Enhancing Performance of Agri-Business through Sustainable Project Management and Technological Orientation: Institutional Theory Perspective

Abstract

The agri-business sector faces mounting pressure due to a persistently challenging business environment, rapidly increasing population, and rising food demand. Drawing on institutional theory, this study explores the role of sustainable project management in enhancing the short- and long-term performance of agri-business projects, with a particular focus on technological orientation as an alternative to traditional approaches. A quantitative research design was employed using a questionnaire survey, with data collected from 342 project managers engaged in agri-business infrastructure projects. The findings confirm that sustainable project management has both direct and indirect positive effects on project performance through technological orientation. These results highlight the critical need for agriculture managers to integrate advanced technologies alongside sustainable project management practices across all project phases—from planning to completion—to effectively address current and future agricultural demands in the context of rapid population growth.

Keywords: Project performance, sustainable project management, technological orientation, agri-business.

1. Introduction

The world's population is expected to reach 9.8 billion by 2050 and 11.2 billion by 2100, indicating that food production will need to double by that time to meet demand (Phokwe & Manganyi, 2023; Abbate et al., 2023). By 2050, it is anticipated that the urbanization trend in developing nations would also be increasing rapidly (Khan et al., 2021). Several studies have closely examined the adverse consequences of rapid population, such as deteriorating air quality, disrupting natural habitats, and weakening social cohesion among residents (Younis et al., 2020). A number of issues, such as climate change, a high rate of biodiversity loss, land degradation due to compaction, erosion, pollution, and salinization, depletion and pollution of water resources, rising production costs, a steadily declining number of farms and, in turn, poverty and a decline in the rural population, threaten agriculture's ability to meet human needs both present and in the future (Rivera-Ferre et., 2013).

The recent literature has highlighted that although agribusiness performance can significantly be increased by the use of latest technologies (Kaushik et al., 2024), but it is also having adverse effects. This includes but limited to the negative environmental effects from improper use of pesticides and chemicals, and potentially high upfront costs of technological advanced equipment (Patel et al.,2024). Yuan et al. (2024) further reported that degradation of soil and water resources caused using modern technology is a huge threat to environment and human life. As a result, the agricultural community faces significant challenges in effectively adopting and utilizing technology. Therefore, a strong technological orientation is essential and must be strategically implemented to maximize its benefits in agricultural practices. The situation is further fuelled with the rapid increase of demand in food (Sridhar et al., 2023). This paradox creates a complex challenge for the agri-business sector, where striking the right balance between meeting growing food demands and effectively utilizing technology is essential for sustainable success. Through the lens of institutional theory, agri-business can navigate the ongoing pressures of climate change, evolving stakeholder expectations, rapid technological advancements, and shifting government policies, providing a strategic framework for resilience and adaptation.

Institutional theory explains how organizations are influenced by the formal and informal rules, norms, and expectations of their external environment (Scott, 2008). It emphasizes that businesses, including those in the agri-business sector, must adapt to institutional pressures—such as regulatory frameworks, stakeholder demands, technological advancements, and socio-environmental changes—to maintain legitimacy and long-term success (DiMaggio & Powell, 1983). In the context of agri-business, institutional theory provides a framework for understanding how sustainable project management practices and technological orientation are shaped by external pressures, including climate change policies, government regulations, and shifting consumer preferences for sustainable agriculture (North, 1990). By aligning with these institutional expectations, agri-businesses can enhance their adaptability and resilience while ensuring long-term performance and food security.

Sustainable project management has emerged as a critical determinant of project success, particularly in sectors requiring long-term sustainability and resilience, such as agri-business. Sustainable project management integrates environmental, social, and economic considerations into project planning and execution, ensuring both short- and long-term benefits (Dubois & Silvius, 2020). Previous studies have demonstrated that sustainability-oriented management practices contribute significantly to project performance across various domains (Chow et al., 2021; Sunassee et al., 2021). However, within the agri-business sector, the role of sustainable project management in enhancing infrastructure project outcomes remains an area requiring further empirical investigation.

A key factor influencing the relationship between sustainable project management and project performance is technological orientation. Technological orientation refers to the extent to which an organization embraces innovation and integrates advanced technologies into its operations (Zhang et al., 2024). Prior research highlights the mediating role of sustainability between innovation and competitiveness (Zhang et al., 2024), suggesting that technological advancements are essential for achieving long-term project success. Moreover, Hashim et al. (2021) argue that project sustainability management mediates the relationship between managerial attributes and project performance, highlighting the significance of sustainable practices in shaping project outcomes. In this study, the focus is placed on understanding how technological orientation mediates the relationship between sustainable project management and the short- and long-term performance of infrastructure projects in agri-business.

Given the global increase in population and rising agricultural demands, agri-business enterprises must adapt their project management strategies to ensure sustainability and efficiency. Institutional theory, institutional logic, and isomorphism provide valuable theoretical frameworks to understand how businesses respond to external pressures and integrate sustainability into their operations. Technological orientation and agricultural infrastructure development act as coercive forces that influence project success in this dynamic environment. By exploring these relationships, this research aims to contribute to the broader discourse on sustainable project management and provide practical insights for enhancing agri-business infrastructure projects.

This study makes several significant contributions to the fields of project management and agri-business. First, while institutional theory has been extensively applied to explore environmental management within organizations, producing mixed results (Hoffman, 1999; Delmas, 2002; Bansal & Clelland, 2005), this study offers new empirical evidence on the positive relationship between sustainable project management and the performance of agri-business projects, particularly through the mediating role of technological orientation. Second, the study highlights that sustainability and technological orientation are not only crucial for meeting the increasing demand for food products but also vital for enhancing the legitimacy of project-based agricultural organizations. Third, this research addresses the limitations of traditional agricultural practices by advocating for a paradigm shift towards sustainable project management and technological orientation. Forth, this study also contributes to the application and understanding of institutional theory in the context of agri-business in Pakistan. While institutional theory has traditionally focused on environmental management within organizations (Hoffman, 1999; Delmas, 2002; Bansal & Clelland, 2005), its application to the agri-business sector, particularly in Pakistan, has been limited.

2. Theory and hypotheses

2.1 Institutional Theory in Agri-Business

According to DiMaggio and Powell (2004), institutional legitimacy refers to the adherence to established norms, regulations, and practices within an institutional framework. In the context of agri-business, legitimacy is defined as compliance with existing technological practices, procedural standards, regulatory frameworks, and societal expectations within legally recognized structures (Starobin, 2021).

Institutional theory identifies three key mechanisms that drive isomorphism in organizational strategies, structures, and procedures: coercive, normative, and mimetic pressures (DiMaggio & Powell, 1983). Coercive isomorphism arises from the influence of powerful authorities, such as governments and regulatory bodies, which enforce compliance through policies and infrastructure requirements in the agri-business sector (Kaukab, 2024). These coercive pressures play a critical role in promoting sustainability and environmental management (Kilbourne et al., 2002).

Normative isomorphism, on the other hand, ensures that organizations adhere to established professional standards and legal frameworks, thereby enhancing their legitimacy (Sarkis et al., 2011). This type of pressure stems from a societal obligation to conform based on widely accepted norms regarding what businesses or individuals ought to do (March & Olsen, 1989). For instance, implementing environmental, social, and economic sustainability practices in agri-business is a form of normative isomorphism (Amin-Chaudhry et al., 2022).

Mimetic isomorphism occurs when organizations emulate the strategies of successful competitors to enhance their legitimacy and competitive advantage (Sarkis et al., 2011). In agri-business, the development of dedicated agricultural infrastructure to ensure a sustainable supply of products to the market exemplifies mimetic isomorphism (Barbosa, 2024).

While resource availability remains a crucial factor in agri-business, institutional theory provides a robust framework for analysing the external forces that shape organizational legitimacy and long-term survival. These forces include cultural norms, social expectations, regulatory environments, historical traditions, and economic incentives (Brunton et al., 2010). One of the key strengths of institutional theory is its ability to explain the adoption of organizational behaviours that may not have an immediate financial benefit but are essential for maintaining legitimacy and sustainability (DiMaggio & Powell, 1983).

2.2 Institutional logics

Institutional logic refers to the socially constructed, historically embedded patterns of material practices, assumptions, values, beliefs, and rules that institutions employ to structure time and space, sustain their material existence, and provide meaning to their social reality

(Durand & Thornton, 2018). This definition highlights the role of institutional logic as a framework that links institutional practices, regulatory systems, and individual perceptions.

Existing literature indicates that infrastructure is widely recognized as a dominant factor in agri-business development (Prus & Sikora, 2021). The previous studies have consistently identified sustainable agricultural infrastructure as a key driver. These infrastructures include irrigation and road development, storage facilities, animal husbandry structures, livestock tracking and monitoring systems, agricultural markets, reforestation and soil restoration projects, seed production facilities, and forest nursery and plantation infrastructure.

Furthermore, green sustainable practices and technological orientation function as isomorphic drivers that introduce new institutional logic within agricultural infrastructure. These sustainable practices encompass a broad spectrum of activities, such as the integration of renewable energy sources and the reduction of energy consumption, which contribute to long-term environmental and economic sustainability in agri-business (Agbelusi et al., 2024).

2.3. Sustainable Project Management and short-run Project Performance

Various management theories have been applied by numerous scholars in organizational studies focusing on sustainability (Sarkis et al., 2011). This study integrates the concept of sustainability in project management through the lens of institutional theory (DiMaggio & Powell, 1983), which posits that organizations adopt business practices primarily to enhance their legitimacy. However, the relationship between sustainable project management and project performance is fundamentally linked to corporate social responsibility (Martens & Carvalho, 2017). Shenhar et al. (1997) introduced a crucial distinction in assessing project performance by differentiating between short-term and long-term performance. In the context of agricultural infrastructure projects, short-term performance refers to the successful completion of a project, encompassing its efficiency, immediate outcomes, and financial viability. According to Popaitoon and Siengthai (2014), short-term project performance is evaluated based on three dimensions: efficiency, user impact, and business success. Efficiency is measured by the project's ability to meet technical and operational requirements while adhering to time and budget constraints. User impact is assessed in terms of addressing operational challenges, fulfilling user needs, and achieving high levels of satisfaction. Business success is determined by the project’s commercial viability and its ability to secure a substantial market share. The significance of sustainability in agricultural infrastructure performance is growing, as stakeholders increasingly demand economic efficiency, environmental responsibility, and ethical considerations in projects (Armenia et al., 2019). Sustainable project management aims to achieve project objectives while optimizing economic, social, and environmental benefits (Armenia, 2019). In commercial agricultural systems, short-term profitability is crucial; however, for cultivators to adopt sustainable agricultural practices, these practices must be viable both in the short and long run (Allen et al., 1991). Sustainable agriculture is founded on the balanced integration of three interrelated sustainability dimensions: economic sustainability, which involves the production of goods and services; environmental sustainability, which focuses on natural resource management; and social sustainability, which contributes to rural socio-economic dynamics (Latruffe et al., 2016). The success of agricultural development projects is contingent upon their ability to enhance production. Short-term project performance, in this context, refers to the immediate fulfilment of food supply demands in accordance with market requirements. Based on these theoretical foundations and empirical justifications, we propose the following:

H_1: Sustainable Project Management is positively associated with short run performance of agri-business projects

2.4. Sustainable Project Management and Long run Project Performance

Institutional theory provides a framework for understanding how decisions regarding sustainable activities are influenced by regulations, technological advancements, and shifts in social behavior (Ball & Craig, 2010), as well as environmental management practices (Tate et al., 2010). According to the existing literature, successful projects are not solely defined by their timely completion, adherence to budget constraints, and minimal impact; rather, they also incorporate long-term sustainability considerations, including social benefits, environmental conservation, and enduring economic implications (Sunassee et al., 2020).

Long-term project performance, in contrast to short-term performance, pertains to the opportunities a project generates for future initiatives. The repetitive nature of product development projects aligns with both short- and long-term project performance metrics (Wheelwright & Clark, 1992). According to Popaitoon and Siengthai (2014), long-term project performance includes the creation of new market opportunities, the introduction of new product lines, and the advancement of innovative technologies. The agribusiness sector, in particular, relies heavily on the infrastructure development of a country. The emergence of new market opportunities and product development is contingent upon infrastructure being designed in accordance with evolving environmental, social, and economic dynamics.

In the agricultural sector, long-term project performance is characterized by the extent to which agricultural infrastructure development projects enhance the quality of life for farmers and rural communities. Van-Cauwenbergh et al. (2007) assert that agricultural sustainability should contribute to the economic prosperity of agricultural communities. The capacity of an agricultural system to endure over time in a dynamic economic environment is referred to as economic sustainability. Economic fluctuations may be driven by variations in input and output prices, crop yields, market accessibility, regulatory frameworks, and community support. Economic viability is primarily assessed through financial and economic performance indicators such as profitability, job creation, gains from recycling, cost management, investment in services and infrastructure, business ethics, innovation management (e.g., research and development, productivity improvements), customer relationship management (e.g., risk and price management), and organizational culture (Martens & Carvalho, 2016). Several studies have demonstrated the positive association between sustainable project management and project performance (Klaus-Rosińska et al., 2021). For instance, Khalifeh et al. (2020) found that the relationship between project sustainability management and project performance is both significant and beneficial. Sustainability aims to drive positive change, and sustainable project management serves as a strategic process that facilitates this transformation (Marcelino-Sádaba et al., 2015; Silvius, 2017). In the agricultural sector, changes are often prompted by evolving social demands, environmental shifts, and economic instability (Newsham et al., 2024). As a result, sustainable project management is increasingly recognized as a critical determinant of project performance (Wu et al., 2023). Based on the discussion above, we propose the following:

H_2: Sustainable Project Management is positively associated with long run performance of agri-business projects

2.5 Technological Orientation as Mediator

Technological orientation plays a crucial role in enhancing agricultural growth. The careful application of technology is essential to ensuring that the agricultural industry can meet global food demands. However, if technology is misused, it poses significant risks. For instance, excessive reliance on machinery for seed planting can have detrimental environmental consequences. Similarly, while technological advancements have improved irrigation processes, farmers who lack technical expertise may struggle to operate such technologies effectively (Theis et al., 2018). Additionally, while fertilizers and pesticides are widely used to enhance agricultural productivity, their excessive application can lead to soil and water contamination. The integration of robotic machines in agriculture has the potential to increase product demand, enhance soil fertility, reduce ecosystem degradation, and improve market efficiency. However, these machines require specific software configurations, as they cannot independently adapt to conventional farming practices (Kassanuk & Phasinam, 2021). Moreover, chemical inputs such as pesticides and fertilizers can contribute to air, water, and soil pollution, posing significant health risks (Sharma & Singhvi, 2017). Given these potential challenges, the adoption of appropriate technologies and infrastructure is vital for the sustainable growth of the agribusiness sector. From an institutional theory perspective, institutional factors play a critical role in shaping technology adoption at the organizational level (Oliveira & Martins, 2010). In the contemporary technology-driven work environment, advanced technological resources are extensively utilized for collaboration, networking, and project management, making technology a central aspect of project execution (Oeij et al., 2018). Projects achieve greater sustainability by incorporating innovation-focused activities, thereby enhancing competitiveness (Silvius & Schipper, 2014). In the agricultural sector, innovative technologies contribute to increased profitability while reducing input requirements for farming operations (Rose et al., 2021). According to Grinstein (2008), "product orientation," "innovation," and "technology orientation" refer to an organization's tendency to introduce or adopt novel concepts, ideas, or technological advancements. Technology orientation is characterized by an organization's commitment to research and development, acquisition of new technologies, and their practical application (Narayanaswami, 2017). Khin and Ho (2019) argue that firms possessing the necessary technological expertise are better positioned to develop superior products and services, thereby gaining a competitive advantage. Furthermore, technology orientation has been identified as a key factor in improving new product performance, as project outcomes typically involve the creation of unique products, processes, or services (Hakala, 2011).

Agricultural communities can leverage technological orientation to evaluate the long-term sustainability of their current practices (OECD & Eurostat, 2005). The introduction of new technologies, products, and services is considered essential for creating customer value and achieving competitive advantage (Hakala, 2011). Empirical research highlights a positive correlation between technological orientation and project performance. According to Lekovic (2018), a strong technological orientation enhances customer satisfaction, as consumers tend to prefer technologically advanced products. This orientation is based on the fundamental principle that long-term success is best achieved through technological innovations in products and services (Grinstein, 2008). Anantatmula (2006) emphasizes that the contribution of technology to project performance depends on how effectively organizations develop their technological infrastructure. Industries that integrate customer-value innovation with technological advancements are more likely to achieve long-term profitability and superior performance (Firdaus, 2021).

The role of technological orientation can be further understood through insights from various scholars. Zhang et al. (2023) assert that the adoption of newly developed technologies can significantly enhance economic, social, and environmental outcomes, providing projects with a competitive edge. The application of environmental technology enables the efficient utilization of natural resources while minimizing waste, mitigating risks, and reducing pollution levels (Carvalho & Rabechini, 2017). A strong technological orientation is thus essential for achieving sustainable project management and improving overall project performance. Based on the above discussion, the following hypotheses have been developed:

H_3: Technological Orientation mediates the relationship between sustainable project management and short run performance of agri-business projects.

H_4: Technological Orientation mediates the relationship between sustainable project management and long run performance of agri-business projects.

2.6. Sustainable Project Management and Technological Orientation

Establishing a competitive agribusiness requires the collaboration of various agricultural organizations, the adoption of advanced technologies, energy-saving practices, and the involvement of highly qualified professionals (Hodgson, 2003). The technological orientations necessary for agricultural projects encompass precision farming (such as GPS, drones, and soil sensors), smart irrigation systems (including drip and sprinkler technologies), genetically modified climate-resilient crops, data-driven farming via mobile applications and AI for yield prediction and pest control, agro-processing technologies for value addition, and solar-powered solutions for energy efficiency. These technologies enhance agricultural growth by improving productivity, optimizing resource management, and promoting sustainability.

According to Garren & Brinkmann (2018), sustainability involves the use of technology that allows resources to be utilized without depleting them permanently. Zhang et al. (2023) argue that the adoption of new technologies can significantly boost economic, social, and environmental benefits, while simultaneously increasing the project's competitive edge. Over the past few decades, sustainability has become an integral component of digital transformation across various industries, including agriculture (Martínez-Peláez et al., 2023). The integration of advanced technologies offers multiple advantages, such as improved financial performance, more efficient resource utilization, increased production flexibility, and the ability to develop innovative business models that foster cooperation among stakeholders (Rahnama et al., 2022).

Project managers who embrace the latest technologies and integrate them into their organization's daily operations are crucial to promoting sustainable project management (Zhang et al., 2023). Doost et al. (2019) highlight that innovation through technology plays a pivotal role in achieving sustainable project management. Based on the above discussion, the following hypothesis has been developed:

H_5: Sustainable Project Management is positively associated with technological orientation in agri-business projects

2.7. Theoretical Framework

Based on literature reviews and theoretical build-up of hypothesis in the light institutional theory, the research model was developed (see Figure 1). This shows that the implementation of sustainable project management leads to project performance and technological orientation mediates the relationship between sustainable project management and project performance.

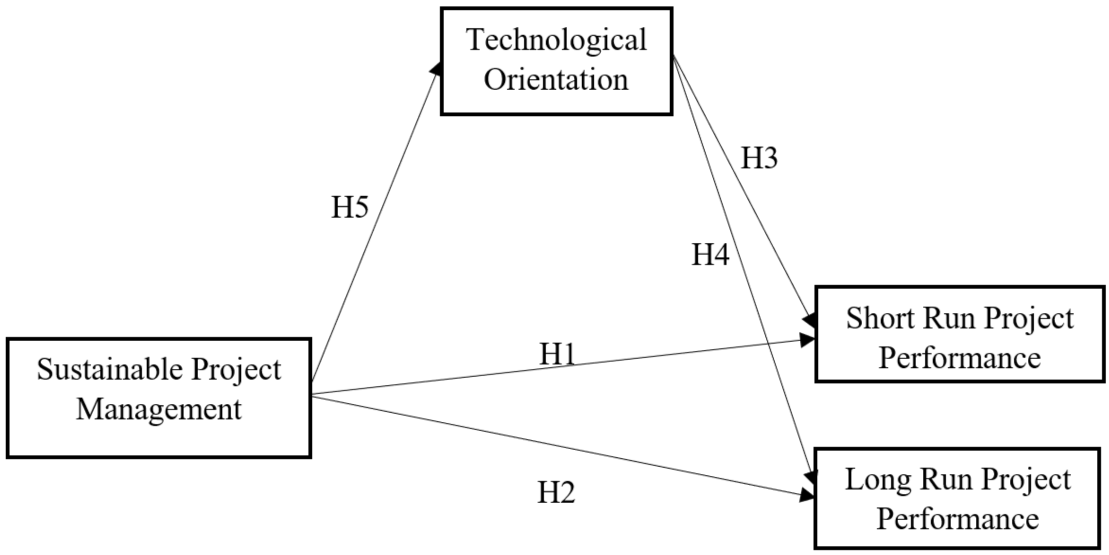

Figure 1. Theoretical framework

3. Research Method

3.1. Sample and Procedure

As the data has been collected from human, the ethics approval was obtained from the author's institution (SZABIST Uuniversity). A total of 500 agriculture project managers were initially approached for data collection. In response, 394 questionnaires were returned, of which 342 were deemed valid and used for the analysis, resulted in a response rate of 68.4%. Prior to model analysis, it is crucial to conduct a power analysis to assess the adequacy of the sample size. As suggested by Faul et al. (2009) the rule of thumb for power analysis is "total number of items into 5" (42*5 = 210). Therefore, it is appropriate to analyse the model and test the hypothesis with this sample size (342 > 210). The population for this study comprised agriculture project managers involved in various agri-business sectors in Punjab, Pakistan, including horticulture and landscaping, agricultural engineering, food technology and security, agronomy, animal sciences, agricultural economics, soil and environmental sciences, plant breeding and genetics, and forestry. Purposive sampling was employed to select the sample, which consisted of 241 males and 101 females. Regarding age distribution, the majority (78.4%) fell within the 18–41 age range, while the minority (21.6%) were aged 42 or above. In terms of experience, the majority (76.3%) had between 0 and 16 years of experience, with the remaining 23.7% having 17 or more years of experience.

Table 1. Descriptive Statistics

Variable	Item	Frequency	Percentage	Cumulative Percentage (%)
Gender	Male	241	70.5	70.5
	Female	101	29.5	100
Age	18 - 25	127	37.1	37.1
	26-33	57	16.7	53.8
	34-41	84	24.6	78.4
	42-49	54	15.8	94.2
	50 & above	20	5.8	100.0
Experience	0 to 5	131	38.3	38.3
	6 to 10	57	16.7	55.0
	11 to 16	73	21.3	76.3
	17 to 22	60	17.5	93.9
	23 to 28	21	6.1	100.0

N = 342

3.2 Infrastructure Projects in Agri-Business (Study Population)

An effective strategy for advancing the agri-business economy is through enhanced agricultural infrastructure (Dobrodomova et al., 2020). Infrastructure improvements, such as better roads, play a pivotal role in the growth of small farm and non-farm industries, including food processing, marketing, transportation, and commerce (Fan et al., 2004). The agricultural projects in this study were selected based on their infrastructure needs, which are critical for fostering agri-business growth. These projects, when managed with sustainable practices and technological integration, are key to increasing production, minimizing environmental impacts, and promoting long-term sustainability (Agbelusi et al., 2024).

In the horticulture and landscaping sector, projects like greenhouse and park construction foster high-value crop cultivation, enhancing yield and profitability (Baudoin et al., 2017). Agriculture engineering projects, such as irrigation and rural road development, ensure water availability, reduce rainfall dependency, and improve market access while lowering transportation costs (Pouliquen, 1999). Food technology projects, including storage facilities, enhance price control, reduce post-harvest losses, and facilitate access to international markets (FAO, 2022). In animal sciences, infrastructure for animal husbandry and livestock tracking boosts productivity, health, and efficiency (FAO, 2024). Agronomy projects, focusing on fertilizer distribution and storage, ensure timely access to fertilizers, increasing yields and reducing waste (Salomonsen & Diachok, 2015). Agricultural economics projects, such as market infrastructure, improve farmers' direct market access, enhancing profitability (Songco, 2002). Soil and environmental sciences projects, like reforestation and soil restoration, enhance soil fertility and prevent erosion, ensuring sustainable farming (Kourous, 2020). Plant breeding and genetics projects, such as seed production and storage, increase output by promoting disease-resistant and high-yield seeds, ensuring quality and availability (FAO, 2022). Finally, forestry-related infrastructure, including forest nursery and plantation projects, provide raw materials for agro-industries, improve ecological balance, and generate revenue through sustainable management (Goel, Ganesh, & Kaur, 2020; Kourous, 2020). The characteristics, scope, cost, and duration of these projects are summarized in Table 2.

Table 2 - Scope, Cost, and Duration of the agri-business Projects

S. No	Agri-business	Scope	Cost (PKR *Million*)	Duration (*Months*)
	Horticulture & Landscaping	Greenhouses, Parks Construction	320	9
1	Agri-Engineering	Irrigations Systems, Roads Development, Farm Machinery	800	24
2	Food Tech & Security	Storage Facilities and Labs	150	4

	Agronomy	Fertilizer Distribution, Storage Infrastructure	120	7
3	Animal Sciences	Animal Husbandry Infrastructure, Livestock Tracking and Monitoring Systems	300	18
	Agri Economics	Market Infrastructure	98	12
4	Soil & Envir Sciences	Reforestation & Soil Restoration	50	5
	Plant Breeding & Genetics	Seed Production & Storage Facilities	140	3
5	Forestry	Forest Nursery & Plantation Infrastructure.	20	8

Agri-business projects Statistics in Figure 2 show that 14 % projects are related to horticulture and landscaping, 17 % agriculture engineering, 18% food technology, 16 % agronomy, 7% animal sciences, 7% agricultural economics, 9% soil and environmental sciences, 6 % plant breeding and genetics, and 6% forestry.

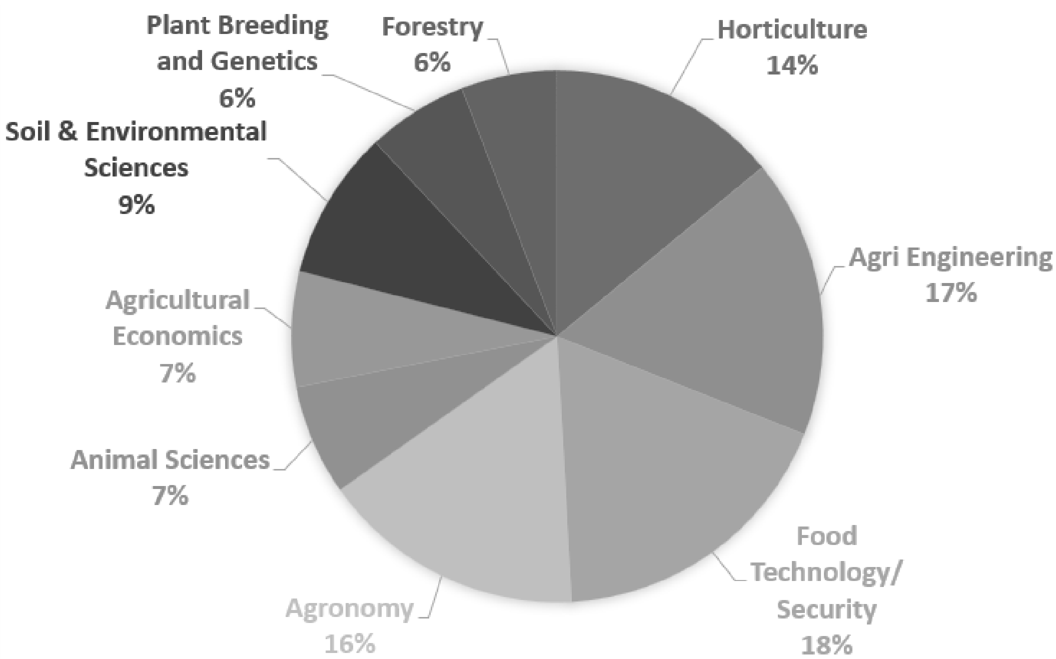

Figure 2. Agri-Projects Statistics

3.3. Operational Measure of Variables

Sustainable Project Management is comprised of environmental, economic and social factors. The economic dimension was measured by using 3 items such as 'financial and economic performance, financial benefits and cost management. Environment dimension was measured by using 3 items such as 'Safety of natural resources, Effective water management and energy management. Social dimension was measured by using 3 items, such as 'Labour practices management, human rights and good relationships with the local community. Three domains of Sustainable Project Management were taken from Martens and chow et al. (2021). ***Project Performance*** were split into long and short run project Performance. A total of 6 items were used to measure the short run project performance, such as "project is meeting operational and technical specifications, project is meeting time and budget goals, project is fulfilling client needs and satisfied with the project's performance. 03 items were used to describe the long run Project Performance, such as new market/opportunity, new line of products and developed a new technology. Both domains of Project Performance were taken from Popaitoon & Siengthai (2014). ***Technological orientation*** was measured by using 4 items such as 'use sophisticated technologies, technologies innovation based on research; and technologies innovation is readily accepted in organization / business. These statements were taken from Zhou et al. (2005). All items were scaled on a five-point Likert scale with weights assigned as Follows: 5 = Strongly Agree, 4= Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree.

4. RESULTS

4.1 Test of validity and reliability

To evaluate the adequacy of the measurement model, confirmatory factor analysis (CFA) was conducted on each construct; sustainable project management, short run project performance, long run project performance and technological orientation; using SPSS AMOS Graphics version 21. Factors were subjected to principal component method using the Promax rotation. Eigenvalues higher than 1 were used for determining the number constructs in the data set, as suggested by Allen et al. (2014). The factor loading, t-value, significance level and squared multiple correlations (SMC)–R^2 value of the individual indicator was used for convergent validity. The correlation value was used to assess discriminant validity. The average variance extracted (AVE) score and its square root score were also used to further assess the convergent and discriminant validity.

4.1.1 Model Validity Measures

Table 3 presents the composite reliability (CR) of the constructs. Results of convergent validity show that all calculated CR scores fall within the range suggested by Hu and Bentler (1999). CR values for sustainable project management, short-run project performance, long-run project performance, and technological orientation were above 0.80 (0.810–0.912), which indicates strong reliability (Fornell & Larcker, 1981; Nunnally, 1978). The average variance extracted (AVE) values were around 0.50 (0.5350–0.588), which confirmed convergent validity, as suggested by Fornell and Larcker (1981). MSV measures the amount of variance shared by each factor with other factors. All factors had low MSV values (below 0.7), indicating that they are not redundant with other factors (Fornell & Larcker, 1981). Additionally, all factors had low MaxR(H) values (below 0.95), which further confirm their distinctiveness (Hair et al., 2010). The remaining cells in the table show the correlations between each factor. Overall, the results suggest that the six-factor model fits the data well, with each factor being distinct and reliable (Gefen et al., 2000).

Table 3. Model Validity Measures

	CR	AVE	MSV	MaxR(H)	SPM	SPP	TEO	LPP
SPM	0.912	0.535	0.120	0.912	0.732			
SPP	0.878	0.547	0.199	0.880	0.346***	0.739		
TEO	0.833	0.555	0.087	0.839	0.198**	0.295***	0.745	
LPP	0.810	0.588	0.199	0.814	0.221***	0.447***	0.234***	0.767

Significance of Correlations:† $p < 0.100$, * $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$
Note: SPM = sustainable project management, SPP = short run project performance, LPP = long run project performance, TEO = technological orientation

4.1.2 Model Fit Measures

A set of common model-fit measures was used to assess the overall goodness-of-fit of the model. The results of measures summarized in Table 4. A smaller value of CMIN indicates a better fit. However, this statistic is sensitive to sample size, and larger samples tend to result in significant chi-square values even when the fit is good. CMIN/DF value was 1.370 which is between 1 and 3, CFI and PClose was greater than 0.95 and 0.05 respectively; and SRMR and RMSEA was less than 0.08 and 0.06 respectively. The result of model-fit met their respective common acceptance criteria, showing that all constructs have a very good fit.

Table 4. Model Fit Measures

Measure	Estimate	Threshold	Interpretation
CMIN	278.056	--	--
DF	203	--	--
CMIN/DF	1.370	Between 1 and 3	Excellent
CFI	0.978	>0.95	Excellent
SRMR	0.044	<0.08	Excellent
RMSEA	0.033	<0.06	Excellent

PClose	0.999	>0.05	Excellent

4.2 Hypothesis Testing

The relationship between construct of sustainable project management and performance (short run and long run) of agricultural business projects as well as the mediation role of technological orientation between relationship mentioned above were examined. Bootstrapping in AMOS was performed to access the statistical significance of the mediation effect. The bootstrapping test has a 95% confidence interval, and the indirect effect is obtained with 2,000 bootstrap re-samples. The model in Figures 3 show the direct relationships between sustainable project management with both long run and short run performance measures of agricultural business projects as well as indirect relationships through technological orientation.

The results in Table 5 indicates that sustainable project management positively affects short run performance (β= .302, p < 0.001) and long run performance (β= .174, p=0.01) of infrastructure projects related to agri-business. Moreover, sustainable project management positively affects technological orientation (β= 0.237, p < 0.001). Therefore, the hypotheses 1, 2 and 5 are supported.

Table 5. Regression Weight

Hypothesis	Estimate	S.E.	C.R.	p
SPM - SPP	0.302	0.061	4.980	0.000
SPM - LPP	0.174	0.059	2.947	0.003
SPM - TEO	0.237	0.075	3.175	0.001

*** p < 0.001; ** p < 0.01; * p < 0.05.
Note: SPM = sustainable project management, SPP = short run project performance, LPP = long run project performance, TEO = technological orientation

4.2.1 Mediating effect

Figure 3 shows a model for testing the mediation of technological orientation on the relationship between sustainable project management and performance (long run and short run) of infrastructure projects related to agri-business. The results in Table 6 indicate significant direct effect between sustainable project management and short run project performance (β= 0.302, p =0.001, 95 % CI 0.182 & 0.443) and further supporting positive indirect effect between sustainable project management and short run project performance through technological orientation (β = .049, p = .001, 95 % CI 0.016, & 0.098). Therefore, the hypothesis 3 is supported. The results indicate direct effect of sustainable project management on long run project performance (*β*=0.174, *p*=0.003, 95 % 0.059 & 0.291) while also supporting the indirect effect through technological orientation (β = 0.039, *p* = 0.006, 95% 0.007& 0.092). Therefore, the hypothesis H_4 supported.

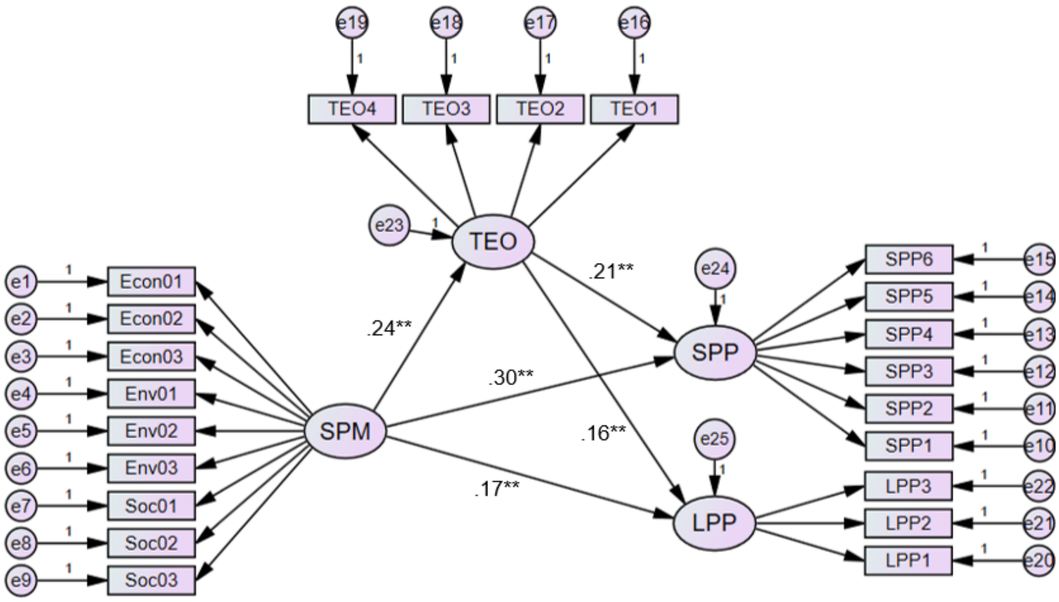

Figure 3. Structural equation model diagram of the research model
Note: SPM = sustainable project management, SPP = short run project performance, LPP = long run project performance, TEO = technological orientation

Table 6. Mediation Effect

Hypothesis	Total effect		Direct effect		Indirect effect		Results
	β	p	*β*	p	*β*	p	
SPM -TEO-SPP	.351	.001	.302	.001	.049	.001	Partial mediation
SPM -TEO-LPP	.213	.001	.174	.003	.039	.006	Partial mediation

Note: SPM = sustainable project management, SPP = short run project performance, LPP = long run project performance, TEO = technological orientation

5. Discussion and Conclusion

5.1 Discussion

The findings of this study highlight the profound impact of sustainable project management on the performance of infrastructure projects within the agri-business sector. The results indicate that sustainable project management exerts a highly significant influence on both short- and long-term project performance, reinforcing previous empirical evidence

(Dubois & Silvius, 2020; Chow et al., 2021; Sunassee et al., 2021; Zhang et al., 2024). These findings align with extant literature, which emphasizes the role of sustainability in improving project outcomes across various domains. Notably, Zhang et al. (2024) explained the mediating role of sustainability in linking innovation and competitiveness at the project level. This study extends that argument by demonstrating how technological orientation serves as a crucial mediator between sustainable project management and infrastructure project performance in the agri-business sector.

The results also support the contention that technological orientation plays a mediating role in the relationship between sustainable project management and project performance. Previous research has explored similar mediating effects in project management. For instance, Hashim et al. (2021) demonstrated that project sustainability management fully mediates the relationship between managerial experience and project performance, reinforcing the notion that sustainability-driven approaches enhance project effectiveness. Similarly, Chow et al. (2021) identified sustainable project planning as a mediator between sustainable project management and sustainable project success. The findings of this study contribute to this discourse by explaining how technological orientation—through the integration of advanced agricultural infrastructure and innovative practices—mediates the relationship between sustainability and project outcomes.

A key contribution of this research is its novel empirical evidence supporting the direct correlation between sustainable project management and both short- and long-term performance of infrastructure projects in agri-business. While prior studies (Sunassee et al., 2021) have argued that project success is not solely defined by adherence to time, budget, and scope but rather by long-term sustainability, this study provides empirical validation of that assertion within the agricultural domain. Given the increasing global population and the consequent rise in agricultural demands, the findings highlight the necessity for agri-business enterprises to adapt their strategies proactively. Institutional theory, institutional logic, and isomorphism offer valuable theoretical lenses through which this adaptation can be understood. Specifically, technological orientation and agricultural infrastructure development emerge as coercive forces that shape agri-business responses to dynamic environmental conditions.

The implications of these findings are far-reaching for both theory and practice. From a theoretical standpoint, this study advances the discourse on sustainable project management by integrating the mediating role of technological orientation in agri-business infrastructure development. From a practical perspective, the results hold significant implications for policymakers, project managers, and agricultural practitioners. This study makes several important contributions to the fields of project management and agri-business, particularly within the context of Pakistan's agricultural sector.

One of the primary contributions of this research is its provision of new empirical evidence regarding the positive relationship between sustainable project management and the performance of agri-business projects. While institutional theory has been extensively applied to explore environmental management practices within organizations (Hoffman, 1999; Delmas, 2002; Bansal & Clelland, 2005), the relationship between sustainability and project outcomes in the agri-business context has remained underexplored. This study advances our understanding by demonstrating that sustainability, particularly when integrated with technological orientation, plays a crucial role in improving project performance. It highlights the importance of adopting sustainable practices within agri-business projects to achieve enhanced productivity, profitability, and overall business performance. This finding is especially significant in the context of Pakistan, where the agriculture sector remains a vital part of the economy, yet struggles with productivity and environmental concerns.

Secondly, the study further highlights that by incorporating sustainability into project management, organizations can significantly improve key project values such as output quality, productivity, and cost-effectiveness (Silvius et al., 2017). This contribution is particularly relevant for agri-businesses in Pakistan, where the industry faces pressure to increase food production while also adhering to environmental and societal expectations. The findings of this research suggest that a focus on sustainability, coupled with technological innovation, is essential for long-term success and competitiveness in the agri-business sector.

A third important contribution of this study lies in its advocacy for a paradigm shift from traditional agricultural practices to more sustainable and technologically oriented project management approaches. The findings highlight that agricultural projects must integrate advanced technological solutions—such as smart irrigation systems and greenhouse technologies—to reduce environmental impact and optimize productivity (Abbate et al., 2023; Al-Agele et al., 2021). By adopting these technologies, agri-business projects can significantly enhance operational efficiency across various stages of production, from cultivation to transportation and storage (Sisinni et al., 2018). This shift is crucial in meeting the growing global demand for food while minimizing resource use and environmental degradation. Moreover, sustainability provides a holistic approach to addressing the interconnected challenges of food production, climate change, and resource depletion, offering long-term benefits that can extend for decades (Alabi et al., 2014; Turner & Zolin, 2012).

Fourthly, this study also makes a notable contribution to the application and understanding of institutional theory within the context of agri-business in Pakistan. While institutional theory has been traditionally focused on environmental management within organizations (Hoffman, 1999; Delmas, 2002; Bansal & Clelland, 2005), its application in agri-business projects, particularly in Pakistan, has been limited. This research extends institutional theory by illustrating how sustainable project management practices can enhance organizational legitimacy and responsiveness to institutional pressures, such as environmental regulations and societal expectations. The study shows that by adopting sustainability and technological innovation, agri-businesses can align themselves with institutional norms, thereby improving their competitive advantage and market positioning. These findings offer a deeper understanding of the role institutional pressures play in shaping project outcomes and organizational strategies within Pakistan's agricultural sector.

5.1.1 Managerial Implications

This study offers several key managerial implications for agri-business leaders and managers, particularly those involved in agriculture projects. The findings stress the importance of integrating sustainable project management practices to promote technological orientation and improve project performance, both in the short and long term. By adopting a sustainable approach, agriculture managers can align their projects with the "Triple P" framework—People, Planet, and Profit—ensuring that the resources used in agricultural projects benefit not only the organization but also society and the environment. This shift towards sustainability is essential for achieving long-term project objectives, as it provides a foundation for responsible resource management while improving business outcomes.

One of the primary implications at the business level is the integration of sustainable project management during the planning phase of agricultural projects. Managers should also prioritize instilling technological orientation within their teams. This will enable them to effectively influence technology in agricultural operations, thus enhancing both short-term performance and long-term sustainability. Incorporating sustainability into project management practices is crucial for ensuring the growth of sustainable agri-businesses. To achieve this, clear long-term objectives should be set to guide business practices, and a corporate sustainability approach should be adopted to define policies and practices that support sustainable project management (Armenia, 2019).

Moreover, agri-business organizations must empower their workforce to embrace sustainability principles by providing education and training on technology and sustainable practices. This initiative can positively influence productivity and support the integration of innovative agricultural practices. Full engagement with sustainability across all facets of project management is vital for achieving both immediate and sustained success in agricultural projects (Sunassee et al., 2020).

The study further suggests that integrating a sustainable approach in project management can enhance project outcomes while mitigating negative social and environmental impacts in agri-business infrastructure projects. Therefore, managers should prioritize the integration of sustainability into their project management methods to foster long-term success and minimize risks.

Additionally, the study highlights the importance of government-supported policies that encourage entrepreneurial farm enterprises to adopt cutting-edge technologies. Such initiatives can help agri-business firms develop innovative, risk-taking, and competitive internal capabilities (Osei & Zhuang, 2024). Managers and agriculture officers can benefit from a deeper understanding of how technology affects agricultural productivity and recognize the potential risks of overusing technology. The key to success in a rapidly changing agricultural environment lies in a technological orientation that is grounded in sustainable agricultural practices.

5.1.2 Theoretical Implications

This study makes several significant theoretical contributions to the fields of sustainable project management and agri-business. First, it provides new insights into the relationship between sustainable project management, technological orientation, and project performance within the context of agri-business. By employing the lens of sustainable project management, the study highlights how technological orientation influences both short-term and long-term project performance. Additionally, it identifies sustainable project management as a critical antecedent that shapes and enhances technological orientation. This perspective offers a novel understanding of how the integration of sustainability within project management can directly impact the technological capabilities of agricultural projects, which, in turn, affects their overall performance.

Second, this research contributes to the growing body of literature by demonstrating that technological orientation is a significant determinant of project performance, particularly in the agri-business sector. The findings suggest that agricultural projects can achieve improved outcomes in both the short and long run through the effective adoption and use of technology, driven by a sustainable project management approach. This connection has not been extensively explored in previous studies, making this research a pioneering effort in examining the role of technological orientation as an antecedent to project performance within the context of sustainable agri-business projects.

In addition to its contributions to sustainable project management and technological orientation, this study also extends the application of institutional theory within the context of agri-business. While institutional theory has traditionally focused on understanding environmental management practices within organizations, this research applies it to the agri-business sector, particularly in Pakistan. The study highlights how institutional pressures, such as environmental regulations and societal expectations, influence organizations to adopt sustainable practices in project management

Furthermore, the study aligns with and extends previous empirical research on project performance and sustainability management. For instance, Khalifeh et al. (2020) found that project performance and sustainability management are positively related, while Zhang et al. (2023) demonstrated that adopting advanced technology can provide substantial economic, social, and environmental benefits. Building on these findings, this study integrates these concepts in the specific context of agri-business, showing how sustainability and technology together enhance both project performance and organizational competitiveness.

Overall, this study represents a substantial theoretical contribution by bridging the gap between sustainable project management, technological orientation, and project performance in the agri-business sector. It lays the groundwork for future research, offering a framework that scholars can build upon to explore the intersections of sustainability, technology, and performance in other sectors and contexts.

5.2 Limitations and Recommendations for Future Research

Despite the significant contributions of this study, several limitations must be acknowledged. First, the study focused exclusively on the agri-business sector in Pakistan. While the findings provide valuable insights for this industry, the generalizability of the results to other sectors, such as construction, manufacturing, and services, remains uncertain. Future research could expand the scope by investigating the impact of sustainable project management and technological orientation on project performance across a wider range of industries. This would help to confirm whether the relationships identified in this study hold true in different business contexts and enhance the external validity of the findings.

Second, the research was based on a cross-sectional survey, which provides a snapshot of data at a single point in time. While this approach is useful for understanding current trends, it does not capture the dynamic nature of project performance over time. To build on this study, future research could employ a longitudinal design to track the evolution of short-term and long-term project performance. This would allow for a more comprehensive understanding of how sustainable project management and technological orientation influence project outcomes over time.

Furthermore, future studies could explore the potential mediating role of short-term project performance between sustainable project management and long-term project performance. By examining this relationship, researchers can better understand how immediate project successes may lead to sustained success in the long run. Additionally, technology orientation or other relevant variables could be tested as potential moderators in this context. Investigating these moderating effects would offer deeper insights into the mechanisms through which sustainability and technology influence project outcomes.

Lastly, the study did not examine potential contextual factors, such as organizational culture or regulatory environments, that might shape the adoption of sustainable practices and technological innovation. Future research could explore how these contextual variables impact the implementation of sustainable project management and its relationship with project performance in various sectors.

5.3 Conclusion

This study explores the relationship between sustainable project management, technological orientation, and agri-business project performance. A research model was developed to examine how sustainable practices (economic, environmental, and social) and technological orientation impact short-run and long-run project performance. The findings show that sustainable project management positively influences project quality, objectives, and stakeholder satisfaction, with technological orientation enhancing these effects. Long-term outcomes, such as market expansion and new product lines, are also improved by adopting technology. The study highlights the role of technological orientation in mediating the relationship between sustainability and project performance, contributing to institutional theory and offering valuable insights for managers in the agri-business sector.

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