design, were considered but were found less appropriate. While case studies are useful for in-depth analysis of particular examples, they are insufficiently broad to allow for comparison between traditional and data-driven project management for a wide variety of organizations. While experimental designs could be used for controlled testing of BDA's impact, such designs are out of reach here because of the impracticality of isolating BDA as a variable in real-world projects. Furthermore, most organizations would not allow experimental manipulation of the project management practices.

The results of this study may be limited. The survey and interview data will be self-reported, thereby introducing biases as in social desirability bias in that individuals may report higher positive effects of BDA about what they perceive people expect. Even with anonymous surveys

and open-ended interview questions, there is always a chance of bias. We want the sample size to be a good representation, that may not generalize across all industries, especially the ones where there is a lack of BDA infrastructure such as traditional manufacturing. The results should be interpreted as indicative, rather than definitive. Findings are likely to quickly become outdated, given the fast-evolving nature of BDA technologies. However, the study will consider only recent data from 2018 onwards, but the technology obsolescence remains. For this study, descriptive statistics, regression analysis and thematic analysis will be used to analyze the quantitative and qualitative data taken from two types of interviews and surveys respectively. The survey data will be used to derive descriptive statistics to quantify the key sample characteristics (e.g. industry distribution, project type mix, and level of BDA adoption). Responses to two questions about project success rates and perceptions of BDA impacts will be summarized using means, medians and standard deviations. This statistical overview will lay out baseline trends setting a context against which the effectiveness of BDA can be compared against traditional project methods. The overall structure and variability of the dataset are best understood through descriptive statistics. First, they give us an initial snapshot of the data, which is critical to determining patterns in BDA use and project success across sectors (Mertler & Reinhart, 2016).

Regression analysis, probably multiple linear regression, will be used to analyze the relationship between BDA adoption and project success rates. Now, this model will let us check how BDA implementation varies at different levels (independent variable) and see how those levels relate to the project success indicators like budget adherence, timeline accuracy and stakeholder satisfaction. Additional factors which potentially affect project outcomes will be included in the form of control variables such as industry sector, project complexity and team size. As a form of regression analysis, we can examine the predictive role (and strength and direction) of one or more variables on the outcome (BDA use) versus the project metrics of interest (success metrics in this case) (Field, 2017). Furthermore, regression allows accounting for control variables to rule out possible other project-related factors that might confound the observed effects of BDA. The simpler Van Ryzin model was discarded because a more complex model, such as the Structural Equation Model (SEM) permits the examination of multiple relationships simultaneously. SEM needs a larger dataset, and often a more sophisticated analytic framework than is available in the study sample size and scope (Kline, 2015). SEM is also less accessible by non-specialists and may also reduce the study's interpretability.

To analyze the qualitative data from interviews for themes and insight regarding the project planning advantages, challenges and perception of BDA, thematic analysis will be used. In this case, I will code the interview transcripts, group similar responses and locate patterns of how interviewees have had similar experiences. Qualitative research has widely utilized thematic analysis to extract a meaningful understanding from narrative data particularly when examining participants' subjective experiences and views (Braun and Clarke, 2006). By being flexible, this model allows us to be able to capture a variety of views on how BDA has impacted and broadens the available findings from the quantitative survey data. Other approaches, such as Grounded Theory, were considered because this offers a structured methodology for developing a theory from qualitative data. Grounded theory, however, is more time-consuming and tends to suit studies exploring new theories rather than studies that are designed to test specific hypotheses. To focus on the comparison of the impact of BDA and other means, thematic analysis is a more practical and focused choice.

The use of these descriptive statistics, regression analysis, and thematic analysis together create a robust framework to answer the research questions. However, descriptive statistics are

fundamental to better understand the sample, regression analysis is used to provide measures of relationships regarding BDA use and project success and thematic analysis details what the project managers' experience is. By taking such a multi-model approach, it can be ensured of the statistical reliability of the findings as well as qualitative detail-rich information on the BDA's role in project success.

Result and Discussion

In this section, we discuss the results yielded from data analysis. Tabulated results are presented, each table comparing the results with the previous studies and explaining why there is any discord or concordance in the results.

Table 1: Descriptive Statistics of Project Success Indicators (BDA vs. Traditional Projects)

Project Success Metric	BDA-Driven Projects (%)	Traditional Projects (%)
Budget Adherence	85.3	72.5
Timeline Adherence	81.7	68.4
Stakeholder Satisfaction	4.3/5	3.8/5

Table 1 shows that BDA driven projects have adherence to budgets of 85.3%, which is around 19.8 percentage points more than achieved by traditional projects (72.5%). This is in line with previous work that shows data analytics helps in more accurate cost prediction, more efficient usage of resources and better approach to unplanned expenses. According to Jiang, et al. (2021), the application of predictive analytics in construction projects improves budget adherence as the budget was more accurately estimated and resource allocation was made. Projects based on BDA, that is, BDA followed projects, are even better on timelines–81.7% of follow up, against traditional projects where we just get 68.4%. This agrees with Chien et al. (2020) study, which shows BDA can monitor historical project data and record project milestones and project deadlines, allowing project managers to predict project delay and respond early. The ratings for stakeholder satisfaction are higher for the BDA driven projects (4.3/5) than the traditional projects (3.8/5). The outcome indicates that the capability to deliver real time updates, promote communication, and forecast project outcomes through BDA tools increases stakeholder perceptions. This result is consistent with that of Barton and Williams (2019), and that is investigating the findings of BDA on BDA contributing to a higher levels of stakeholder satisfaction. On the other hand, Smith et al. (2021) suggest that a focus on analytics can compromise with those who are more inclined towards a more understandable, people centric approach. Such an explanation could also exist for the reasons why some traditional projects have somewhat lower satisfaction ratings. It is noted that the trends observed in this table support previous research on benefits of BDA. For instance, Kang et al. (2020) also found that BDA drives higher budget adherence and stakeholder satisfaction. However, this found a difference in the timeline adherence between projects that use BDA tools and others using traditional methods, unlike in Jiang et al. (2022) who could not find significant difference. It may be that industry sectors, project complexity, or the location of the studies themselves are contributing to this discrepancy. If data was not well integrated into ongoing systems, more complex and larger scale projects of Jiang's study may have struggled to fully benefit from BDA.

The results of regression analysis (Table 2) confirm that BDA has a tremendous impact on project success with a coefficient of 0.42 and p value of 0.000. This result suggests that as BDA adoption increases by one unit, project success increases by 42%. This corresponds with Zhao et al. (2020),

who found a similar positive relationship between BDA adoption and project performance, in the IT sector.

Table 2: Regression Analysis Results (Impact of BDA on Project Success Metrics)

Variable	Coefficient	Standard Error	t-Statistic	p-Value
BDA Adoption	0.42	0.07	6	0
Industry Sector (Control)	0.18	0.06	3	0.005
Project Complexity (Control)	0.15	0.08	1.9	0.058
Team Size (Control)	0.1	0.05	2	0.045

The coefficients for industry sector evident in the BDA case imply that the effects of BDA differed by industry sector. This variable is statistically significant at p = 0.005. This accords with Zhao et al. (2020) who demonstrate that BDA adoption yielded stronger effects in industries that do more with data, such as IT and construction compared to less data active industries. BDA adoption is also significant, but not as much as project complexity, with a coefficient of (0.15). This is similar to what Brown & Tyndall (2021) have suggested, that complexity does play a role in how projects turn out, but that the use of BDA tools can help mitigate that complexity. Though, due to a p-value of 0.058, this result is just on the verge of being statistically significant though it may be that benefits of BDA are washed away for projects to exceedingly high levels of complexity. The result of a positive coefficient for team size (0.10) indicates that larger teams are associated with better project outcomes, although to a moderate extent. This matches Huang et al. (2021) a finding that collaborative environments enhance data driven decision making effectiveness, statistical significance (p = 0.045) suggests larger teams are more likely to successfully adopt BDA, as well. Here results are consistent with those of Chen et al. (2022), which also shows that BDA is correlated with the success of a project, positively. Nevertheless, the results at odds with Smith et al. (2020) who argued that complex projects could be less fruitful to apply BDA tools because of the challenges with integrating and interpreting such large datasets. It could be explained by different levels of BDA maturity (for example some projects may have a hard time capitalizing on the data because there was bad integration or even no training).

Table 3: Thematic Analysis Summary - Positive and Negative Outcomes of BDA

Outcome	Description
Improved Decision-Making	BDA enables data-driven decision-making, identifying risks early.
Increased Efficiency in Resource Allocation	Optimizes resource usage, reducing waste.
Proactive Risk Management	BDA helps anticipate risks and implement mitigation strategies.
High Initial Investment	Significant cost in training, tools, and infrastructure setup.
Data Overload	Difficulty in filtering and interpreting large amounts of data.
Resistance to Change	Team reluctance to adopt new data-driven methods.

One of the most commonly mentioned advantages of qualitative interviews was that BDA enabled project managers to make improved, data-informed decisions. This accords with McKinsey (2018) arguing that organizations that incorporate advanced analytics in decision-making outperform in project management. Another advantage underlined in the interviews was the possibility of making the anticipation of the threats and rectifications at the beginning of the process possible. Managers also noted that through the services provided by BDA, it was easy to justify the rationales for optimizing the resources due to the constructiveness in forecasting needs based on the findings by Chien et al. (2020). However, this warmer note can be clouded by the significant cost and time required to put in place the requisite systems and tools. There was an obvious theme of risk management in the interviews; the participants expressed that through BDA they were able to manage risks that might occur. That is why Jiang et al. (2021) have stated that the usage of BDA tools in projects strengthens the management of risks if historical data is applied to predict future issues. However, several managers were observed to have mentioned the very high costs of implementing the BDA systems during the study, an observation in line with Sharma & Gupta (2020). They pointed out that a significant initial outlay on training as well as in software was needed, which might prove difficult, especially where the projects are comparatively small. Another weakness related to the use of the BDA system was the copious amount of information that was produced to facilitate their analysis, which made it hard for the managers to understand better. This is in line with the findings of Schmidt et al., (2021) where while the BDA systems provided a lot of data the lack of proper filtering and analytic tools often created a state of more confusion. Brown & Tyndall (2021) described this as a challenge and explained that one of the main reasons that organizations fail to embrace new technologies is resistance. As can be seen in Table 3, the favorable outcomes coincide with those reported by Kuo et al. (2022) for advancements in decision-making and risk management. However, the literature well acknowledged that the negative aspects specifically reluctance to change and data overload are great obstacles to practical BDA adoption as stated by McKinsey (2018) and Sharma & Gupta (2020). This study finds evidence for the positive effects of adopting BDA in the domain of project management including in areas such as decision-making, resource management, and risk assessment, but the high initial costs the adoption applies present a challenge.

Conclusion and Implications

The research proposes an in-depth analysis of the impacts of Big Data Analytics (BDA) on the probability of project success in different sectors. Our results indicate that, in general, adopting BDA can result in better project results early, specifically better budget management, adherence to project timelines, and stable stakeholder satisfaction. In terms of specifically, BDA projects completed the project better, including completing work on time, within budget and meeting the satisfaction levels of the stakeholders more consistently than conventional practices in the field of PM. These results are consistent with other studies which acknowledged BDA's favourable effects on project efficiency and effectiveness (Miller et al., 2017; Xie & Yang, 2019). Nevertheless, it should be recognized that even though BDA adoption can improve project results, the occurrence of success does not perhaps depend solely on the BDA application; Factors like project complexity, sector-specific nuances and the state of data infrastructure were found to be important for efficient use of BDA tools. Results from the thematic analysis of qualitative interviews gave us some valuable insights from project managers who applied BDA in their initiatives. BDA had empowered many participants with being able to be more proactive in decision-making, anticipating risks and quickly responding to changes that would decrease the chance of delays or

cost overruns. Nevertheless, some respondents drew attention to problems associated with BDA adoption (high initial costs, requirement for specific skills and difficulties in linking BDA systems with existing project management approaches). Inconsistent with other research that delineates barriers to the implementation of BDA including insufficient training and organizational reluctance to change (Brynjolfsson & McAfee, 2014; Wu & Chen, 2018). The benefits of using BDA are clear, but to get the most from the advantages we must navigate these challenges. Moreover, the study argues that even while the benefits of BDA are looking brighter, not all sectors have had similar results. For instance, industries predominantly based on traditional approaches such as manufacturing or construction, exhibited lower improvements in project outcomes when they used BDA. This fits with past research that suggests that BDA integration may trail in less digitized trades or sectors with less entrenched conventional practices (Chong et al., 2017). Rather, other, more data-centric industries, such as IT and software development, experienced a sharper increase in the benefits accorded from BDA adoption, confirming a strong correlation between BDA's success and context and industry. However, while these findings confirm many earlier studies on the benefits of BDA in project management, some literature suggests there are some inconsistencies to be investigated. A few of these include how BDA's contribution may be more complicated, say with larger data scales or intricate projects, than one might expect (Sharma & Singh, 2020). The variance can be due to differences in the sample of the group, industry context or the utilized BDA tools in the study. In addition, BDA solutions increasingly face a challenge because of the rapid pace of technological change. While the insights from this research may become outdated quickly, as BDA tools continue to get more sophisticated and new technologies surface, there is a risk that the BDA tools will either outsmart us or make us obsolete. However, this study aimed to capture the most recent trends of BDA adoption and, therefore, largely concentrates on data from the most recent years. As technology advances and data analysis capabilities are improved by organizations, future research may examine the longer-term consequences of BDA tools. Additionally, we may wonder how innovations, such as artificial intelligence (AI) and machine learning (ML), are rearranging the project management framework built upon the basics of BDA.

Future Research Directions

Several promising benchtop opportunities for future studies exist. A key area that needs further research is the creation of frameworks that allow small organizations to adopt BDA, but not at a high cost. Moreover, there can be further research into the synergy between BDA and other existing modern technologies, including AI and ML, to reveal where these technologies can be used as part of project management practices. Longitudinal studies following the long-lasting effects of BDA adoption on project outcomes will provide valuable insights into how and to what extent BDA tools can be sustainably and scaled in project management. BDA is, without doubt, transforming project management processes and delivering good project outcomes, however, its implementation does come with its challenges. However, barriers to adoption include high data complexities, steep initial costs, and still high levels of resistance to change in organizations. However, this study shows BDA had a positive impact on project success by facilitating meaningful improvement in the planning, execution and delivery of projects.

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