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**Impact of Project Governance on
Sustainable Project Performance in
Pakistan's Agriculture Sector**

by

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A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

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“This work is dedicated to my wife.”



CERTIFICATE OF APPROVAL

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With profound gratitude,

Abstract

This study is aimed to investigate the influence of project governance on sustainable project performance within Pakistan's agricultural sector, primarily focused on Green Pakistan Initiative project. The study examined the mediating role of big data analysis-artificial intelligence on the relationship between project governance and sustainable project performance. The research also investigated the moderating role of project management office among project governance and sustainable project performance also project governance and big data analysis-artificial intelligence. A quantitative research technique, using a structured questionnaire was adopted to gather data from employees working on agriculture related projects under the ambit of Green Pakistan Initiative. Partial Least Square - Structure Equation Modeling technique was used and analysis were performed on Smart PLS-4 software. The results revealed that project governance has a significant and positive impact on sustainable project performance. Furthermore, the study also proved that big data analysis-artificial intelligence is a positive and significant mediator between project governance and sustainable project performance. The project management office has a positive and significant moderating impact on the relationship between project governance and sustainable project performance. However, the moderating impact of project management office on the relationship between project governance and big data analysis-artificial intelligence remained positive and insignificant. Findings of this study will contribute meaningfully to the evolving body of knowledge on sustainable project management, particularly within the context of public sector agriculture projects in Pakistan. On the practical side, this study provides a proposal and sets up a benchmark for implementing effective project governance mechanisms and technological prowess for Green Pakistan Initiative project to become more sustainable.

Keywords: Project Governance, Big Data Analysis-Artificial Intelligence, Project Management Office, Sustainable Project Performance, Green Pakistan Initiative

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Abbreviations

AI	Artificial Intelligence
BDA & AI	Big Data Analysis & Artificial Intelligence
GCI	Green Corporate Initiative
GPI	Green Pakistan Initiative
PG	Project Governance
PP	Project Performance
SDGs	Sustainable Development Goals
SPP	Sustainable Project Performance

Chapter 1

Introduction

The introduction part of the research thesis comprises of background, gap analysis, problem statement, research questions, objectives, hypotheses statements, significance, and theoretical foundations.

1.1 Background

Building upon the guiding principle of ‘People, Planet, Prosperity, Process, and Products’ (Carboni et al., 2024), sustainable project management has emerged as an important global priority. In order to ensure the persistence of life on Earth, it is imperative that sustainability initiatives be launched to address the project’s social, environmental, and economic impacts (Carboni et al., 2024). In Pakistan, one such example of the recent drive towards sustainability initiatives is the Green Pakistan Initiative (GPI) project; a major public sector agricultural development project. As per Green Pakistan Initiative - Growing a Sustainable Future (2024), Pakistan’s agriculture sector is vital for meeting the growing needs of the rising population, while also ensuring environmental, social and economic sustainability (Saleem et al., 2024). Despite these efforts, many impediments including climate change, public sector governance mechanism, and availability of limited resources for agriculture have prompted the research for adopting to new project management approaches along with the use of cutting-edge technology (Raihan, 2024). The increasing focus on incorporating sustainability into project goals has rendered the intersection of

governance mechanism, latest technology, and institutional processes more vital ([Adanma and Ogunbiyi, 2024](#)), which is also apparent for success of GPI project.

The interplay of project governance, big data analytics-artificial intelligence, and project management offices is garnering academic and practical interest as a triadic approach to enhance sustainable project performance ([Obana, 2024](#)). Therefore, [Carboni et al. \(2024\)](#) emphasize that effective implementation of sustainability in projects requires a comprehensive strategy that integrates the five guiding principles across the project lifespan. In Pakistan's agricultural sector, the integration of these components will provide a systematic approach to address the issues such as inadequate governance mechanism, technology void, and inconsistent execution, particularly in the context of complex, large-scale public sector initiatives like the GPI project. This aspect will also require coordination in execution while supporting decision-making, eventually contributing to achievement of sustainable development goals (SDGs) in agriculture ([Atapattu et al., 2024](#)). As illustrated by [GPI \(2024\)](#), the primary goal of GPI project is to increase the agricultural production in Pakistan while ensuring food security by adopting environment friendly farming methods that also preserve the environment, solve environment related problems, and eventually contribute to long term sustainability. Since Pakistan's agriculture sector demonstrates a significant role in steering the economy towards right direction as well as improving people's living, launching of sustainable initiatives are critical for long-term development and productivity ([Sheikh et al., 2024](#)). However, to achieve these objectives, the agricultural sector in Pakistan is required to adopt new technology, latest governance mechanism, and innovative project management methods ([Zafarullah and Azmat, 2024](#)).

[Fu et al. \(2024\)](#) describes that the project governance (PG) is essential because it provides a conducive environment and creates set of rules to be followed for undertaking important choices that would affect the entire project. [Ammar \(2024\)](#) argues that traditional governance mechanisms may not be enough to address the increasing complexity of projects due to sustainability requirements. Therefore, to improve upon the decision-making and achieve sustainable project performance, it is necessary to integrate advanced data-driven input and structured project management frameworks through all phases involving the life cycle of any project

(Langseth, 2024). Augmented with the ability to optimize resource utilization, enhance production, and improve decision-making processes, big data analysis-artificial intelligence can optimally transform the agriculture in Pakistan (Tan et al., 2024). With the proliferation of data sources, such as those pertaining to land information and management, crop yield enhancement, weather pattern studies, water management, and soil health, big data analysis-artificial intelligence offers insights that facilitate swift and precise decision-making, which in turn leads to long-term success of the project (Belhadi et al., 2024).

Being a mediator, big data analysis-artificial intelligence can not only optimize resource allocation but will also provide predictive insight, both of which may improve the impact of governance structures on sustainable project performance (SPP) (Akter et al., 2024). Within the framework of the GPI project, big data analysis-artificial intelligence nexus has the ability to maximize agricultural output in Pakistan, which would ultimately add to the overall deliverables of GPI project.

Similarly, the project management office's (PMO) function may also play a significant role in moderating the effect of both project governance and big data analysis-artificial intelligence on sustainability outcomes. As per research by Muhammad et al. (2024), project management office serves as a central point for the management of project and direct & support organizations to achieve project goals through the promotion of effective and efficient project execution.

Varajão et al. (2024) delineates that project management offices do more than just to offer standardized procedures and processes; they also monitor compliance and make sure that governance frameworks are effectively implemented over the whole project lifetime. In the context of GPI project and Pakistan's agricultural sector, project management office can provide a hand in connecting project governance to sustainable project performance and project governance to big data analysis-artificial intelligence, especially in cases where sustainability outcome is of utmost importance. Due to this, a strong project management office may strengthen the impact of governance mechanisms on sustainable project performance by incorporating big data analysis-artificial intelligence into GPI sponsored agricultural projects.

1.2 Gap Analysis

Despite growing focus on sustainability outcomes for Pakistan's agricultural sector in general and GPI related agriculture project in specific, a significant knowledge gap still exists regarding the effect of project governance on sustainable project performance in public sector agriculture projects in Pakistan. Although, existing literature provides / highlights the ample role of governance structures and mechanism in steering the projects in line with intended objectives and also the role of big data analysis-artificial intelligence for decision-making and resource optimization (Didas et al., 2024). Even then, the explicit mechanisms through which big data analysis-artificial intelligence mediates the project governance and sustainable project performance relationship in Pakistan's agriculture sector remains understudied (Talpur et al., 2024). It is also unclear how the project management office moderates the effect of governance on sustainable performance in agricultural projects and the relationship between project governance and sustainable project performance and also big data analysis-artificial intelligence and sustainable project performance, despite the fact that project management offices are essential for controlling project management and bolstering governance structures (Muhammad et al., 2024). This research gap is most prevalent in Pakistan's agriculture sector, where GPI related agriculture project lacks the formal governance mechanisms necessary to achieve long-term sustainability and success (Waheed et al., 2024). Since, filling up these knowledge gaps will help better understand how project governance, big data analysis-artificial intelligence, and project management office work together to achieve long-term success in agriculture projects with sustainability objectives. Henceforth, this research will contribute to existing body of knowledge on sustainable project management to educate those in charge of agriculture sector in Pakistan and others interested about the sustainable outcomes to make the project more sustainable and successful.

1.3 Problem Statement

Notwithstanding a commendable increase of 6.5% in year 2023-24, the agricultural sector in Pakistan is still facing environmental, socioeconomic, and food security

issues, which necessitate adopting to more sustainable initiatives and practices (Saleem et al., 2024). Due to its infancy, the GPI project requires the integration of strong project governance, big data analysis-artificial intelligence, and project management office nexus in order to harmonize sustainability goals, reduce resource waste, and improve project outcomes.

Public sector initiatives in Pakistan, particularly those involving agriculture, mostly rely on outdated systems, governance mechanism, and project management approaches, that don't embrace the modern insights and technology required for long-term success and sustainability (Fatima, 2024).

Despite its potential to optimize agricultural processes and decision making for sustainable results, little research has been conducted on the big data analysis-artificial intelligence's mediating function within governance frameworks and sustainable outcomes in Pakistan's agriculture sector (Allahham et al., 2023). Moreover, more empirical research is required for determining the moderating effect of the project management office on governance, sustainable project outcome and technological insights that attempt to improve sustainable performance in agriculture, especially within the framework of the agriculture projects.

This knowledge gap also restricts a thorough comprehension of how the interconnections among project governance, big data analysis-artificial intelligence, and project management office jointly impact sustainable project performance in GPI project. Lacking optimum understanding of these processes complicates the identification of synergies, possible outcomes, and opportunities for improvement within the existing systems (Akanfe et al., 2024). Addressing this gap is also essential for establishing a comprehensive framework that coincides with the goals of the Green Pakistan Initiative (GPI) and for optimizing the functions of project governance, big data analysis-artificial intelligence, and project management office to attain sustainable results. An explicit framework may enhance the incorporation of technology, refine governance mechanisms, and guarantee synchronized efforts across all stakeholders (Xiao et al., 2024). This will improve decision-making processes, facilitate effective resource allocation, and augment the resilience and sustainability of Pakistan's agricultural sector including GPI project.

1.4 Research Questions

Following are this study's research questions:-

- Q1** Does project governance and big data analysis - artificial intelligence have impact on sustainable project performance?
- Q2** Does big data analysis - artificial intelligence mediate between project governance and sustainable project performance?
- Q3** Does project management office moderate between project governance & sustainable project performance and also between big data analysis - artificial intelligence and sustainable project performance?

1.5 Research Objectives

Following are the research's objectives:-

1. To examine the relationship between project governance, big data analysis - artificial intelligence, and sustainable project performance.
2. To investigate the mediating role of big data analysis - artificial intelligence between project governance and sustainable project performance.
3. To investigate the moderating role of project management office on relationship of project governance and sustainable project performance and also between project governance and big data analysis - artificial intelligence.

1.6 Hypotheses

- H1:** Project governance is positively associated with sustainable project performance.
- H2:** Project governance is positively associated with big data analysis - artificial intelligence.

- H3:** Big data analysis - artificial intelligence is positively associated with sustainable project performance.
- H4:** Big data analysis - artificial intelligence positively mediates the relationship between Project governance and sustainable project performance.
- H5:** Project management office moderates the relationship between project governance and sustainable project performance. (Such as project management office is high the impact of project governance and project management office will be high on sustainable project performance).
- H6:** Project management office moderates the relationship between project governance and big data analysis - artificial intelligence. (Such as project management office is high the impact of project governance and project management office will be high on big data analysis - artificial intelligence).

1.7 Research Significance

This research is significant as it highlights the current insufficiencies in the governance of sustainable agriculture initiative in public sector initiatives in Pakistan. The focus is on analyzing the synergistic effect of project governance, big data analysis-artificial intelligence, and the project management office on sustainable outcomes for agricultural project in Pakistan like GPI project. The research will also investigate the unique mediating function of big data analysis-artificial intelligence in enhancing the influence of project governance on sustainable project performance, aligning with the worldwide trend of data-driven insights and decision-making in agriculture projects. Big data analytics-artificial intelligence in agriculture related projects may markedly enhance resource allocation, yield forecasting, and climate risk management, therefore directly supporting sustainability objectives (Rane and Paramesha, 2024). Nevertheless, there is still a gap of empirical research about the efficacy of big data analytics-artificial intelligence in aligning governance structures with sustainable results, particularly in Pakistan's agriculture sector. This research will address this gap by investigating the mediating role of big data analytics-artificial intelligence, by offering practical insights for GPI project to investigate the impact of data-driven governance for sustainable outcomes.

Additionally, the study will also examine the moderating effect of the project management office, which is crucial for implementing governance frameworks and technological advancement and assuring their adherence throughout the project life cycle. The project management office is essential to safeguard accountability and regularization, especially in projects with intricate sustainability indicators (Alshabragi et al., 2024). Empirical information about the optimization of governance benefits by project management office in sustainable agriculture projects in Pakistan remains limited (Ahtesham, 2024). Therefore, the study will investigate the efficacy of the project management office in facilitating sustainable governance frameworks within the scope of the GPI project. This research will further reinforce Pakistan's dedication to sustainability-focused initiatives by presenting a methodology that amalgamates governance, data-driven insights, and standardized project management methods to optimize the environmental and social outcomes of agricultural projects. This study's results will enhance academic literature on sustainable project management and provide practical insights for the implementation of adaptive governance approaches in response to changing sustainability problems.

1.8 Theoretical Foundation

Keeping in view all variables independently, the research can be conducted based on any of the five theoretical frameworks: stakeholders' theory, resource-based theory, institutional theory, contingency theory, and systems theory. However, to analyze the particular linkages among all key variables; project governance, big data analysis-artificial intelligence, and the project management office in attaining sustainable agricultural outcomes in GPI projects, the research has been undertaken based on institutional theory, since it addresses the cumulative effect and influence of all key variables within a particular setting. Institutional theory developed by John Meyer, Paul DiMaggio, and Walter Powell in 1970 offers a thorough comprehension of the relationships of project governance, big data analysis-artificial intelligence, and the project management office within sustainable agriculture projects. This also provides a theoretical framework for analyzing how organizations assimilate practices and technology in reaction to

institutional constraints, norms, and expectations, which may influence their structure, performance, and results (Pattanaik et al., 2024). Institutional theory also argues that organizations are influenced by coercive, mimetic, and normative factors that affect their governance procedures and approaches (Adewuyi et al., 2024; Wukich et al., 2024).

Within the realm of project governance, institutional constraints may arise from the governance culture of the public sector, legal frameworks, and organizational norms that compel organizations to implement certain governance structures and frameworks (Fu et al., 2024). The objective of this research is sustainable project performance, which is impacted by project governance, big data analysis-artificial intelligence, and project management office. Institutional theory postulates that organizations match their aims and performance measurements to fulfil sustainability expectations (León-Bravo and Caniato, 2024). Big data analysis-artificial intelligence is crucial in improving decision-making and performance assessment, therefore bridging the connection between project governance and sustainable project performance. Institutional theory also elucidates how organizations adopt technology to retain competitive advantage and fulfil external requirements for data-driven sustainable practices (Chaudhuri et al., 2024). The project management office may moderate the impact of project governance on sustainable project performance and big data analysis-artificial intelligence on sustainable project performance by providing structure, resources, and monitoring, therefore facilitating the alignment of project activities with institutional sustainability requirements.

1.9 Definitions of Variables

Definitions and explanation of all key variables are illustrated below:-

1.9.1 Independent Variable: Project Governance

Project governance is the set of rules, framework, mechanisms and procedures that enable decision-making, accountability, and stakeholder coordination in project management, hence affecting project results (Brunet and Choinière, 2024). Effective

project governance guarantees congruence with organizational goals, optimizes resource allocation, and mitigates hazards (Kalleparambil et al.).

1.9.2 Dependent Variable: Sustainable Project Performance

Carboni et al. (2024) define sustainable project performance as the degree to which projects fulfil environmental, social, and economic goals while mitigating adverse effects and fostering long-term sustainability. This multifaceted concept includes environmental performance, social responsibility, and economic sustainability.

1.9.3 Mediating Variable: Big Data Analysis - Artificial Intelligence

According to Tan et al. (2024), big data analysis-artificial intelligence integrates advanced analytics and artificial intelligence technologies to support decision-making in project management. Big data analysis-artificial intelligence enhances project efficiency, effectiveness, and sustainability by providing predictive insights, real-time monitoring, and optimization capabilities.

1.9.4 Moderating Variable: Project Management Office

As per Woolcott (2024), project management office serves as a centralized unit that standardizes project management practices, ensures governance compliance, and fosters accountability. project management office moderates the relationship between project governance and sustainable project performance by providing strategic guidance, oversight, and support.

Chapter 2

Literature Review

2.1 Theoretical Framework

This study has been conducted based on theoretical foundation of intuitional theory, which highlights the impact of social, cultural, and regulatory influences on organizational behavior (Ahmad et al., 2024). Since, projects follow certain scope and procedures not only because they are useful, but also for requirement of legitimacy, through which these are suitable to fit in with society and adhere to established organizational standards (Hess, 2025). In the context of the research, interplay of all constructs including project governance, sustainable project performance, big data analytics-artificial intelligence, and project management offices, within a particular organizational setting can be better understood and explained by incorporating the institutional theory. Theoretically, institutions respond to demands for legitimacy from outside sources by instituting governance structures (Lee et al., 2024). Compulsory pressures (such as government regulations and requirements), normative pressures (such as industry practices and professional standards), and mimetic pressures (such as emulating successful governance models from other agricultural projects) may shape the project governance mechanisms (Yuning et al., 2024). Since governance mechanisms are bound to assure conformity with institutional standards, which improves project credibility and long-term sustainability (Twaissi et al., 2025).

One possible explanation for big data analysis-artificial intelligence function, occurs when organizations embrace comparable developments in order to retain their

legitimacy and is especially true in the realm of technology. Mimetic forces (the adoption of artificial intelligence solutions from global agriculture projects) and normative pressures (trends in smart agriculture pushed by experts) are both at work in the integration of big data analysis-artificial intelligence into agricultural project. The project management office function also lies in line with the emphasis on structural legitimacy in institutional theory, which refers to structured components that ensure adherence to institutional norms (Dahmani et al.). Project management offices can serve as institutional carriers, integrating technology and governance into day-to-day operations to improve sustainability results (Carboni et al., 2024). The study's emphasis on sustainable project performance in GPI project is a result of both voluntary (government regulations for environmentally friendly farming) and mandatory (global sustainability objectives like sustainable development goals). The favorable effect of project governance and big data analysis-artificial intelligence on sustainable project performance shows how public sector organizations may strengthen their legitimacy via the use of institutionalized techniques that lead to performance results that meet stakeholder requirements.

2.2 Project Governance and Sustainable Project Performance

Wang et al. (2024) highlights that the existing literature on project governance is distinctly divided into two streams: one perceiving project governance as an external procedure to any project, and the other defining project governance as an internal activity within the project. Over the period of time, project governance has become a crucial element of project management by integrating the structure and mechanisms that steer and regulate projects throughout the project life cycle (Adetoba, 2024). Research by Brunet and Choinière (2025) has proposed many governance models to alleviate project complexities, highlighting the need of openness and effective decision-making. As per Haghghi and Takian (2024), sustainable governance approaches include economic (profit), social (people), and environmental (planet) factors into project results, assuring coherence with broader society objectives. Consequently, good governance

models include decision-making processes, accountability standards, and supervision methods to limit risks and guarantee successful project results (Bhatt et al., 2024). Similarly, project performance encompasses both conventional criteria (cost, deadlines, and quality) and unconventional indicators (social effect, sustainability, and environmental responsibility) (Nwaogbe et al., 2025). Critical factors for these measures are efficient planning, enhanced stakeholder management, optimized resource allocation, and strategic risk management (Bakhtiari et al., 2024). Study by (Emeka-Okoli et al., 2024) indicates that robust governance frameworks improve project results by fostering accountability, stakeholder involvement, and resource distribution. Governance frameworks enhance performance by providing supervision, flexibility, and the integration of sustainability (Efunniyi et al., 2024).

Research conducted by Orieno et al. (2024) has placed a greater emphasis on the dynamic interaction between governance frameworks and long-term project sustainability, expanding upon earlier views of project governance and its incorporation with sustainable results. Sustainable project results are more likely to be achieved with adaptive governance frameworks that can respond to changing stakeholder requirements and environmental concerns (Adebayo, 2025). To support the triple bottom line approach; social equality, economic viability, and environmental stewardship, these frameworks emphasize continuous learning, iterative decision-making, and stakeholder inclusion (Priya, 2024). In addition, sustainability indicators should be included into performance evaluation systems in order to connect governance processes with long term sustainability objectives (Marrucci et al., 2024). Agyekum et al. (2025) adds to the existing body highlighting the importance of organizational culture, leadership commitment, and institutional maturity as determinants of governance's ability to promote sustainable success (Zahari et al., 2024). Therefore, project governance is changing from a role focused on compliance to one that facilitates strategic initiatives, fostering innovation, and creating long-term value (Moghaddasi et al., 2025). Sustainable project performance is the result of integrative, adaptable, and context-specific governance methods (Njue and Kariuki, 2024).

In this regard, institutional theory provides a useful framework for comprehending

the development and relevance of project governance with sustainable outcomes (Rane and Paramesha, 2024). This places equal emphasis on internal organizational structures that impact decision-making and governance practices as it does on external institutional pressures like societal norms and regulatory requirements in project governance (Li et al., 2025). As mentioned by Li et al. (2025), project governance has evolved into an integral part of project management due to its incorporation of formal procedures and frameworks that guarantee adherence to regulations and satisfaction of stakeholders.

Governance models' emphasis on openness, responsibility, and good decision-making is in line with institutional theory's emphasis on how organizations adapt to rules and standards to become legitimate and operate better. Organizations are under increasing institutional pressure to satisfy environmental, social, and economic expectations, which is reflected in the inclusion of sustainability issues and larger societal goals (Tetteh et al., 2024). Governance frameworks, according to institutional theory, boost project performance in terms of sustainability and social impact as well as more conventional metrics like cost and quality (Feng et al., 2024).

H1: Project governance is positively associated with sustainable project performance.

2.3 Project Governance and Big Data Analysis-Artificial Intelligence

Ahmed (2024) illustrates that the big data analysis-artificial intelligence has notably altered the decision-making processes in diverse and sustainability-oriented projects, such as agriculture. big data analysis-artificial intelligence extensive structured and unstructured data to facilitate predictive insights, enhance processes, and improve outcomes (Chen and Asif, 2024). This integration of diverse data sources, including satellite imagery, weather forecasts, soil health metrics, and market data, has significantly transformed agriculture (Fuentes-Peñailillo et al., 2024). This integration improves stakeholders' capacity to make informed decisions regarding crop selection, pest management, and yield optimization (Jaber et al.,

2022). The integration of various data sources in agricultural project management enhances planning and resource allocation while aligning agricultural practices with sustainability goals (Büyüközkan and Uztürk, 2024). Big data analysis-artificial intelligence facilitates precision agriculture methods that optimize resource use, decrease environmental impact, and enhance output efficiency. This is especially pertinent regarding global challenges like climate change, water scarcity, and the necessity for sustainable food production systems (Oluwaseyi and Stilinski, 2024). Recent research highlights the critical importance of big data analysis-artificial intelligence in tackling intricate agricultural issues through the provision of actionable insights. The insights encompass multiple dimensions, such as forecasting weather patterns to reduce the effects of climate variability, evaluating soil health to identify suitable interventions, and examining market dynamics for improved pricing strategies and supply chain efficiency.

Padmavathi et al. (2024) emphasize the application of machine learning algorithms and geospatial analysis in developing predictive models that assist farmers and policymakers in optimizing resource use and managing risks. Decisions are made easier with a more complete picture of the project when big data analysis-artificial intelligence is integrated into project governance frameworks. Desgourdes and Ram (2024) has found that project managers may now make choices that align with sustainability objectives. Improving project governance frameworks by data analysis allows for quicker reactions to new problems (Ajiga et al., 2024). Regardless of these functions, Ali (2024) note that the public sector of Pakistan is one of the only places where big data analysis-artificial intelligence has not been sufficiently investigated as a tool for governance in sustainable agriculture initiatives. Big data analysis-artificial intelligence may help improve project governance by looking forward to possible problems and finding ways to fix them; this can make project performance more resilient and long-lasting (Duman-Altan et al., 2024). As an added bonus, big data analysis-artificial intelligence facilitates sustainable practice advancement and conformity with regulatory criteria. To make the most of big data analysis-artificial intelligence, experts in the field should work together to create systems that integrate it into governance and decision-making processes. When it comes to agricultural projects in particular, institutional theory provides

a framework to for building the understanding to incorporate big data analytics - artificial intelligence into project governance.

Consistent with institutional theory's emphasis on the impact of internal and external structures on organizational behavior and decision-making, [Tchasseem \(2024\)](#) asserts that big data analysis and artificial intelligence transform decision-making by utilizing various data sources to provide predictive insights and improve outcomes. Organizations are under institutional pressure to adopt practices that fulfill social and environmental standards. One way to address this is by integrating big data analytics - artificial intelligence in agricultural governance. This helps with better planning, resource allocation, and sustainability alignment. As discussed by [Dugbartey \(2025\)](#), organizations respond to external challenges like climate change and resource scarcity through the use of predictive models. This supports the notion from institutional theory that organizations must adapt to both formal regulations and informal societal norms. [Chen and Asif \(2024\)](#) found that big data analytics - artificial intelligence may improve project governance frameworks and make project management more responsive and sustainable. This shows how institutional forces impact organizational behaviors, which is important for long-term resilience and regulatory compliance. The idea of organizational adaptability to both internal and external pressures is consistent with big data analytics - artificial intelligence's function in project governance, which is to promote informed decision-making ([Bushuyev et al., 2024](#)).

***H2:** Project governance is positively associated with big data analysis - artificial intelligence.*

2.4 Big Data Analysis-Artificial Intelligence and Sustainable Project Performance

[Siddiqui et al. \(2024\)](#) demonstrates that big data analysis-artificial intelligence improves project results by illuminating ways to better allocate resources and anticipate their outcomes. Similarly, [Adewuyi et al. \(2024\)](#) illustrates that big data analysis-artificial intelligence is crucial in the agricultural related projects for reducing waste and optimizing resource allocation because of the large impact of social,

economic, and environmental aspects on project results. This feature allows project managers to accomplish their productivity targets while simultaneously lowering their environmental effect, which leads to a more sustainable end result (Adewuyi et al., 2024). In addition to helping project managers integrate their operations with larger environmental goals, big data analysis-artificial intelligence is helpful in monitoring and analyzing sustainability measures including water consumption, biodiversity preservation, and carbon emissions (Fayssal, 2024). Whereas, Aljehani et al. (2024) mentions that organizations are using big data analysis-artificial intelligence for sustainable outcomes to increase the success rate of attaining project goals. For agricultural projects that prioritize long-term environmental health, effective big data analysis-artificial intelligence implementation is essential for making decisions that line with sustainability aims (Adewuyi et al., 2024).

New opportunities for studying innovations, improvements in governance frameworks, and the advantages of data-driven decision-making for sustainability-focused agricultural initiatives are opening up as big data analysis-artificial intelligence methodologies and technologies develop. Therefore, study by Ram and Desgourdes (2024) has shown that big data analysis-artificial intelligence and sustainable project performance are inter-related. As per Jariwala(2024), big data analysis-artificial intelligence may improve sustainable project performance by providing useful information for managing climate risk, predicting yields, and optimizing the use of resources. With the right use of big data analysis-artificial intelligence agricultural operations can keep better tabs on sustainability measures, which improves the outcomes. Using big data analysis-artificial intelligence to back sustainability activities is also associated with better target attainment for organizations (Sohu et al., 2025). By illuminating the ways in which both internal practices and external constraints from institutions impact decision-making, institutional theory offers a valuable perspective for examining the use of big data analysis and artificial intelligence in project governance within the agricultural sector. The ability of big data analysis and artificial intelligence to improve resource allocation and forecast outcomes aligns with institutional theory's focus on how organizations adapt to formal regulations and implicit social norms, as

proposed by Siddiqui et al. (2024). Institutional constraints on firms to conform their behaviors to societal and environmental standards are mirrored in big data analysis-artificial intelligence's contribution to sustainability objectives, as pointed out by (Riaz and Ali, 2025).

Nexus to above, while using big data analysis-artificial intelligence, organization may better meet institutional standards for social responsibility and environmental stewardship by maximizing resource use, decreasing waste, and tracking sustainability indicators such as water usage and environmental hazards (Chen and Khan, 2024b). Moreover, as highlighted by Ibrahim (2024), businesses may link project aims with larger societal objectives via the incorporation of big data analysis-artificial intelligence into governance frameworks. This ensures that choices are in line with institutionalized expectations for sustainability. Tamym and Benyoucef also highlight that big data analysis-artificial intelligence improves agricultural project organizations' flexibility, which helps them fulfill social demands and regulatory requirements while delivering long-term, sustainable results. Conclusively, organizational behaviors are influenced by both internal governance structures and external institutional pressures; big data analysis-artificial intelligence is an example of an institutional reaction to the increasing need for sustainable agriculture practices (Shah Alam et al., 2024).

H3: Big data analysis - artificial intelligence is positively associated with sustainable project performance.

2.5 Big Data Analysis-Artificial Intelligence as Mediator

Singh and Dhingra (2024) highlights that the big data analysis-artificial intelligence may revolutionize governance systems, especially for programs focused on sustainability, such as agriculture. Aligning governance procedures with sustainability targets is made easier with big data analysis-artificial intelligence's real-time, data-driven insights (Ram and Desgourdes, 2024). Big data analysis-artificial intelligence ensures informed decision-making by bridging governance processes

with data-driven insights (Shukla and Agnihotri, 2024). This feature is very beneficial in the agricultural sector, since sustainable project performance is influenced by dynamic elements. Sustainability is promoted and adaptability to changing situations is enhanced by the integration of big data analysis-artificial intelligence into governance frameworks (Carboni et al., 2024). However, additional empirical research is needed to understand the processes that connect big data analysis-artificial intelligence to project governance and sustainable project performance. There is also a paucity of research on how big data analysis-artificial intelligence makes governance processes work for specific sustainability goals including reducing environmental hazards, protecting biodiversity, and making better use of water resources (Tamym and Benyoucef).

Incorporating big data analysis-artificial intelligence into governance models while taking constraints and ethical considerations into account is necessary to address these difficulties (Sabharwal, 2025). Further investigation is necessary to properly understand the role of big data analysis and artificial intelligence as a mediator between project governance and sustainable project performance.

As highlighted by Chen et al. (2024), big data analysis-artificial intelligence increases the effect of governance frameworks on sustainable outcomes via providing data-driven insights. In the case of sustainable outcome for agriculture, the exact ways in which big data analysis-artificial intelligence mediates linkages between governance and sustainable performance remain unclear.

Big data analysis-artificial intelligence integration into governance systems may also be better understood via the lens of institutional theory. This is particularly true in sustainability-focused industries like agriculture. Bringing decision-making processes in line with sustainability objectives is one way big data analysis-artificial intelligence might transform governance (Rashid et al., 2025). This would be in line with institutional theory's focus on how organizations adhere to established standards and expectations. In order to better react to changing factors that impact sustainability, such as climate change and resource shortages, businesses may benefit from big data analysis-artificial intelligence's real-time, data-driven insights, which make governance frameworks more adaptable (Rane and Choudhary,

2024). Nevertheless, it is still not fully understood how big data analysis-artificial intelligence mediates the relationship between governance frameworks and project performance. This lack of clarity highlights a research gap that could shed light on how institutions change and adapt to new technologies.

From the institutional theory perspective, big data analysis-artificial intelligence may be seen as a technical facilitator that aids in the institutionalization of sustainability standards and governance structures (Rane and Paramesha, 2024). Institutional theory asserts that organizations frequently adopt methods and technologies not alone for efficiency, but also to achieve legitimacy by adhering to societal expectations and regulatory mandates (Fuenfschilling and Truffer, 2014). Within the framework of sustainable project performance, big data analysis-artificial intelligence can serve as a mediator by converting abstract sustainability objectives into tangible, data-driven choices that conform to institutional standards (Khan and Chen, 2024).

This technology-facilitated mediation enables organizations to comply with external pressures, such as environmental rules, global climate obligations, and stakeholder demands and assert that the legitimacy derived from aligning governance procedures with sustainability norms is markedly improved when big data analysis-artificial intelligence is used to monitor, assess, and forecast performance results in real time. Moreover, big data analysis-artificial intelligence may formalize learning processes by analyzing trends from previous project data, therefore reinforcing best practices and facilitating ongoing improvement in governance techniques (Soori et al., 2024). Nonetheless, institutional inertia and opposition to technological advancement may restrict the comprehensive incorporation of big data analysis-artificial intelligence into governance frameworks (Alqasimi et al., 2025). Consequently, understanding the interaction between institutional pressures; coercive, mimetic, and normative, and organizational capacities in relation to the facilitation or obstruction of big data analysis-artificial intelligence adoption is an essential area of study. Future research should examine how big data analysis-artificial intelligence influences the governance-performance connection, not just via technological efficiency but also from the perspectives of institutional legitimacy and compliance, which are crucial for maintaining long-term organizational transformation.

H4: *Big data analysis - artificial intelligence positively mediates the relationship between project governance and sustainable project performance.*

2.6 Project Management Office as Moderator

In accordance with [Ammar \(2024\)](#), a thorough examination of the existing literature emphasizes the significance of project management office in bolstering governance frameworks, propelling sustainable project performance, and guaranteeing accountability throughout the project lifecycles. The project management office bridges the gap between project governance and sustainability goals by instituting activities and procedures that are in line with sustainability indicators ([Alshabragi et al., 2024](#)). As per [Muhammad et al. \(2024\)](#), project management offices expedite project processes and assure governance compliance by adopting standardized frameworks and tools. This successfully leads to sustainable project results. The function of project management office in supporting governance structures is vital in initiatives such as agriculture, where the need for sustainability is of the utmost importance ([Malik et al., 2024](#)). Sustainability measures that assess the effects on society and the environment over the long run are very important for agricultural projects ([Liebig et al., 2024](#)). Still, there is a paucity of data on how project management office affects the long-term viability of agricultural operations.

As per research by [Bulut and Wu \(2024\)](#), the agriculture sector has been comparatively understudied compared to business and infrastructural initiatives. Research on the functions of project management office in agricultural projects, particularly as they pertain to GPI, should be undertaken in the future. Governance systems targeted towards sustainable project performance may greatly benefit from the moderating influence that project management office can play ([Zada et al., 2024](#)). Project management offices are a great way to standardize procedures, make sure everything is in line with governance norms, and make sure everyone is held accountable for their work ([Varajão et al., 2024](#)). Research has shown that project management office that actively promote governance practices may enhance project performance by better aligning project goals with sustainability measures ([Carboni et al., 2024](#)). There is limited study, especially in the GPI project, on the

moderating influence of the project management office on sustainability results in agricultural projects.

Institutional theory offers an important perspective for comprehending the function of the project management office in improving governance frameworks and promoting sustainable project performance. As [Carboni et al. \(2024\)](#) highlights, the project management office plays a critical role in bridging the gap between project governance and sustainability goals by implementing standardized activities and processes aligned with sustainability indicators, which reflects institutional theory's emphasis on how organizational structures and practices adapt to conform to external norms and regulations. The institutional pressures for sustainability in sectors like agriculture, as noted by [Malik \(2024\)](#), further illustrate how governance frameworks must evolve to meet environmental and societal expectations. project management office helps organizations meet these institutional demands, reinforcing accountability and long-term viability ([Veronika and Latief, 2025](#)). However, as noted by [Umasekar \(2024\)](#), research on the role of project management office in agricultural projects, remains limited, suggesting a gap in understanding how institutional forces and governance structures interact in this context. The moderating influence of project management office in standardizing procedures and ensuring alignment with governance norms reflects institutional theory's focus on how structures, such as the project management office, help organizations maintain legitimacy and achieve sustainable outcomes in the face of institutional pressures ([Umasekar, 2024](#)).

H5: *Project management office moderates the relationship between project governance and sustainable project performance. (Such as that impact of project management office is high the impact of project governance and project management office will be high on sustainable project performance).*

project management offices are also crucial for an organization's legitimacy since they standardize procedures and make sure everyone follows the rules when it comes to governance ([Yousaf et al., 2024](#)). project management offices moderating effect between governance regulations and practical methods for adopting technology, especially when it comes to sophisticated technology like big data analysis-artificial intelligence is wanting. [Tchasseem \(2024\)](#) found that governance frameworks help

get big data analysis-artificial intelligence adopted because they provide standards for data management, accountability, and risk reduction. Applications of artificial intelligence and big data need coordinated decision-making and allocation of resources, making strong governance all the more crucial in complicated projects (Kehinde). On the other hand, project management offices and other organizational support systems frequently determine how strong this link is. In addition, project management offices help with the distribution of resources, which guarantees that the rules governing an organization have sufficient financial backing and professional knowledge (Woolcott, 2024).

As per research conducted by Woolcott (2024) in the fields of information technology and agriculture, project management offices that have reached maturity greatly enhance the process of translating governance into successful technology adoption. In agricultural projects in India where project management offices strictly enforced governance norms, the World Bank (2022) found that artificial intelligence usage increased by 40%.

These results indicate that industries like agriculture, where operational and institutional hurdles to technology adoption are common, benefit greatly from project management office engagement. Although there is evidence that project governance, project management office, and big data analysis-artificial intelligence are all important in their own right, however, there is dearth of research to look at the ways in which project management office influences the interaction between project governance, big data analysis-artificial intelligence. This disparity is more noticeable in agricultural initiatives funded by the public sector, which face additional obstacles due to institutional pressures and limited resources. By positing and evaluating the moderating influence of the project management office within the context of GPI, Hypothesis H6 may fill this gap.

H6: *Project management office moderates the relationship between project governance and big data analysis - artificial intelligence. (Such as project management office is high the impact of project governance and project management office will be high on big data analysis - artificial intelligence).*

2.7 Research Framework

Research framework reflects variables relations; independent variable - project governance, dependent variable - sustainable project performance, mediator - big data analysis-artificial intelligence and moderator - project management office.

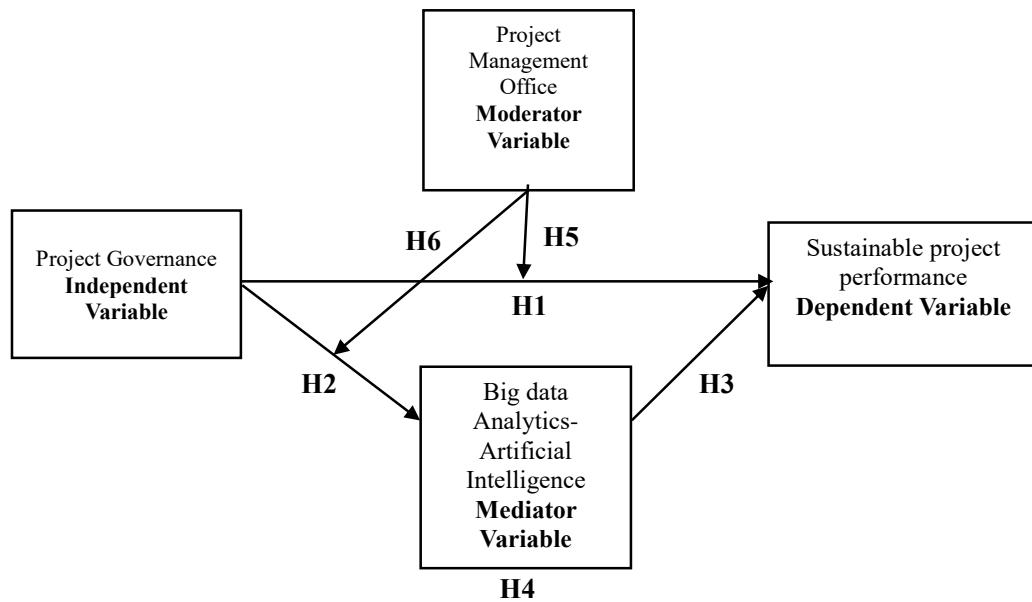


FIGURE 2.1: Research Framework

Chapter 3

Research Methodology

3.1 Introduction

Research methodology encompasses the specifics on all the procedures used to collect data, answer research questions, and accomplish study goals. The research design is addressed in the methodology section, which also includes estimates, ethical considerations, and all the methods of data collecting (both population and sample).

3.2 Research Design

[Al Humdan et al. \(2024\)](#) defines the research design as, the researcher's intended approach for identifying and collecting data, as well as the steps taken in order to get the answers they need. This involves research type, study settings (including work, environment, and respondent level), and time horizons (where, when, and for how long will the study take place). Moreover, how long it takes to get the data, if there are ethical concerns, and what kind of unit of analysis (individuals, teams, organizations, etc.)

The expected effect of PG on sustainable project performance in GPI-related agricultural projects was the focus of this quantitative analysis. The mediating function of big data analysis-artificial intelligence and the moderating function of the project management office was also examined in the research. This study provided empirical insights into the link between governance frameworks, enhanced

by big data analytics, and better sustainability results in the agriculture sector by collecting structured data and analyzing it statistically. Research was based on Positivism research philosophy for objectivity and for empirical evidences. As delineated by [Park et al. \(2020\)](#), scientific research has led to the emergence of positivism, a philosophical framework that remained predominant in the scientific research during 19th and 20th centuries. The basic argument of this philosophy suggests that acquiring scientific knowledge necessitates reliance on direct, objective observation and measurement. Positivists also assert that the universe can be better comprehended by systematic and rigorous scientific methods, and that a singular reality exists independent of our perceived perceptions.

3.3 Population and Sample

Participants in this research consisted of GPI project employees i.e. project managers, agricultural specialists, and data analysts. A representative sample has been chosen from GPI related agricultural projects, to guarantee that the results are applied to a broader context.

3.4 Time Horizon

Three months (4 January to 6 April 2025) have been utilized for data collection for the research. As the study is not time lagged, therefore, cross-sectional time frame has been adopted.

3.5 Ethical Issues

At all times, research ethics remained the first priority during the conduct of research. Following essential steps were undertaken to address ethical issues before data collection: -

1. Ethics approval (Ref: CUST/FMSS/REC/2025-1353) was undertaken from CUST University Ethics Approval Committee after deliberately submitting the committee provided checklist, questionnaire and participants consent form.

2. Each participant was asked to provide "informed consent".
3. Research instrument, ethics approval letter and consent form are attached as Appendix I to III respectively.

3.6 Unit of Analysis

[Nowakowska-Siuta \(2024\)](#) describes that the research goals and methods dictate the analytical unit. People, businesses, organizations, nations, groups, or even cultures may serve as the basis for an analysis. In this research, employees of each agricultural project carried out as part of the GPI project served as the unit of analysis.

3.7 Population & Sample

A population is a collection of entities, comprising individuals and objects, that are relevant to the researcher's area of interest for analysis ([Willie, 2024](#)). As per [Kumar and Praveenakumar \(2025\)](#), it is arduous for any researcher to collect data from the whole population; thus, it is essential to pick a sample that ensures the study is credible and that the information gathered accurately represents the total community. This research aims to concentrate on agriculture-based project within the context of GPI. The present research population comprises project managers and team members engaged in GPI project.

G*Power uses maximum predictors and model settings to calculate sample size instead of gathering the complete population and has been used to assess a number of statistical tests in the fields of biomedicine, social science, and behavioral research ([Faul et al., 2009](#)). For this research, The G*Power 3.1.9.4 tool has been used to determine the appropriate sample size. To examine the current four-predictor framework, 77-participants sample is required, yielding a power of 0.80 and a medium effect. The G*Power of the minimum sample size and obtained sample size are illustrated in Figure 3.1.

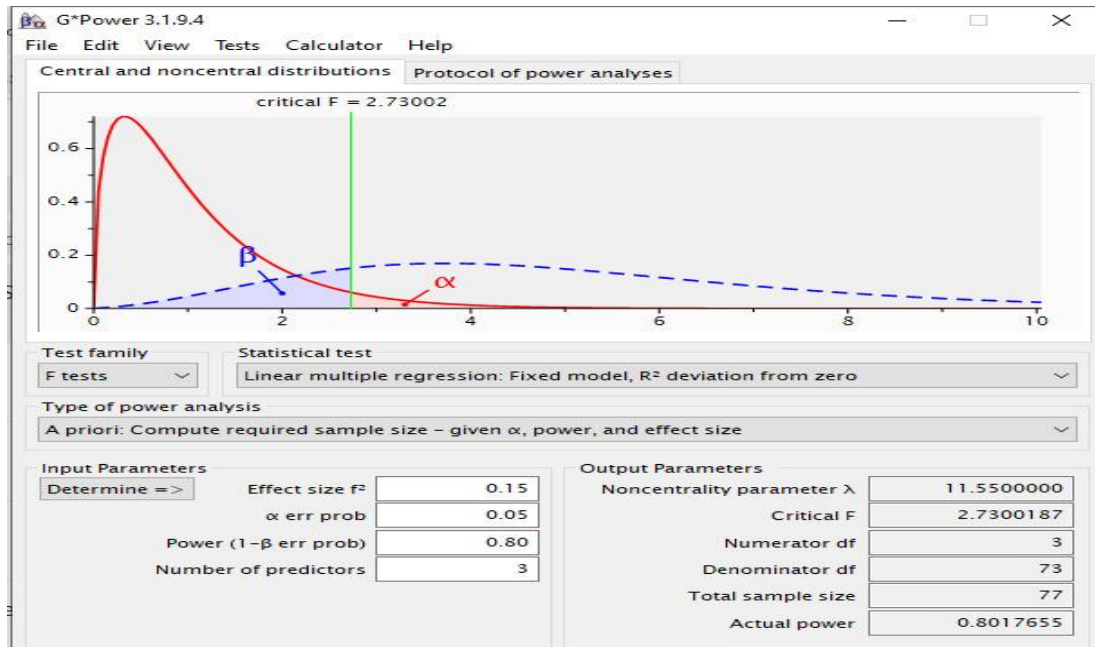


FIGURE 3.1: G* Power (with the power = 80 %)

To illustrate further the number of participants, Figure 3.2 shows that 119 participants are needed based on G* Power analysis at 95% power, even though 77 people were needed to achieve a minimum power of 80%. With 129 people on staff, GPI project has a 95% probability of finding an impact. Nonetheless, 300 people will be contacted for the survey in order to ensure the most genuine findings.

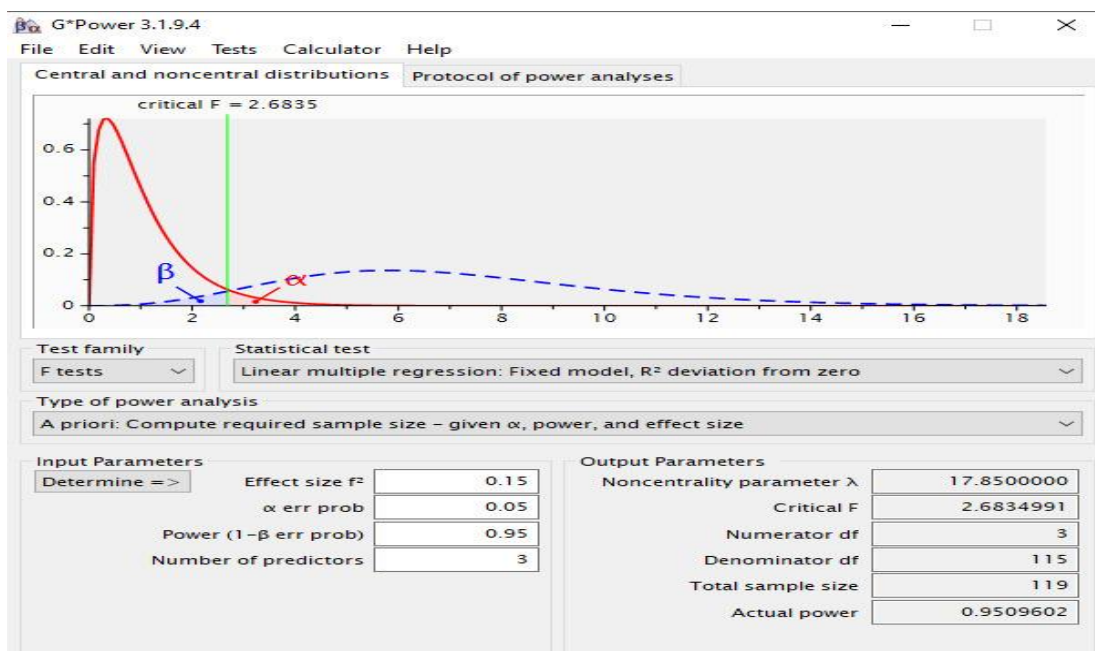


FIGURE 3.2: G* Power (with power = 95 %)

3.8 Sample and Sampling Technique

The sample is a representation of the whole population for the research, elucidating the two distinct methodologies: probability and non-probability (Shamsudin et al., 2024). The non-probability method is used to collect information from a well-represented segment of the population. This research used a purposive sampling approach to gather data, since it eliminates bias from the data collecting process, yields representative samples, and encompasses a broad spectrum of the population to examine the influence of project governance on sustainable project performance. Employees working at GPI project such as project officials, PMO representatives, and data science specialists in the agriculture sector made up the sample. Using this method, the research analyzed project management office responsibilities, data-driven decision-making, and governance procedures across a diverse group of GPI initiative participants.

3.9 Data Collection

For data collection, structured questionnaire has been adapted to acquire the data from participants about their opinions on project governance, sustainable project performance, the mediating effects of big data analysis-artificial intelligence, the role of the project management office as moderator. Quantitative assessments of different factors were made possible by the closed-ended questions of questionnaire by using a 5-point Likert scale. In order to make the questionnaire more accessible, it was provided in physical form. A total of 350 questionnaires were issued to employees working across various Green Pakistan Initiative projects; however, only 311 were adequately completed and returned that were included for analysis, and the response rate is 90.

3.10 Sample Characteristics

The total number of responses was 311. The demographics used in the surveys included gender, age, educational attainment, job experience, and organizational

experience. The characteristics of the respondents from whose data were obtained are shown in the following tables.

3.10.1 Gender

Being an important element in demography, it underscores the importance of maintaining gender equality, since it is a critical component of demographics, reflecting the male-to-female ratio within a certain population sample (Simon and Hasan, 2025). The proportion of male respondents exceeded that of female respondents, since the majority of members initiating the projects were male. Table 3.1 displays the gender composition of the population, which indicates that males were 74.3%, while the female appears to be only 25.7 % of the participants.

TABLE 3.1: Gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	231	74.3	74.3	74.3
Female	80	25.7	25.7	100.0
Total	311	100.0	100.0	

3.10.2 Age

Age is also a significant aspect of demography; nonetheless, some respondents exhibit reluctance in disclosing their age. Rather than inquiring about the precise age, several age ranges were used to mitigate respondents' discomfort. Table 3.2 illustrates the sample composition concerning age groups, revealing that 49.8 % of respondents were aged 31-40 years, 31.2 % were aged 20-30 years, 18.6 % belonged to the 41-50-year age group, and 0.3% were over 50 years old. The review indicates a large number of responders below 30 years age.

TABLE 3.2: Age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
20-30 Years	97	31.2	31.2	31.2
31-40 Years	155	49.8	49.8	81.0
41-50 Years	58	18.6	18.6	99.7
>50 Years	1	.3	.3	100.0
Total	311	100.0	100.0	

3.10.3 Experience

As a significant component of demography, work experience enhances individual abilities and creativity, making it a significant component of demography ([Ayanwale et al., 2024](#)). To gather information on the respondents' experiences. Four separate ranges were used for collection. Employee tenure information indicates that these years are appropriate for representatives to choose job experience relevant to their specific fields of industry. Table 3.3 indicates that 7.4 % of employees of GPI have less than 5 years of work experience, 31.5 % had between 5 to 10 years, 39.5 % had 11 to 15 years, and 20.9 % had more than 15years of work experience. This indicates that a significant proportion of respondents has fewer than five years of job experience.

TABLE 3.3: Experience

Experience	Frequency	Percent	Valid Percent	Cumulative Percent
<5 Years	23	7.4	7.4	7.4
5-10 Years	98	31.5	31.5	38.9
11-15 Years	124	39.9	39.9	78.8
>15 Years	65	20.9	20.9	99.7
Total	311	100.0	100.0	

3.10.4 Experience in Organization

To gather data on the respondents' experiences specifically within GPI project, four separate ranges were used for collection. Table 3.4 indicates that 8.7 % of respondents possessed less than 3 years of experience, 11.9 % had between 3 to 5 years, 27 % had 6 to 10 years, and 39.5% of employees have more than 10 years of work experience in the organization. This indicates that a significant proportion of respondents has fewer than three years of job experience in GPI project.

TABLE 3.4: Organizational Experience

Experience	Frequency	Percent Valid	Percent	Cumulative Percent
Valid <3 Years	27	8.7	8.7	8.7
3-5 Years	37	11.9	11.9	20.6
6-10 Years	84	27.0	27.0	47.6
>10 Years	123	39.5	39.5	87.1
Total	311	100.0	100.0	

3.10.5 Education

Education level is a crucial demographic factor, akin to age and gender, as it affords opportunities for the employees to augment their knowledge, skills, and techniques, enabling them to compete globally. Education is vital for the success of any nation. The questionnaire referenced four distinct categories of degrees to collect educational data. Table 3.5 indicates that 22.5 % of respondents had a Bachelor's degree, 49.5 % possessed a Master's degree, 23.5% had an MS/M.Phil., and 3.5% held a PhD. The rate of bachelor's degree holders has increased.

TABLE 3.5: Education

Education	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor	70	22.5	22.5	22.5
Masters	154	49.5	49.5	72.0
MS	73	23.5	23.5	95.5
PhD	11	3.5	3.5	99.0
Total	311	100.0	100.0	

3.11 Research Instruments

In Pakistan, English is taught as a mandatory subject beginning from primary school level. Therefore, the survey questionnaire mentioned at Table 3.5 was developed in the English language. Guidelines at the university level are also provided in English language. Given that the majority of respondents were college graduates, they should not have had any difficulties comprehending the questionnaire. All elements were assessed via a closed-ended questionnaire. A Likert scale with five answer alternatives, 1 as strongly disagree to 5 as strongly agree, has been adapted to assess all variables.

Based on the nature of the study, the questionnaire was separated into two halves. The first half included elements on the respondent's demographics, including gender, age, experience, education, organization experience, position, project type, and duration. The second half addressed the independent variable (project governance), the dependent variable (sustainable project performance), the mediating variable (big data analysis-artificial intelligence), and the moderating variable (project management office). Hard copies of questionnaire were distributed to the employees working under GPI. A total of 350 questionnaire were distributed for response and only 311 responses were obtained.

3.11.1 Project Governance (PG)

15-item scale created by Khan et al., (2019) was used to assess project governance as the independent variable. Sample items included the 15, with Cronbach's alpha

reliability for project governance was recorded at 0.812.

3.11.2 Sustainable Project Performance (SPP)

For SPP, 8-item scale of Um & Kim, (2018) was adapted to evaluate sustainable project performance as the dependent variable, with Cronbach's alpha reliability recorded at 0.751.

3.11.3 Big Data Analysis – Artificial Intelligence (BDA-AI)

8-item scale used by Tsai et al., (2015) was implemented for big data analysis-artificial intelligence measure as the mediating variable. having Cronbach's alpha reliability of 0.719.

3.11.4 Project Management Office (PMO)

Bhandari, (2022) 12 item scale was used to for measuring project management office as the moderating variable. Sample items are 12, with Cronbach's alpha reliability for project management office was recorded at 0.913.

TABLE 3.6: Research Instrument

Variable	Items	Sources
PG	15	(Khan et al., 2019)
SPP	8	(Um and Kim, 2018)
BDA-AI	8	(Tsai et al., 2015)
PMO	12	(Bhandari, 2022)

Chapter 4

Data Analysis and Results

Section 4.1 of this chapter discourses the data screening procedure. Section 4.2 delineates upon the findings of data analysis via the evaluation of the measurement model and the structural model. Finally, section 4.3 summarizes the outcomes of all the hypotheses examined.

4.1 Data Screening

Data screening is the process, essential for evaluating the completeness, distribution, and quality of data, while also assuring the validity and reliability of measurements (Riskin et al., 2025). Data screening involves the examination of data for outliers, missing values, and issues related to normalcy (Sun and Xia, 2024). Researchers may minimize inaccuracies that may influence the conclusions by meticulously analyzing the data. This approach establishes a robust basis for significant and dependable research outcomes (Ojoboh and Igben, 2024).

4.1.1 Data Cleaning

Data cleaning enhances data accuracy by rectifying mistakes, addressing missing numbers, and eliminating extraneous information. It eliminates any incorrect data points and improves the quality of the dataset (Ahuja et al., 2024). Researchers advocate for the utilization of data analytics to guarantee the quality and accuracy of outcomes, as well as to assess normalcy distribution and may enhance the

integrity of findings and get more dependable outcomes by refining the data (Imjai et al., 2024).

4.1.2 Missing Values and Outliers

The presence of any missing values when no data value is recorded, may substantially affect the validity and accuracy of the findings. This occurs when responders leave the response unanswered, either inadvertently or deliberately (Zhou et al., 2024). A comprehensive data collection offers a more accurate interpretation of study results and enhances the overall analysis (Karunarathna et al., 2024). The present research neither had missing values nor outliers in the data.

4.2 Results

Partial least squares structural equation modeling (PLS-SEM) using Smart PLS Version 4 (Sarstedt et al., 2024) has been performed in two steps: the first step is measurement model evaluation, followed by structural model evaluation. The measurement model, commonly interpreted as the outer model, illustrates the links between constructs and their indicators (Huda and Risman, 2024), while the structural model, referred to as the inner model, demonstrates the interrelations among the constructs (Cheung et al., 2024). Prior to initiating the first step, the gathered data was evaluated for common method bias through the performing of the Harman single factor test (Saxena et al., 2024). The extraction sums of squared loading indicated a total variance of 19.77%, which falls short of the essential threshold of 40%. Therefore, this indicates that there was no significant common bias problem in the data.

4.2.1 Measurement Model Assessment

Through construct reliability and construct validity, the reliability and validity of the scale items for all variables has been carried out. Cronbach alpha (CA) reliability and composite reliability (CR) were evaluated to determine the construct reliability. Construct validity was measured after the analysis of average variance extracted (AVE) and outer loadings. The Average variance extracted denotes the

extent of variation extracted by latent variables or constructs from their indicators. The dependability of each variable item was evaluated based on its outer loadings.

4.2.1.1 Construct Reliability and Convergent Validity

Table 4.1 below shows that CA readings are greater than 0.7 for all construct and AVE values are above the minimum acceptable threshold of 0.5 (Cheung et al., 2024). This indicates that all variable items were converging to reflect their respective underlying constructs.

TABLE 4.1: Construct Reliability and Convergent Validity

Constructs	CA	CR (rho-a)	CR (rho-c)	AVE
BDAAI	0.719	0.717	0.736	0.511
PG	0.812	0.829	0.849	0.588
PMO	0.913	0.920	0.926	0.510
SPP	0.751	0.764	0.828	0.509

4.2.1.2 Outer Loadings

Outer loadings with a minimum threshold value of 0.7 are deemed adequate (Kiswanto et al., 2025). The outer loading values, as shown in Table 4.2, varied from 0.552 to 0.921. Sarstedt et al. (2022) and Hair et al. (2016) advise against the removal of items with outer loadings between 0.40 and 0.70, permitting their removal alone if it augments AVE and CR. As the maximum values are above the requisite threshold, only two items were eliminated. Thus, Table 4.2 demonstrates the convergent validity.

TABLE 4.2: Outer Loadings

Variables	Item	OL		Item	OL
PG	PG1	0.320	SPP	SPP1	0.646
	PG2	0.318		SPP2	0.621
	PG3	0.709		SPP3	0.677
	PG4	0.635		SPP4	0.535
	PG5	0.688		SPP5	0.748
	PG6	0.684		SPP6	deleted
	PG7	0.673		SPP7	deleted
	PG8	0.507		SPP8	0.768
	PG8	0.364	BDAAI	BDAAI1	0.529
	PG9	0.318		BDAAI2	0.433
	PG10	0.532		BDAAI3	0.490
	PG11	0.459		BDAAI4	0.554
	PG12	0.291		BDAAI5	0.228
	PG13	0.598		BDAAI6	0.469
	PG14	0.583		BDAAI7	0.635
PG15	0.383	BDAAI8		0.692	
PMO	PMO1	0.601			
	PMO2	0.711			
	PMO3	0.717			
	PMO4	0.712			
	PMO5	0.756			
	PMO6	0.740			
	PMO7	0.746			
	PMO8	0.740			
	PMO9	0.757			
	PMO10	0.697			
	PMO11	0.741			
	PMO12	0.637			

4.2.1.3 Discriminant Validity

Research using latent variables must undergo discriminant validity assessment to avoid multicollinearity problems. The most used tool for this purpose is the Fornell and Larcker criteria. The Fornell-Larcker criteria is a widely used method for assessing the discriminant validity of measurement models (Rane and Paramesha, 2024). According to this criterion, the square root of the average variance extracted by a construct must be surpassing the correlation between that construct and any other construct. Upon fulfillment of this requirement, discriminant validity is confirmed (Nugroho and Angela, 2024). Table 4.3 below illustrates discriminant validity through Fornell-Larcker Criterion.

TABLE 4.3: Discriminant Validity through Fornell-Larcker Criterion

Construct	BDAAI	PG	PMO	SPP
BDAAI	0.520			
PG	0.355	0.536		
PMO	0.115	0.351	0.714	
SPP	0.439	0.505	0.272	0.670

However recently, a new approach has surfaced for determining discriminant validity evaluation using the Heterotrait-Monotrait (HTMT) ratio of correlations technique. Henseler et al., (2015) developed this unique method for evaluating discriminant validity: the heterotrait-monotrait ratio of correlations (HTMT). The technique quantifies the similarity between latent variables. If the HTMT is significantly less than one, discriminant validity may be considered established (Lim, 2024). A threshold of 0.85 reliably distinguishes between pairs of latent variables demonstrating discriminant validity and those lacking it. Furthermore, the HTMT is rather simple to calculate, requiring just the correlations of the observed variables as input. Neither exploratory nor confirmatory factor analysis is required. Table 4.4 illustrates all constructs achieved discriminant validity as the values are below than 0.90 according to the HTMT criterion. This ensures

the reliability of measurement model and constructs are distinct with minimal overlapping. Thus, discriminant validity was deemed adequate.

TABLE 4.4: Discriminant Validity through HTMT

Construct	BDAAI	PG	PMO	SPP
BDAAI				
PG	0.376			
PMO	0.179	0.398		
SPP	0.370	0.600	0.312	

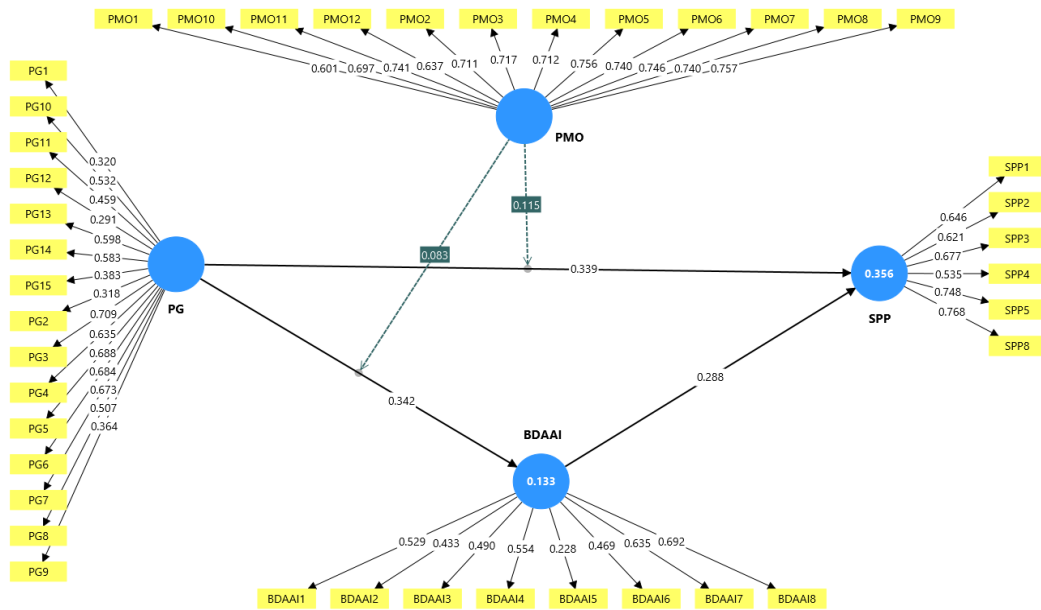


FIGURE 4.1: Measurement Model Analysis

4.2.2 Structural Model Assessment

To evaluate the inner model in accordance with the standards established by Henseler et al. (2015), the second step of PLS-SEM was performed, aiming to investigate the mediating effects of big data analysis-artificial intelligence, as well as the moderating influence of project management office. Four criteria are the

coefficient of determination (R^2), predictive relevance (Q^2), effect magnitude (f^2), and the importance of route coefficients (Hair et al., 2021).

4.2.2.1 Coefficient of Determination and Predictive Usefulness

The coefficient of determination (R^2) and the model's predictive usefulness (Q^2) were evaluated. R^2 statistics indicate the variation in the dependent variable attributable to independent variable, indicating the extent of change in the dependent variable resulting from one or more independent variables (Hair et al., 2019). Cohen (1988) categorizes R^2 values for dependent variables as, 0.26 (substantial), 0.13 (moderate), and 0.02 (weak). Table 4.4 provides the R^2 values for sustainable project performance at 0.356 and for project management office at 0.133 (% variance), all of which are significant. Subsequently, the predictive relevance of the structural model was assessed through the evaluation of Q^2 values, which, if exceeding zero ($Q^2 > 0$), signify effective reconstruction of values and demonstrate the model's predictive relevance (Amalia et al., 2023). The use of PLS-Predict yielded findings shown in Table 4.3, are indicating that the Q^2 values for the dependent variables exceeded zero, hence confirming predictive significance.

TABLE 4.5: Coefficient of Determination

Construct	R-Square	R-square adjusted	Q^2 predict
BDA-AI	0.133	0.125	0.088
SPP	0.356	0.347	0.248

4.2.2.2 Direct Relationship Analysis

A bootstrapping approach with default subsamples of 5000 was used to ascertain the significance and t-values for the path coefficients. The data at Table 4.5 indicate that project governance positively associated with SPP ($\beta = 0.337$, $t = 6.031$, $p < 0.05$), hence supporting the first hypothesis of this research (H1). Secondly, the results of this research demonstrate that project governance is associated positively with big data analysis-artificial intelligence ($\beta = 0.345$, $t = 6.529$, p

< 0.05). Therefore, H2 was supported. Thirdly, the findings indicate that big data analysis-artificial intelligence exhibits a positive correlation with sustainable project performance ($\beta = 0.293$, $t = 4.448$, $p < 0.05$); hence, hypothesis H3 is also substantiated. Big data analysis-artificial intelligence significantly mediates the relation between project governance and sustainable project performance ($\beta = 0.101$, $t = 3.819$, $p < 0.05$), hence H4 was supported.

TABLE 4.6: Direct Relationship

H	Relationship	β	M	STDEV	t values	P values	2.5% LLCI	97.5% ULCI	Remarks
Direct effect									
H1	PG -> SPP	0.337	0.341	0.056	6.031	0.000	0.230	0.450	Supported
H2	PG -> BDAAI	0.345	0.363	0.053	6.529	0.000	0.255	0.464	Supported
H3	BDAAI -> SPP	0.293	0.297	0.066	4.448	0.000	0.170	0.429	Supported

4.2.2.3 Mediation Analysis

To evaluate the indirect effects of big data analysis-artificial intelligence on the relationship between project governance and sustainable project performance, mediation analysis was conducted by utilizing a bootstrapping procedure with a default of 5000 subsamples. The findings shown in Table 4.7 indicated a significant indirect impact of project governance on sustainable project performance via big data analysis-artificial intelligence ($\beta = 0.101$, $t = 3.819$, $p < 0.05$), consequently, H4 is also supported.

4.2.2.4 Moderation Analysis

The moderating influence of project management office on the link between project governance and sustainable project performance and also project governance and big data analysis-artificial intelligence was analyzed using the bootstrapping method, analogous to the examination of direct correlations and mediating effects. Table 4.8 presents the findings, indicating that the interaction term of project management office exerts a positive impact between relationship of project governance on sustainable project performance ($\beta = 0.155$, $t = 2.999$, $p = 0.003$). This suggests that a high moderating effect of project management office enhances the relationship

between project governance and sustainable project performance. This indicates that the moderation is contributing to the explanation of the dependent variable (SPP). Consequently, this indicates that project management office moderates the association between project governance and sustainable project performance, Consequently, H5 was corroborated. On the contrary, project management office moderation effect between relationship of project governance and big data analysis-artificial intelligence is not positive and significant, thereby, H 6 is not supported.

TABLE 4.7: Mediation Analysis

H	Relationship	β	M	STDEV	t values	P values	2.5% LLCI	97.5% ULCI	Remarks
Indirect effect									
H4	PG -> BDAAI -> SPP	0.101	0.107	0.027	3.819	0.000	0.061	0.164	Supported

TABLE 4.8: Moderation Analysis

H	Relationship	β	M	STDEV	t values	P values	2.5% LLCI	97.5% ULCI	Remarks
H5	PMO x PG -> SPP	0.115	0.115	0.038	2.999	0.003	0.040	0.189	Supported
H6	PMO x PG -> BDAAI	0.081	0.081	0.063	1.279	0.201	-0.046	0.201	Not Supported

In order to have a better understanding of the nature of the moderating effect, Figure 4.2 presents the slope analysis. It can be seen that red line, which shows the SE of project management office (PMO) being close to -1, in other words, low PMO is much steeper as compared to the green line, which represents higher PMO with SE for project governance (PG) being close to +1. At higher PMO, the green, red and blue line tend to slope. This clearly, shows that higher PMO strengthens the relationship between PG and sustainable project performance, while the low PMO weakens the relationship.

TABLE 4.9: Conditional Direct Effect of PMO on PG and SPP

	PG -> BDAAI	PG -> SPP
PMO at +1 SD	0.425	0.454
PMO at -1 SD	0.259	0.223
PMO at Mean	0.342	0.339

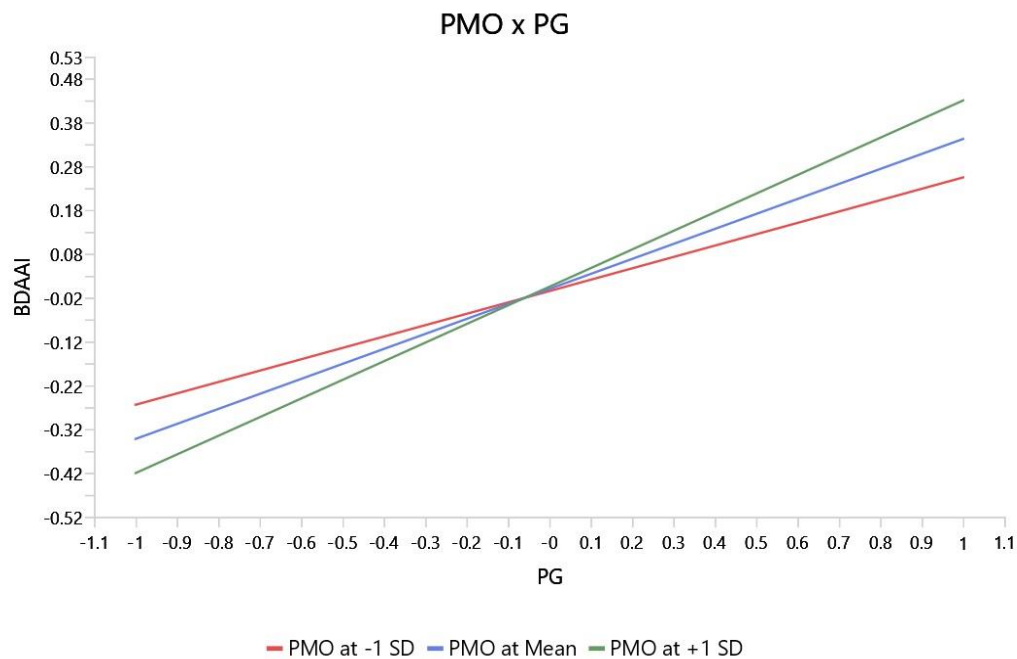


FIGURE 4.2: Moderation Analysis

In Figure 4.2. it can be seen that red line, which shows the SE of PMO being close to -1, in other words, low PMO, is less steep as compared to the green line, which represents higher PMO with SE for PMO being close to +1. At higher PMO, the red line tends to straighten. This clearly, shows that higher PMO weakens the relationship between PG and BDA-AI, while the low PMO strengthens the relationship.

TABLE 4.10: Conditional Indirect Effect

PG -> BDAAI -> SPP	
PMO at +1 SD	0.123
PMO at -1 SD	0.075
PMO at Mean	0.099

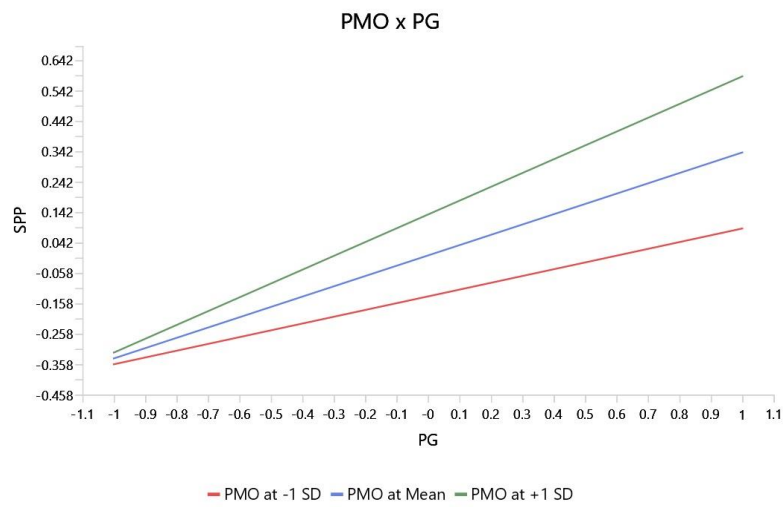


FIGURE 4.3: Moderation Analysis

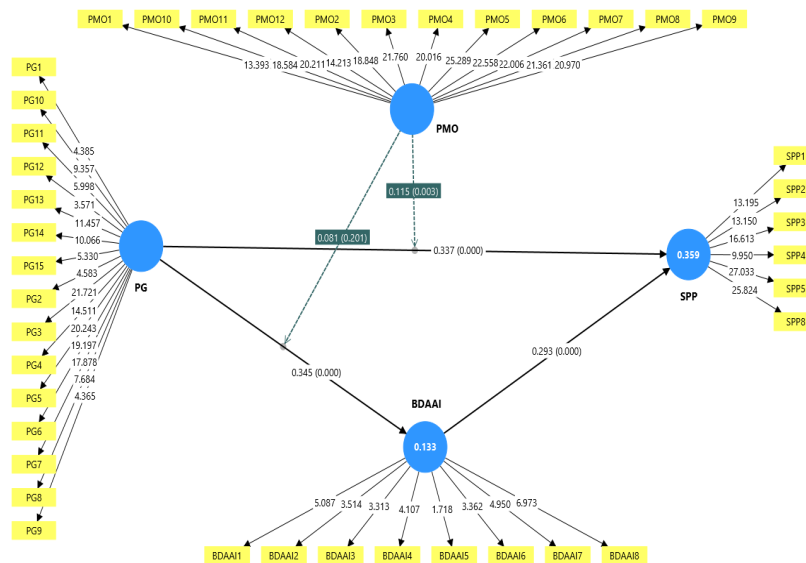


FIGURE 4.4: Structural Model Analysis

4.3 Hypothesis Result Summary

TABLE 4.11: Hypothesis Result Summary

Hypothesis	Statement	Result Decision
H1	Project governance is positively associated with sustainable project performance.	Supported
H2	Project governance is positively associated with big data analysis - artificial intelligence.	Supported
H3	Big data analysis - artificial intelligence is positively associated with sustainable project performance.	Supported
H4	Big data analysis - Artificial intelligence positively mediates the relationship between Project governance and sustainable project performance.	Supported
H5	Project management office moderates the relationship between project governance and sustainable project performance.	Supported
H6	Project management office moderates the relationship between project governance and big data analysis - artificial intelligence	Not Supported

Chapter 5

Discussion

5.1 Introduction

This chapter infers the results and findings mentioned in the chapter 4 of this study and further discusses their implications in relation to the existing literature, research objectives and hypotheses. The purpose of this study is to examine the impact/ role of project governance in achieving sustainable project performance in Pakistan's agricultural sector, specifically under the Green Pakistan Initiative project. The study has also explored the mediating function of big data analytics-artificial intelligence and the moderating role of the project management office. The results obtained from analysis performed through the Smart PLS-4 software provide valuable insights and partially validate the proposed conceptual model; all hypotheses except H6 have been statistically supported. The following sections discuss the hypothesis-by-hypothesis results of the study, duly incorporating existing the literature.

5.2 Hypothesis Discussions

5.2.1 H1: Project Governance is Positively associated with Sustainable Project Performance

The findings of the study confirm a significant and positive relationship between project governance and sustainable project performance ($\beta = 0.337$, $t = 6.031$, $p <$

0.05), supporting that well-structured governance mechanisms enhance sustainable performance in agricultural projects of GPI. This is also consistent with the previous literature on the issue, suggesting that the project governance ensures stakeholder alignment, clear accountability, and strategic alignment, which are essential for sustainable outcomes of project (Orieno et al., 2024). Within the context of Pakistan's GPI project, governance mechanism provides the strategic oversight and control necessary for long-term environmental, social, and economic sustainability of the project but also congruence with organizational goals, optimizes resource allocation, and mitigates hazards, as illustrated by (Kalleparambil et al.). In line with the body of literature that illustrates the crucial role of governance in sustainability, this study confirms a significant association between project governance and sustainable project performance. Since, project goals and organizational strategy are better able to integrate when there are solid governance mechanisms in place (Menon, 2024). Therefore, the importance of best project governance practices in public sector projects in Pakistan cannot be overstated. It is the key to ensuring stakeholder cooperation, managing risks, and making decisions in a transparent manner. Since, governance frameworks also enhance performance by providing supervision, flexibility, and the integration of sustainability (Efunniyi et al., 2024); thereby, this finding is supported by the fact that in the context of Pakistan's Green Pakistan Initiative project, where projects address complex socio-economic and environmental issues, project governance becomes an essential tool for guaranteeing sustainable project performance.

Furthermore, current empirical research also highlights that project governance should go beyond conventional control methods to actively integrate sustainability-focused decision-making throughout the project lifetime. Rane and Paramesha (2024) emphasize that adaptive governance models, which respond to environmental, social, economic and stakeholder dynamics, provide more robust and sustainable results in large-scale public undertakings. This is especially pertinent to agriculture sector, where unpredictability from climatic change, resource constraint, and changing regulatory environments necessitates flexible but resilient governance frameworks (Chinbuah and Peprah, 2024). The GPI project illustrates this need, functioning within a complex system that encompasses regulations, local execution,

and environmental requirements. The study's findings substantiate existing literature by demonstrating that governance frameworks incorporating sustainability principles from the beginning; such as inclusive stakeholder engagement, proactive environmental risk management, and transparent reporting, are more likely to attain long-term project success (Tumpa and Naeni, 2025). Consequently, project governance functions as both a legislative framework and a strategic facilitator of sustainable outcome in public sector venture i.e. GPI project.

5.2.2 H2: Project Governance is Positively associated with Big Data Analytics – Artificial Intelligence

The second hypothesis has also been supported, with results indicating a strong positive relationship between project governance and big data analysis-artificial intelligence ($\beta = 0.345$, $t = 6.529$, $p < 0.05$). This suggests that sound project governance mechanism creates the organizational structure and culture that supports the integration of advanced technologies into project. Governance structures enable data-driven decision-making by facilitating investments in technology infrastructure, talent development, and data policies (Magakwe, 2025). This resonates with findings from (Balaji, 2025), who emphasized e-governance as a catalyst for digital transformation in public-sector projects.

Findings that substantiate H2 are in line with current research that depicts project governance as a facilitator of digital change. Since, the integration of various data sources in agricultural project management enhances planning and resource allocation while aligning agricultural practices with sustainability goals (Büyüközkan and Uztürk, 2024). Therefore, big data analysis-artificial intelligence facilitates precision agriculture methods that optimize resource use, decrease environmental impact, and enhance output efficiency (Chen and Asif, 2024). By distributing resources and encouraging a spirit of innovation, governance structures in agricultural development initiatives like GPI provide a foundation for technology-driven decision-making. Organizations with strong governance mechanisms are more likely to embrace and use digital technologies to improve efficiency and alignment of strategy and outcome.

Moreover, recent studies have highlighted the ample significance of governance mechanism that facilitate compliance and supervision while also nurturing innovation in public sector enterprises. [Sirisomboonsuk et al. \(2018\)](#) propose that project governance integrating technological literacy can markedly expedite the adoption of technologies and affect project outcome. In agriculture-centric projects like the GPI, these governance mechanisms are essential for guaranteeing that digital technologies are not only implemented but also properly used throughout project phases. As emphasized by [Archana \(2025\)](#), the incorporation of big data analysis-artificial intelligence is significantly reliant on leadership dedication and organized governance frameworks that promote organizational cooperation. This corresponds with the current results by demonstrating how project governance serves as a fundamental facilitator of technological change, aiding in the connection between governance and data-driven execution. Consequently, efficient project governance within the GPI framework not only facilitates the use of big data analysis-artificial but also accelerates it by integrating digital innovation into the fundamental aspects of project planning and execution. Therefore, study's results are consistent with these claims.

5.2.3 H3: Big Data Analysis - Artificial Intelligence is Positively associated with Sustainable Project Performance

Hypothesis 3 has been validated through a positive and significant relationship between big data analysis-artificial intelligence and sustainable project performance ($\beta = 0.293$, $t = 4.448$, $p < 0.05$). This confirms that the use of big data analysis-artificial intelligence technologies leads to improved project performance, particularly in terms of sustainability metrics like resource efficiency, early risk detection, and stakeholder engagement. In the GPI context, BDA-AI applications in agriculture such as precision farming, remote sensing, and predictive analytics likely enhance sustainability outcomes via enhancing project efficiency, effectiveness, and sustainability by providing predictive insights, real-time monitoring, and optimization capabilities, as illustrated by ([Tan et al., 2024](#)). Use of big data

analysis - artificial intelligence in agriculture allows for more accurate forecasts, less resource waste, and precision farming. As [Riipa et al. \(2025\)](#) argued that analytics and artificial intelligence may improve stakeholder participation, use resources more efficiently, and help with decision-making in real-time, all of which are important for long-term success. Consistent with these results, the present research implies that big data analysis-artificial intelligence empowers GPI projects to implement sustainable practices by enabling them to make predictive insights leading to decision making. In accordance with this, it is concluded that data-driven techniques are crucial for sustainability-oriented initiatives to achieve their goals.

Recent research increasingly supports the valuable impact of technology on sustainable project performance, particularly in data requiring industries such as agriculture sector. As per [Indiazi \(2025\)](#), modern data analytics improve operational efficiency and provide ongoing environmental monitoring and proactive adaptation to climate-related hazards. Such capabilities are quite important in initiatives such as GPI project, where sustainability goals must correspond with variable environmental and socio-economic circumstances. Therefore, [Jensén \(2025\)](#) asserts that the use of artificial intelligence in sustainability-focused initiatives enhances outcome by forecasting long-term effects and refining decision-making in real time. This predictive capacity guarantees improved alignment with sustainable development goals (SDGs) and aids in informed policy adaptations ([Leal Filho et al., 2024](#)). The outcomes of this research confirm that big data analysis-artificial functions as a strategic facilitator, equipping employees of GPI project with actionable insights and promoting a culture of sustainability. Big data analysis-artificial intelligence serves as both a technological asset and a vital catalyst for sustainable outcome in agriculture-oriented public sector projects i.e. GPI project.

5.2.4 H4: Big Data Analysis - Artificial Intelligence Mediates the Relationship between Project Governance and Sustainable Project Performance

In order to analyze the results, mediation analysis has revealed that big data analysis-artificial intelligence significantly mediates the relationship between project

governance and sustainable project performance ($\beta = 0.101$, $t = 3.819$, $p < 0.05$), providing sufficient empirical support for confirmation of H4. This highlights that big data analysis-artificial intelligence as a key enabler through which project governance enhances sustainable outcome of project. Project governance not only directly influences project performance but does so indirectly by fostering an infrastructure favorable of data-driven sustainability initiatives. The findings of the study align with existing literature indicating that digital enablers play a mediating role between governance and sustainable outcome. It is also clear from big data analysis-artificial intelligence's mediating function that digital technologies play a key enabling role through which governance mechanisms impact sustainability results (Makhdoom et al., 2024). As research by Neiroukh et al. (2024) indicates, artificial intelligence and analytics play a crucial role in translating directions from upper-level leadership and governance into practical insights and operational efficiency. Their suggested framework supports this idea. This reflects that in the context of GPI, project governance lays the groundwork for digital adoption and big data analysis-artificial intelligence turns that execution into measurable performance gains. Consistent with the mediation seen here, research shows that big data analysis-artificial intelligence capabilities governance frameworks with outcome.

Although, existing literature provides little evidences but substantiate the function of digital technologies as mediators in the correlation between governance and project outcomes, particularly in sustainability-focused initiatives. Khan and Chen (2024) assert that the proficient use of big data analysis - artificial intelligence adapts governance mechanism into data-driven operational practices, guaranteeing that sustainability goals are not just envisaged at the strategic level but are also executed throughout the lifespan of the project. In agricultural initiatives, where sustainability is affected by intricate, interconnected factors involving climate, soil health, and market dynamics, artificial intelligence-driven solutions allow governing entities to oversee progress, modify policies, and enhance resource allocation in real-time (SS et al., 2024). Furthermore, Khan and Chen (2024) argue that the mediating influence of big data analysis -artificial intelligence is particularly significant when governance promotes digital inclusion and open data, conditions

often seen in organized agriculture projects. These insights correspond with the current results, confirming that big data analysis -artificial intelligence functions as a vital instrument via which strong governance frameworks convert sustainability objectives into concrete, quantifiable outcomes in project performance.

5.2.5 H5: PMO Moderates the Relationship between Project Governance and Sustainable Project Performance

The study found that project management office significantly moderates the relationship between project governance and sustainable project performance ($\beta = 0.155$, $t = 2.999$, $p < 0.05$). At higher levels of project management office involvement, the positive and significant effect of project governance on sustainable project performance becomes stronger, confirming that project management office acts as a structural support mechanism. Project management offices may provide standardization, resource alignment, and monitoring tools that bridge governance and execution. This result supports previous literature by [Adam and Campa \(2024\)](#), which identified project management office as a crucial organizational entity for translating governance strategies into operational excellence. Consistent with research that highlights project management office as crucial tool for strategy execution and governance enforcement, our results show that project management office enhances the bond between project governance and sustainable project performance. [Ismail and Salama \(2025\)](#) have pointed out that project management office assists improve performance results by standardizing methods, ensuring compliance with governance standards, and enhancing project visibility. When it comes to sustainability-focused initiatives in the context of GPI project, project management office plays a crucial role in monitoring environmental and social indicators via their reporting and monitoring responsibilities ([SS et al., 2024](#)). The present research confirms that PMOs are important because they transform governance concepts into consistent practices that enhance performance.

[Namuag \(2024\)](#) highlights the transformation of project management office from administrative support entities to strategic partners that facilitate sustained value

development. As per Veronika and Latief (2025), PMOs are essential for incorporating sustainability measures into project governance frameworks by integrating best practices, promoting stakeholder alignment, and guaranteeing ongoing performance monitoring. This aspect corresponds with the GPI project's setting, where the intricacy and magnitude of sustainability goals need centralized governance and adaptive management roles are progressively integrated into project management office tasks. Veronika and Latief (2025) also argue that project management office improves governance efficacy by establishing feedback loops between strategic planning and project execution, which are essential for maintaining sustainability principles throughout the project lifetime. The moderating effect shown in this research illustrates wider trends in project management office development, affirming that robust project management office considerably enhances the positive effect of governance frameworks on sustainable project performance.

5.2.6 H6: Project Management Office Moderates the Relationship between Project Governance and Big Data Analysis - Artificial Intelligence

Contrary to expectations, H6 was not statistically supported ($\beta = 0.081$, $t = 1.279$, $p > 0.05$). This suggests that project management office may not significantly influence how project governance translates into technological adoption and integration. One possible explanation could be that the role of big data analysis-artificial intelligence in the preview of agriculture projects under GPI is still emerging and may not yet be embedded into standard project management office practices. Alternatively, project management office might lack the technical expertise or mandate to influence data science initiatives. This opens a future research avenue for investigating how project management office can evolve to support technological innovation more effectively. New inquiry about the changing function of project management office in facilitating technical innovation arise from the dearth of backing for H6.

Although project management office has long been linked to process standardization and supervision, their function in embracing new technologies is still not well-defined.

Because big data analytics-artificial intelligence integration is still in its infancy, this is especially important in industries like agriculture.

Therefore, while PMOs make a big change in terms of performance and governance, there's room for improvement in how they affect the adoption of technology. This is in line with the future study paths with project management office's changing perspectives.

Although, the lack of statistical evidence for H6 corresponds with recent work emphasizing the evolving characteristics of project management office in response to the requirements of digital transformation.

[Namuag \(2024\)](#) underscore that many project management offices, especially within the public sector and conventional sectors such as agriculture, continue to function under outdated frameworks that stress compliance, paperwork, and resource management rather than fostering innovation. This organizational inertia may constrain their ability to successfully facilitate or impact the incorporation of modern technologies such as big data analysis-artificial intelligence ([Chen and Khan, 2024a](#)).

Furthermore, [Chagani \(2024\)](#) contend that effective mediation of technology via governance frameworks necessitates project management office to transform into agile, technology-savvy entities with proficiency, an development that is inconsistent across various organizations.

In the context of GPI, the incorporation of big data analysis-artificial intelligence may indicate that these digital competences remain beyond the purview of project management office requirements.

The results indicate a disparity between conventional project governance enforcement and the management of developing technologies, highlighting the need for more study on how project management office might be reorganized or enhanced to close this gap and effectively facilitate digital transformation.

5.3 Confirmation of Hypotheses

Hypothesis	Statement	Result
H1	$PG \rightarrow SPP$	Supported
H2	$PG \rightarrow BDA-AI$	Supported
H3	$BDA-AI \rightarrow SPP$	Supported
H4	$PG \rightarrow BDA-AI \rightarrow SPP$ (Mediating)	Supported
H5	$PMO \times PG \rightarrow SPP$ (Moderating)	Supported
H6	$PMO \times PG \rightarrow BDA-AI$ (Moderating)	Not Supported

5.4 Implications

5.4.1 Theoretical Implications

Since, it is one of the first empirical investigations in GPI related agriculture projects to explore the mediating role of big data analysis-artificial intelligence and the moderating role of project management office in the relationship between project governance and sustainable project performance. Therefore, it can be argued that the research contributes meaningfully to the evolving body of knowledge within the context of public sector projects specifically agricultural sector for sustainable outcomes incorporation of modern.

The study advances the theoretical discourse by empirically confirming the direct impact of project governance on sustainability, a relationship that has been under-explored in emerging economies like Pakistan. Furthermore, it introduces big data analysis-artificial intelligence as a mediating construct, offering a fresh perspective on how digital technologies can serve as a conduit between strategic governance and project outcomes.

The identification of project management office as a moderating factor enriches the understanding of organizational structures in sustainability-driven project environments. Notably, the absence of moderation between project governance and big data analysis-artificial intelligence invites further academic inquiry into the

technological roles of project management office and highlights a gap in current literature. By focusing exclusively on the GPI project, the study adds both academic depth and policy relevance to the discourse on sustainable project performance through effective project governance.

Furthermore, the use of Smart PLS-4 for conducting the Partial Least Squares Structural Equation Modeling (PLS-SEM) enabled rigorous testing of complex relationships between variables, ensuring the statistical robustness of the model. Future studies can build upon this framework by exploring comparisons, longitudinal impacts, or incorporating qualitative insights to deepen understanding.

This research also emphasizes that organized structures, such as project governance and project management office, contain institutionalized practices that influence organizational behavior and decision-making within public sector project contexts. The results indicate that in Pakistan's agriculture sector, governance structures are progressively being formalized to validate sustainability initiatives in accordance with broader socio-economic and environmental demands.

This reinforces the notion that organizations adapt certain structures and technology not alone for efficiency, but to attain legitimacy within their institutional framework (Liu et al., 2024). The mediating function of big data analysis-artificial intelligence demonstrates how emergent technologies may be institutionalized when they are linked with strategic aims and governance standards.

The limited moderating influence of the project management office on technological adoption highlights institutional inertia, suggesting that although governance and sustainability practices are becoming more legitimate, digital transformation may still be regarded as marginal or insufficiently integrated within current institutional structures.

Consequently, the study enhances institutional theory by demonstrating how the imperatives of environmental sustainability and technological innovation beginning to transform the governance framework in public sector projects, while also revealing structural inflexibilities that necessitate reform for more profound institutional change.

5.4.2 Practical Implications

On practical side, the findings of the research highlight important implications for project managers working within Pakistan's agricultural sector, particularly those involved in the GPI project. First, the confirmed positive influence of project governance on sustainable project performance highlights the critical role of structured oversight, transparency, and accountability in delivering long-term sustainability outcomes. Project managers should prioritize governance frameworks that incorporate stakeholder engagement, environmental accountability, and ethical standards into every phase of agricultural projects.

Second, the significant role of big data analytics-artificial intelligence suggests that project managers should actively seek to integrate data-driven tools for planning, monitoring, and performance evaluation. Adopting artificial intelligence-powered solutions like precision agriculture, predictive modeling, and automated reporting can vastly enhance efficiency and sustainability outcomes.

Finally, the moderating role of the project management office between governance and performance outcomes emphasizes the need to empower project management offices with both authority and capacity. PMOs should not only act as administrative bodies but also evolve into strategic enablers that align project governance with modern data-driven approaches.

This study also provides a proposal for implementing effective project governance mechanisms in public sector agricultural projects. Project managers involved in GPI and similar initiatives should establish formalized governance models that promote strategic alignment, compliance, and management. Furthermore, the validated mediating role of big data analysis-artificial intelligence underscores the importance of technological integration in agriculture projects.

Government agencies and NGOs must invest in digital infrastructure, farmer training, and artificial intelligence-powered decision support systems to amplify the positive effects of project governance. Practical steps may include deploying remote sensing technologies, artificial intelligence-based irrigation systems, or crop health prediction tools.

Additionally, the study highlights the importance of strengthening project management office structure to ensure effective translation of governance policies into actionable results. While project management office influence on artificial intelligence adoption was not supported, enhancing the technical expertise of project management offices can bridge this gap, ensuring their relevance in digitally transforming agricultural project environments.

5.5 Limitations and Future Research Directions

Although the study provides significant insights into project governance dynamics, sustainable project performance, and technological mediation in Pakistan's agricultural sector, but it also has few imitations. First, the study was cross-sectional in nature, capturing responses at a one point of time. The aspect has restricted the ability to observe the evolution of governance and technology impacts over different project phases.

Second, the research was limited to the context of agriculture projects under the ambit of the Green Pakistan Initiative (GPI), which may constrain the generalizability of the findings of this study to other similar projects requiring sustainability outcomes. Third, the e-governance dimension of project governance was not covered amply. Based on the conclusions of this study, subsequent research may investigate into several avenues.

First, longitudinal studies could be conducted to assess how the relationships among project governance, big data analysis-artificial intelligence, and sustainable project performance evolve over the entire project lifecycle. This would offer a dynamic perspective on the journey of agricultural projects towards sustainability.

Second, considering that the moderating role of project management office on big data analysis-artificial intelligence was not supported, future research could investigate how project management office can be digitally transformed to actively support technological adoption and innovation. Researchers might also examine sectoral differences, comparing agriculture with other project-intensive sectors such as energy or infrastructure, to understand how governance and data strategies differ.

These comparisons could help adopting Pakistan's governance and sustainability practices against global standards, offering insights for policy and institutional reforms. Moreover, e-governance dimension may be covered by linking the nexus of project governance with technology. Lastly, this study may be taken as a benchmark to conduct further research on all other similar projects under the ambit of GPI with sustainable practices i.e. livestock, fisheries, tourisms etc.

5.6 Conclusion

The purpose of this research was to examine the impact of project governance on sustainable project performance within the context of Pakistan's agricultural sector, with a specific focus on the Green Pakistan Initiative (GPI) project. It also investigated the mediating function of big data analytics-artificial intelligence and the moderating role of the project management office in these relationships.

The findings of the study not only provided robust empirical evidence that project governance significantly contributes to improved sustainable outcomes in agricultural projects. But also, big data analysis-artificial intelligence was shown to play a meaningful mediating role, demonstrating how technologies enhance governance outcomes, while project management office emerged as a strategic enabler, moderating the project governance and sustainable project performance relationship.

Although the project management office's moderating effect on the project governance and big data analysis-artificial intelligence relationship was not supported, this opens avenues for future research and institutional improvements. In nutshell, this research enhances the academic discourse on sustainable project management in public sector initiatives and provides ample practical guidance to policymakers and project leaders aiming to attain sustainability objectives through improved governance and technological innovation in the agricultural sector.

Bibliography

- Adam, W. and Campa, J. (2024). The integrated pmo (ipmo): The award-winning journey of opgl.
- Adanma, U. M. and Ogunbiyi, E. O. (2024). A comparative review of global environmental policies for promoting sustainable development and economic growth. *International Journal of Applied Research in Social Sciences*, 6(5):954–977.
- Adebayo, W. G. (2025). Resilience in the face of ecological challenges: Strategies for integrating environmental considerations into social policy planning in africa. *Sustainable Development*, 33(1):203–220.
- Adetoba, O. M. (2024). *Adopting Project Management Standards to the Success of IT Projects*. Thesis.
- Adewuyi, A. Y., Adebayo, K. B., Adebayo, D., Kalinzi, J. M., Ugiagbe, U. O., Ogunraku, O. O., Samson, O. A., and Richard, O. (2024). Application of big data analytics to forecast future waste trends and inform sustainable planning. *World Journal of Advanced Research and Reviews*, 23(1):2469–2479.
- Ahmad, S. I., Ozturk, M. B., and Tatli, A. (2024). National context and the transfer of transgender diversity policy: An institutional theory perspective on multinational corporation subsidiaries in pakistan. *Gender, Work & Organization*, 31(5):1828–1844.
- Ahmed, E. M. (2024). Big data analytics implications on central banking green technological progress. *International Journal of Information Technology & Decision Making*, 23(05):2065–2087.

- Ahtesham, S. (2024). *Measuring Success and Sustainability in Project Management: A Case Study Supporting the Delivery of Quality Education Projects in Pakistan*. Thesis.
- Ahuja, L., Singh, B., and Simon, R. (2024). Data cleaning: Paving a way for accurate and clean data. *Global Journal of Enterprise Information System*, 16(1):18–25.
- Ajiga, D., Okeleke, P. A., Folorunsho, S. O., and Ezeigweneme, C. (2024). Methodologies for developing scalable software frameworks that support growing business needs.
- Akanfe, O., Lawong, D., and Rao, H. R. (2024). Blockchain technology and privacy regulation: Reviewing frictions and synthesizing opportunities. *International Journal of Information Management*, 76:102753.
- Akter, S., Babu, M. M., Hani, U., Sultana, S., Bandara, R., and Grant, D. (2024). Unleashing the power of artificial intelligence for climate action in industrial markets. *Industrial Marketing Management*, 117:92–113.
- Al Humdan, E., Shi, Y., and Behnia, M. (2024). *Research Design and Methodology*, pages 127–166. Springer.
- Ali, I. M. (2024). A guide for positivist research paradigm: From philosophy to methodology. *Ideology Journal*, 9(2).
- Aljehani, S. B., Abdo, K. W., Nurul Alam, M., and Aloufi, E. M. (2024). Big data analytics and organizational performance: Mediating roles of green innovation and knowledge management in telecommunications. *Sustainability*, 16(18):7887.
- Allahham, M., Sharabati, A.-A. A., Hatamlah, H., Ahmad, A. Y. B., Sabra, S., and Daoud, M. K. (2023). Big data analytics and ai for green supply chain integration and sustainability in hospitals. *WSEAS Transactions on Environment and Development*, 19:1218–1230.
- Alqasimi, S. A., Zervopoulos, P. D., Sharker, A. E., and Fousteris, A. E. (2025). A review of the impact of institutions on public sector efficiency. *International Review of Management and Marketing*, 15(3):352–390.

- Alshabragi, A. M., Almohsen, A. S., and Bin Mahmoud, A. A. (2024). Developing a maturity rating system for project management offices. *Systems*, 12(9):367.
- Ammar, M. B. (2024). *The University Project Management Office Model for Sustainable Project Success*, pages 111–171. IGI Global.
- Archana, T. (2025). *Artificial Intelligence (AI) and Digital Competencies in the Public Sector*, pages 95–120. IGI Global Scientific Publishing.
- Atapattu, A. J., Ranasinghe, C., Nuwarapaksha, T. D., Udumann, S. S., and Dissanayaka, N. S. (2024). *Sustainable agriculture and sustainable development goals (SDGs)*, pages 1–27. IGI Global.
- Ayanwale, M. A., Adelana, O. P., Molefi, R. R., Adeeko, O., and Ishola, A. M. (2024). Examining artificial intelligence literacy among pre-service teachers for future classrooms. *Computers and education open*, 6:100179.
- Bakhtiari, V., Piadeh, F., Chen, A. S., and Behzadian, K. (2024). Stakeholder analysis in the application of cutting-edge digital visualisation technologies for urban flood risk management: A critical review. *Expert Systems with Applications*, 236:121426.
- Balaji, K. (2025). E-government and e-governance: Driving digital transformation in public administration. *Public Governance Practices in the Age of AI*, pages 23–44.
- Belhadi, A., Kamble, S., Subramanian, N., Singh, R. K., and Venkatesh, M. (2024). Digital capabilities to manage agri-food supply chain uncertainties and build supply chain resilience during compounding geopolitical disruptions. *International Journal of Operations & Production Management*.
- Bhatt, T. K., Wang, W., Dang, X., and Jan, S. Q. (2024). The role of corporate governance structures in mediating the relationship between external supervision, credit appraisal measurement, capital adequacy, and performance of commercial banks in nepal. *PloS one*, 19(6):e0303926.

- Brunet, M. and Choinière, O. (2024). Governance framework trajectory for major public projects: The case of Canada. *Project Management Journal*, page 87569728241251710.
- Brunet, M. and Choinière, O. (2025). Governance framework trajectory for major public projects: The case of Canada. *Project Management Journal*, 56(1):74–89.
- Bulut, C. and Wu, P. F. (2024). More than two decades of research on IoT in agriculture: a systematic literature review. *Internet Research*, 34(3):994–1016.
- Bushuyev, S., Bushuyev, D., Bushuyeva, V., Bushuyeva, N., and Tykchonovych, Y. (2024). Strategic project management development under influence of artificial intelligence. *Bulletin of the National Technical University "KhPI". Series: Strategic management, portfolio, program and project management*, (1 (8)):3–7.
- Büyükoçkan, G. and Uztürk, D. (2024). Integrated design framework for smart agriculture: Bridging the gap between digitalization and sustainability. *Journal of Cleaner Production*, 449:141572.
- Carboni, J., Duncan, W. R., Gonzalez, M., Pace, M., Smyth, D., and Young, M. (2024). *Sustainable Project Management: The GPM Practice Guide*. GPM Global.
- Chagani, M. A. (2024). *Qualitative Case Study Research on Success Strategies for Healthcare Information Technology Projects*. Thesis.
- Chaudhuri, R., Chatterjee, S., Mariani, M. M., and Wamba, S. F. (2024). Assessing the influence of emerging technologies on organizational data driven culture and innovation capabilities: A sustainability performance perspective. *Technological forecasting and social change*, 200:123165.
- Chen and Asif (2024). Modeling the impact of BDA-AI on sustainable innovation ambidexterity and environmental performance. *Journal of Big Data*, 11(1):124.
- Chen and Khan (2024a). Modeling the impact of BDA-AI on sustainable innovation ambidexterity and environmental performance. *Journal of Big Data*, 11(1):124.

- Chen and Khan, A. (2024b). Modeling the impact of bda-ai on sustainable innovation ambidexterity and environmental performance. *Journal of Big Data*, 11(1):124.
- Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., and Wang, L. C. (2024). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, 41(2):745–783.
- Chinbuah, J. and Peparah, C. O. (2024). Multi-risk management in ghana’s agricultural sector: Strategies, actors, and conceptual shifts—a review. *Review of Agricultural, Food and Environmental Studies*, 105(4):393–418.
- Dahmani, S., Bacha, E., Gardiner, P., and Berkani, A. Agile transformation in uncertain times: exploring diffusion strategies and organisational maturity. In *Supply Chain Forum: An International Journal*, volume 26, pages 28–38. Taylor & Francis.
- Desgourdes, C. and Ram, J. (2024). The role of big data analytics for decision-making in projects: uses and challenges. *Enterprise Information Systems*, 18(4):2317153.
- Didas, M., Chali, F., and Elisa, N. (2024). The nexus of big data and big data analytics for managerial business decision-making: A systematic review analysis. *Journal of ICT Systems*, 2(1):36–58.
- Dugbartey, A. N. (2025). Systemic financial risks in an era of geopolitical tensions, climate change, and technological disruptions: Predictive analytics, stress testing and crisis response strategies. *International Journal of Science and Research Archive*, 14(02):1428–1448.
- Duman-Altan, A., Beyca, m. F., and Zaim, S. (2024). Link between digital technologies adoption and sustainability performance: Supply chain traceability/resilience or circular economy practices. *Sustainability*, 16(19):8694.
- Efunniyi, C. P., Abhulimen, A. O., Obiki-Osafiele, A. N., Osundare, O. S., Agu, E. E., and Adeniran, I. A. (2024). Strengthening corporate governance and

- financial compliance: Enhancing accountability and transparency. *Finance & Accounting Research Journal*, 6(8):1597–1616.
- Emeka-Okoli, S., Nwankwo, T. C., Otonnah, C. A., and Nwankwo, E. E. (2024). Effective stakeholder relationship management in the oil & gas sector: A conceptual and review perspective. *Finance & Accounting Research Journal*, 6(3):372–383.
- Fatima, B. (2024). *Social-ecological resurgence through farmers' traditional knowledge and agroecology in Pakistan*. Thesis.
- Faul, F., Erdfelder, E., Buchner, A., and Lang, A.-G. (2009). Statistical power analyses using g* power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, 41(4):1149–1160.
- Fayssal, F. (2024). Sustainable water management in naturally deforested regions & proportional accreditation: Uae case study.
- Feng, T., Qamruzzaman, M., Sharmin, S. S., and Karim, S. (2024). Bridging environmental sustainability and organizational performance: The role of green supply chain management in the manufacturing industry. *Sustainability*, 16(14):5918.
- Fu, Y., Leiringer, R., and Gottlieb, S. C. (2024). Navigating institutional demands: Organizational responses to institutional complexity in megaproject delivery. *International Journal of Project Management*, page 102602.
- Fuenfschilling, L. and Truffer, B. (2014). The structuration of socio-technical regimes—conceptual foundations from institutional theory. *Research policy*, 43(4):772–791.
- Fuentes-Peñailillo, F., Gutter, K., Vega, R., and Silva, G. C. (2024). Transformative technologies in digital agriculture: Leveraging internet of things, remote sensing, and artificial intelligence for smart crop management. *Journal of Sensor and Actuator Networks*, 13(4):39.
- Haghighi, H. and Takian, A. (2024). Institutionalization for good governance to reach sustainable health development: a framework analysis. *Globalization and Health*, 20(1):5.

- Hess, K. M. (2025). Corporate moral responsibility vs. corporate social responsibility: Friedman was right. *Journal of Business Ethics*, pages 1–16.
- Huda, N. and Risman, A. (2024). The behavioral finance of msme: Financial inclusion and financial technology (case study on msme in west jakarta).
- Ibrahim, M. (2024). *Unleashing the Potential of Artificial Intelligence for Dynamic Supply Chain Optimization and Sustainability*, pages 381–410. IGI Global.
- Imjai, N., Swatdikun, T., Rungruang, P., Basiruddin, R., and Aujirapongpan, S. (2024). Empowering generation z accountants in the era of data complexity and open innovation: Nurturing big data analytics, diagnostic, and forensic accounting skills. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(2):100308.
- Indiazi, C. (2025). The roles of ai on predictive analytics in managing climate change risks in reinsurance. *Gospodarka i Innowacje.*, 55:39–49.
- Ismail, S. M. A. and Salama, G. E. (2025). *Components and Architecture of Project Management Information Systems: Exploring PMIS Dynamics*, pages 49–98. IGI Global Scientific Publishing.
- Jaber, M. M., Ali, M. H., Abd, S. K., Jassim, M. M., Alkhayyat, A., Aziz, H. W., and Alkhuwayldee, A. R. (2022). Predicting climate factors based on big data analytics based agricultural disaster management. *Physics and Chemistry of the Earth, Parts A/B/C*, 128:103243.
- Jariwala, M. Integrating artificial intelligence to enhance sustainability in project management practices. *International Journal of Computer Applications*, 975:8887.
- Jensén, E. (2025). Key competences in a transition towards ai for sustainability.
- Kalleparambil, S., Mekala, S., Ibrahim, A., and Granata, M. Maximizing efficiency: Centralized project material management for owner operators in oil and gas. In *Abu Dhabi International Petroleum Exhibition and Conference*, page D031S082R007. SPE.

- Karunarathna, I., Gunasena, P., Hapuarachchi, T., and Gunathilake, S. (2024). Comprehensive data collection: Methods, challenges, and the importance of accuracy. *Uva Clinical Research*, pages 1–24.
- Kehinde, O. Leveraging data-driven decision-making for enhanced risk management and resource allocation in projects.
- Khan, A. and Chen, S.-C. (2024). Modeling the impact of bda-ai on sustainable innovation ambidexterity and environmental performance. *Journal of Big Data*, 11(1):124.
- Kiswanto, A., Sugiarto, S., Hendratono, T., Rohman, N., and Maulana, R. (2025). Operational risk management and user satisfaction as drivers of homestay loyalty in nglanggeran tourism village, gunungkidul, yogyakarta. *Asian Journal of Social and Humanities*, 3(5):893–912.
- Kumar, A. and Praveenakumar, S. (2025). *Research methodology*. Authors Click Publishing.
- Langseth, M. (2024). Data-driven decision-making in the public procurement system: The case of norway.
- Leal Filho, W., Dibbern, T., Dinis, M. A. P., Cristofolletti, E. C., Mbah, M. F., Mishra, A., Clarke, A., Samuel, N., Apraiz, J. C., and Abubakar, I. R. (2024). The added value of partnerships in implementing the un sustainable development goals. *Journal of Cleaner Production*, 438:140794.
- Lee, M., Pak, A., and Roh, T. (2024). The interplay of institutional pressures, digitalization capability, environmental, social, and governance strategy, and triple bottom line performance: A moderated mediation model. *Business Strategy and the Environment*, 33(6):5247–5268.
- León-Bravo, V. and Caniato, F. (2024). Sustainability performance measurement in the food supply chain: Trade-offs, institutional pressures, and contextual factors. *European Management Journal*, 42(4):633–646.

- Li, X., Dewi, A. U., and Shin, J. C. (2025). The myth of institutional transplantation: disjunctions between formal structures and power distribution in university governance in lao pdr. *Higher Education*, pages 1–20.
- Liebig, M. A., Abendroth, L. J., Robertson, G. P., Augustine, D., Boughton, E. H., Bagley, G., Busch, D. L., Clark, P., Coffin, A. W., and Dalzell, B. J. (2024). The ltar common experiment: Facilitating improved agricultural sustainability through coordinated cross-site research. *Journal of Environmental Quality*.
- Lim, W. M. (2024). A typology of validity: content, face, convergent, discriminant, nomological and predictive validity. *Journal of Trade Science*, 12(3):155–179.
- Liu, G., Liu, J., Gao, P., Yu, J., and Pu, Z. (2024). Understanding mechanisms of digital transformation in state-owned enterprises in china: An institutional perspective. *Technological Forecasting and Social Change*, 202:123288.
- Magakwe, J. (2025). *Advancing Governance: Role of Data Analytics in Driving Evidence-Based Decision-Making in Public Administration*. IntechOpen.
- Makhdoom, Q., Junejo, I., Sohu, J. M., Shah, S. M. M., Alwadi, B. M., Ejaz, F., and Hossain, M. B. (2024). Impact of green supply chain management on sustainable performance: A dual mediated-moderated analysis of green technology innovation and big data analytics capability powered by artificial intelligence. *F1000Research*, 13:1140.
- Malik, Wang, L., and Zhu, F. (2024). Understanding variations of governmentality and governance structures at the project level in project-based organizations. *International Journal of Managing Projects in Business*, 17(4/5):644–685.
- Malik, T. A. (2024). Navigating sustainable supply chains in pakistan’s textile industry: Addressing regulatory, infrastructural, and social challenges for enhanced sustainability.
- Marrucci, L., Daddi, T., and Iraldo, F. (2024). Creating environmental performance indicators to assess corporate sustainability and reward employees. *Ecological Indicators*, 158:111489.

- Menon, S. (2024). Best practices and implementation challenges in effective project management. *International Business Research*, 17(2):1913–9013.
- Moghaddasi, S., Kordani, K., Sarvari, H., and Rashidi, A. (2025). Redefining project management: Embracing value delivery offices for enhanced organizational performance. *Buildings*, 15(7):1176.
- Muhammad, K. M. A., Kariri, E. I. D. A., Dhayhi, E. A. S., Alkathami, E. S. A., Alqarni, E. T. A. M., and Alzawawi, E. H. H. (2024). Role of the project management office (pmo) in enhancing project success factors in saudi arabia: A case study of the jazan region. *International Research Journal of Innovations in Engineering and Technology*, 8(3):111.
- Namuag, P. (2024). Contributions of project management offices (pmos) to organizational success-a bibliometric analysis and systematic literature review on value delivery and best practices.
- Neiroukh, S., Emeagwali, O. L., and Aljuhmani, H. Y. (2024). Artificial intelligence capability and organizational performance: unraveling the mediating mechanisms of decision-making processes. *Management Decision*.
- Njue, N. G. and Kariuki, S. N. (2024). Contextual and structural factors, project modelling and sustainability of entrepreneurial development projects: A conceptual framework. *European Journal of Business and Management Research*, 9(2):35–42.
- Nowakowska-Siuta, R. (2024). How should comparative research be conducted and what purpose does it serve? *Annual Review of Comparative and International Education 2023*, pages 57–79.
- Nugroho, D. and Angela, P. (2024). The impact of social media analytics on sme strategic decision making. *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, 5(2):169–178.
- Nwaogbe, G., Urhoghide, O., Ekpenyong, E., and Emmanuel, A. (2025). Green construction practices: Aligning environmental sustainability with project efficiency. *International Journal of Science and Research Archive*, 14(01):189–201.

- Obana, L. R. (2024). Collaboration of artificial intelligence and project management.
- Ojoboh, T. M. and Igben, H. G. (2024). Impact of research methodology on data quality and research findings. *JPPUMA: Jurnal Ilmu Pemerintahan dan Sosial Politik UMA (Journal of Governance and Political Social UMA)*, 12(1):34–42.
- Oluwaseyi, J. and Stilinski, D. (2024). Aligning it project evaluation with sustainable development goals (sdgs): A framework for developing economies.
- Orieno, O. H., Ndubuisi, N. L., Eyo-Udo, N. L., Ilojiana, V. I., and Biu, P. W. (2024). Sustainability in project management: A comprehensive review. *World Journal of Advanced Research and Reviews*, 21(1):656–677.
- Padmavathi, M., Manikandan, M., Sumithra, M., Dhivyasri, G., and Inbanathan, F. P. (2024). *Impact of Advanced Sensing Technologies in Agriculture with Soil, Crop, Climate and Farmland-Based Approaches Using Internet of Things*, pages 109–146. Springer.
- Park, Y. S., Konge, L., and Artino Jr, A. R. (2020). The positivism paradigm of research. *Academic medicine*, 95(5):690–694.
- Pattanaik, P. K., Gupta, S., Pani, A. K., Himanshu, U., and Pappas, I. O. (2024). Impact of inter and intra organizational factors in healthcare digitalization: a conditional mediation analysis. *Information Systems Frontiers*, pages 1–28.
- Priya, M. S. R. (2024). *The Triple Bottom Line of Green Transitions: Assessing the Economic, Social, and Environmental Impacts of Sustainable Development Goals by 2030*, pages 182–201. IGI Global.
- Raihan, A. (2024). A review of the potential opportunities and challenges of the digital economy for sustainability. *Innovation and Green Development*, 3(4):100174.
- Ram, J. and Desgourdes, C. (2024). Using big data analytics (bda) for improving decision-making performance in projects. *Journal of Engineering and Technology Management*, 74:101849.

- Rane and Choudhary (2024). Artificial intelligence for enhancing resilience. *Journal of Applied Artificial Intelligence*, 5(2):1–33.
- Rane and Paramesha (2024). Artificial intelligence and business intelligence to enhance environmental, social, and governance (esg) strategies: Internet of things, machine learning, and big data analytics in financial services and investment sectors. *Trustworthy Artificial Intelligence in Industry and Society*, pages 82–133.
- Rashid, A., Baloch, N., Rasheed, R., and Ngah, A. H. (2025). Big data analytics-artificial intelligence and sustainable performance through green supply chain practices in manufacturing firms of a developing country. *Journal of Science and Technology Policy Management*, 16(1):42–67.
- Riaz, A. and Ali, F. H. (2025). Institutional pressure and responsible innovation: how big data analytics adoption drives manufacturing smes toward competitiveness. *Journal of Global Responsibility*, 16(2):245–264.
- Riipa, M. B., Begum, N., Hriday, M. S. H., and Haque, S. A. (2025). Role of data analytics in enhancing business decision-making and operational efficiency. *International Journal of Communication Networks and Information Security*, 17(2):400–412.
- Riskin, D. J., Monda, K. L., Gagne, J. J., Reynolds, R., Garan, A. R., Dreyer, N., Muntner, P., and Bradbury, B. D. (2025). Implementing accuracy, completeness, and traceability for data reliability. *JAMA Network Open*, 8(3):e250128–e250128.
- Sabharwal, R. (2025). An innovative big data analytics method for detecting data abnormalities in business organisations.
- Saleem, A., Anwar, S., Nawaz, T., Fahad, S., Saud, S., Ur Rahman, T., Khan, M. N. R., and Nawaz, T. (2024). Securing a sustainable future: the climate change threat to agriculture, food security, and sustainable development goals. *Journal of Umm Al-Qura University for Applied Sciences*, pages 1–17.
- Sarstedt, M., Richter, N. F., Hauff, S., and Ringle, C. M. (2024). Combined importance–performance map analysis (cipma) in partial least squares structural

- equation modeling (pls-sem): a smartpls 4 tutorial. *Journal of Marketing Analytics*, pages 1–15.
- Saxena, M., Bagga, T., Gupta, S., and Kaushik, N. (2024). Exploring common method variance in analytics research in the indian context: A comparative study with known techniques. *FIIB Business Review*, 13(5):553–569.
- Shah Alam, S., Ahsan, M. N., Masukujjaman, M., Kokash, H. A., and Ahmed, S. (2024). Adoption of big data analytics and artificial intelligence among hospitality and tourism companies: Perceive performance perspective. *Journal of Quality Assurance in Hospitality & Tourism*, pages 1–35.
- Shamsudin, M. F., Hassim, A. A., and Abd Manaf, S. (2024). Mastering probability and non-probability methods for accurate research insights. *Journal of Postgraduate Current Business Research*, 9(1):38–53.
- Sheikh, A. T., Chaudhary, A. K., Mufti, S., Davies, S., and Rola-Rubzen, M. F. (2024). Soil fertility in mixed crop-livestock farming systems of punjab, pakistan: The role of institutional factors and sustainable land management practices. *Agricultural Systems*, 218:103964.
- Shukla, A. and Agnihotri, A. (2024). Ai-driven smart management processes: Transforming decision-making and shaping the future. *Library of Progress-Library Science, Information Technology & Computer*, 44(3).
- Siddiqui, A. H., VP, S., Chowdhary, H., Krishna, R., Muniyandy, E., and Maguluri, L. P. (2024). Harnessing big data: Strategic insights for it management. *International Journal of Advanced Computer Science & Applications*, 15(7).
- Simon, R. and Hasan, S. (2025). Patriarchy and gender inequality: A comprehensive analysis of women’s empowerment in contemporary india. *Gender Issues*, 42(1):7.
- Singh, A. and Dhingra, L. (2024). the digitalised world: New age of technology. *Unleashing Absorptive Capacity and Unlearning for Organizational Excellence*, page 41.
- Sirisomboonsuk, P., Gu, V. C., Cao, R. Q., and Burns, J. R. (2018). Relationships between project governance and information technology governance and their

- impact on project performance. *International journal of project management*, 36(2):287–300.
- Sohu, J. M., Mirani, M. A., Shaikh, S. N., Memon, U., Bhanbhro, A., and Kherazi, F. Z. (2025). *Integrating Green Human Resource Management and Big Data Analytics Capability for Sustainable Environmental Performance in SMEs*, pages 145–172. IGI Global.
- Soori, M., Jough, F. K. G., Dastres, R., and Arezoo, B. (2024). Ai-based decision support systems in industry 4.0, a review. *Journal of Economy and Technology*.
- SS, V. C., Hareendran, A., and Albaaji, G. F. (2024). Precision farming for sustainability: An agricultural intelligence model. *Computers and Electronics in Agriculture*, 226:109386.
- Sun, J. and Xia, Y. (2024). Pretreating and normalizing metabolomics data for statistical analysis. *Genes & Diseases*, 11(3):100979.
- Talpur, F., Tabbassum, K., Irfan, M., Luhana, K. K., Koondhar, M. Y., Memon, A. B., Maher, Z. A., and Ali, A. (2024). Exploring nexus among big data analytics, artificial intelligence and operational performance.
- Tamym, L. and Benyoucef, L. How can big data analytics and artificial intelligence improve networked enterprises’s sustainability? In *2024 International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA)*, pages 1–6. IEEE.
- Tan, F., Zhang, Q., Mehrotra, A., Attri, R., and Tiwari, H. (2024). Unlocking venture growth: Synergizing big data analytics, artificial intelligence, new product development practices, and inter-organizational digital capability. *Technological Forecasting and Social Change*, 200:123174.
- Tchassem, T. (2024). *A Qualitative Study Leveraging Artificial Intelligence and Big Data Analytics to Improve Organizational Risk Management Frameworks*. Thesis.
- Tetteh, L. A., Agyenim-Boateng, C., and Simpson, S. N. Y. (2024). Institutional pressures and accountability processes in pursuit of sustainable development goals:

- Insights from ghanaiian indigenous oil companies. *Corporate Social Responsibility and Environmental Management*, 31(1):89–107.
- Tumpa, R. J. and Naeni, L. (2025). Improving decision-making and stakeholder engagement at project governance using digital technology for sustainable infrastructure projects. *Smart and Sustainable Built Environment*.
- Twaissi, N. M., Almomany, G. A., Masa'dehs, R., and Ashal, N. M. (2025). The impact of effective project governance on project success: The mediation role of relational norms. *Calitatea*, 26(204):57–65.
- Umasekar, V. (2024). Evaluating the role of project management offices (pmos) in large-scale construction projects: insights from construction industry professionals. *International Journal of Multidisciplinary: Applied Business and Education Research*, 5(1):302–310.
- Varajão, J., Lopes, L., and Tenera, A. (2024). Framework of standards, guides and methodologies for project, program, portfolio, and pmo management. *Computer Standards & Interfaces*, page 103888.
- Veronika, A. and Latief, Y. (2025). The dynamics of pmo in construction companies: A systematic literature review. *Journal of Project Management Research (JPMR)*, 1(1):1.
- Waheed, A., Kousar, S., Khan, M. I., and Fischer, T. B. (2024). Environmental governance in pakistan: Perspectives and implications for the china-pakistan economic corridor plan. *Environmental and Sustainability Indicators*, 23:100443.
- Wang, J., Shu, X., Bach, B., and Hinrichs, U. (2024). Visualization atlases: Explaining and exploring complex topics through data, visualization, and narration. *IEEE Transactions on Visualization and Computer Graphics*.
- Willie, M. M. (2024). Population and target population in research methodology. *Golden Ratio of Social Science and Education*, 4(1):75–79.
- Woolcott, J. (2024). *Advancing PMO Maturity: A Framework to Integrate Data Governance and Data Ethics Measures in Project Management Maturity Assessments*. Thesis.

- Wukich, J. J., Neuman, E. L., and Fogarty, T. J. (2024). Show me? inspire me? make me? an institutional theory exploration of social and environmental reporting practices. *Journal of Accounting & Organizational Change*, 20(4):673–701.
- Xiao, M., Luo, S., and Yang, S. (2024). Synergizing technology and tradition: A pathway to intelligent village governance and sustainable rural development. *Journal of the Knowledge Economy*, pages 1–56.
- Yousaf, M., Linzhuo, and Fangwei (2024). Understanding variations of governmentality and governance structures at the project level in project-based organizations. *International Journal of Managing Projects in Business*, 17(4/5):644–685.
- Yuning, M., Taozhen, H., Saleem, N., and Hassan, A. H. (2024). Institutional pressure and low carbon innovation policy: the role of ems, environmental interpretations and governance heterogeneity. *Frontiers in Environmental Science*, 12:1385062.
- Zada, M., Khan, J., Saeed, I., Zada, S., and Yong Jun, Z. (2024). Linking sustainable leadership with sustainable project performance: mediating role of knowledge integration and moderating role of top management knowledge values. *Journal of Knowledge Management*, 28(6):1588–1608.
- Zafarullah, H. and Azmat, F. (2024). *Governance-Sustainable Development Nexus in South Asia: An Introduction*, pages 3–23. Springer.
- Zahari, A. I., Said, J., Muhamad, N., and Ramly, S. M. (2024). Ethical culture and leadership for sustainability and governance in public sector organisations within the esg framework. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(1):100219.
- Zhou, Y., Aryal, S., and Bouadjenek, M. R. (2024). Review for handling missing data with special missing mechanism. *arXiv preprint arXiv:2404.04905*.

Appendix-I



CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Management Sciences

Dear Respondent,

As a master's degree candidate in project management at Islamabad's Capital University of Science & Technology, I want to write my thesis on the following topic: **"Impact of Project Governance on Sustainable Project Performance in Pakistan's Agricultural Sector; Big Data Analysis-Artificial Intelligence as a Mediator and PMO as a Moderator."**

For this purpose, I have drafted a survey. I assure that we will protect the confidentiality of your identity as the responder. You are free to speak your mind on the reality you encounter on the ground. The survey should take no more than ten to fifteen minutes of your time, and we promise to utilize the data we collect for only academic purposes.

For more queries, please email mukhtarawan100@gmail.com. I really appreciate your time for filling up this questionnaire. Thanks, in anticipation for your help and support

Sincerely, Regards,

Mukhtar Ahmed Awan

Demographics - Please tick (✓) the relevant box

Gender

Male	Female
------	--------

Age

21 to 30 years	41 to 50 years
31 to 40 years	More than 50 years

Experience

Less than 5 years	11 to 15 years
5 to 10 years	>15 years

Education Level

Bachelor	MS/M.Phil.
Master	PhD.

Experience in Current Organization

Less than 3 years	6 to 10 years
3 to 5 years	>10 years

Position

Project manager	Human resource directors
Agriculture expert	CEOs
Senior managers	

Keeping in view your employer, please indicate the extent of your agreement and disagreement by entering the appropriate option.

Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agreed = 4, Strongly Agreed = 5

(Please Reply Keeping in View Green Pakistan Initiative, Agriculture Project)

Project Governance (PG)						
Sr No:		1	2	3	4	5
1	A reasonably centralized management structure, appropriate number of managers, well-organized departments, robust resource utilization capabilities, and commendable flexibility exists in Green Pakistan Initiative.					
2	Stakeholders' roles, duties, responsibilities, benefits, and expectations are clearly laid out in Green Pakistan Initiative.					
3	Prompt reaction, excellent supply-chain integration, and procurement system is adopted in Green Pakistan Initiative.					
4	A fair project finance framework, various investment and financing channels are adopted in Green Pakistan Initiative.					
5	Management structures are enforced in Green Pakistan Initiative; that are both thorough and simple to understand, with measurable and decomposable levels.					
6	A robust and organized system for exchanging information and receiving feedback exists in Green Pakistan Initiative.					

7	Green Pakistan Initiative is creating for coordination, methodologies and a protocol for cooperation.					
8	Green Pakistan Initiative uses protocols for handling conflicts, mitigation of authority, and arbitration, and preparations for handling conflicts in the event of an emergency.					
9	Green Pakistan Initiative adopts diverse incentive methods (e.g., spiritual, monetary, and publicity rewards), transparent incentive standards and evaluation indicators.					
10	The establishment of an accountability structure exists in Green Pakistan Initiative; regular and ad hoc inspections by functional groups and the management team.					
11	A distinct border exists in Green Pakistan Initiative between responsibilities and benefits; use the highest decision-making authority.					
12	Green Pakistan Initiative plans several events to build and nourish organization's culture; highlight a value system.					
13	Green Pakistan Initiative maintains a stable market environment and a regulated labour, and engineering consultancy.					
14	Green Pakistan Initiative establishes a suitable regulatory department to oversee and control the project life cycle.					
15	Green Pakistan Initiative utilizes various public communication avenues disseminate project details; establish a public oversight channel to solicit public feedback.					

Project management Office (PMO)						
Sr No:		1	2	3	4	5
1	One benefit of using effective reporting systems in Green Pakistan Initiative is the time it saves when sharing project information.					
2	Project management approaches used in Green Pakistan Initiative make it easier to handle interfaces across different disciplines.					
3	Green Pakistan Initiative is offering mentoring services to project managers which assists them in handling challenging.					
4	In Green Pakistan Initiative, project leaders can determine the optimal course of action to resolve challenges while minimizing negative effects via rigorous risk analysis.					
5	In Green Pakistan Initiative, improving coordination for supply procurement is facilitated by managing project interfaces with suppliers.					
6	Members of a multidisciplinary team in Green Pakistan Initiative are better able to coordinate and handle task interfaces when share knowledge.					
7	Green Pakistan Initiative alignment with the ever-changing construction environment may be enhanced via the use of portfolio management methods.					
8	Project Management Office in Green Pakistan Initiative assess and coordinate project management tools and systems so they may be integrated into one platform.					

9	In Green Pakistan Initiative, it is possible to overcome uncertainty and prevent similar difficulties from happening again by sharing lessons learnt across initiatives.					
10	PMOs reduced related uncertainty by advising projects on how to handle new technology on building sites.					
11	Third parties engaged in a project may be integrat- edly overseen by project governance structure.					
12	In order to prevent any delays in the procurement process, primary contractors might benefit from monitoring the performance.					

Big Data Analysis – Artificial Intelligence (BDA-AI)						
Sr No:		1	2	3	4	5
1	Supplier analysis for agricultural goods was greatly facilitated by big data analysis – Artificial intelligence in Green Pakistan Initiative.					
2	Thorough inventory of all high-tech equipment used in agriculture was planned and conducted in GPI project.					
3	Using data analysis technologies, warehouse operations were significantly improved during the execution stage of Green Pakistan Initiative.					
4	Thorough monitoring of processes and equipment was carried out at all stages of Green Pakistan Initiative.					
5	Transportation planning for move of machinery was conducted using data analysis during initiation of Green Pakistan Initiative.					

6	Demand forecasting is accurate throughout the Green Pakistan Initiative project by employing data analysis.					
7	HR management of Green Pakistan Initiative project was optimized through big data analysis.					
8	Application of data-driven strategies was manifested to the cost of equipment, seeds, and infrastructure during planning stage of Green Pakistan Initiative.					

Sustainable Project Performance (SPP)						
Sr No:		1	2	3	4	5
1	The Green Pakistan Initiative project's long-term profitability makes it financially feasible at all stages.					
2	Green Pakistan Initiative project provides job possibilities for the local community, which in turn boosts economy & Social Viability.					
3	Green Pakistan Initiative goals include meeting the needs of local communities, which includes improving livelihoods and ensuring food security.					
4	Farmers, communities and indigenous peoples of Green Pakistan Initiative project are local stakeholders that the project interacts with and benefits.					
5	Steps have been taken to reduce the Green Pakistan Initiative project's impact on the environment, which includes noise, water, and air pollution.					
6	During the building and operating stages of the Green Pakistan Initiative project, energy conservation and efficient resource usage are included.					

7	Continuity and flexibility are ensured by Green Pakistan Initiative project, even during circumstances such as climate change and market changes.					
8	To ensure that the advantages of the Green Pakistan Initiative project continue even after it is finished, there are plans in place for knowledge transfer and capacity development.					

Appendix-II



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Ref: CUST/FMSS/REC/2025-1353

RESEARCH ETHICS COMMITTEE CERTIFICATE OF REVIEW AND SUPPORT

This is to certify that Project titled: *“Impact of Project Governance on Sustainable Project Performance in Pakistan’s Agricultural Sector; Big Data Analysis - Artificial Intelligence as a Mediator and PMO as a Moderator.”* submitted by *Mukhtar Ahmad Awan* and supervised by: *Dr. Syed Arslan Haider* reviewed by the Research Ethics Committee of Faculty of Management and Social Science, meets the requirements of the American Psychological Association’s Ethical guidelines for Human Research and is **REVIEWED** and **APPROVED** by Research Ethics Committee of Faculty of Management and Social Sciences.

It is the Scholar’s responsibility to ensure that all researchers associated with this project are aware of the conditions of approval and which documents have been approved.

The Scholar is required to notify the Research Ethics Committee in case of any amendment in the project, specifically:

- Any significant change to the project and the reason for that change, including an indication of ethical implications (if any)
- Serious adverse effects on participants and the actions taken to address those effects
- Any other unforeseen events or unexpected developments that merit notification
- The inability of the Principal Investigator to continue in that role, or any other change in research personnel involved in the project
- A delay of more than 12 months in the commencement of the project; and,
- Termination or closure of the project.

Dr. Sabahat Haqqani

Convener, Research Ethics Committee
Faculty of Management and Social Sciences
Capital University of Science and Technology
Islamabad

Appendix-III

Participant Consent Form

I understand the procedure described above. My question has been answered to my satisfaction. I acknowledge that I am participating in this study at my own free will. I also understand that I may refuse to participate or stop participating at any time.

Name: _____ Signature: _____ Date: _____