SDIJournals

Journal of Sustainable
Development Issues, 2026, 4(1),

pp. 83-94.

Journal homepage: https://journalsdi.com/index.php/jsdi/index; **ISSN: 3078-2546**

An AI-Driven Dashboard for Sustainable Project Decision-Making: The Case of a Pilot Application of the 4P Framework

Carmen Macias[1], Idris A. Adelakun [2,*]

[1] *School of Applied Professional Studies, College of Integrative Sciences and Arts, Arizona State University, Arizona, United States*

[2] *School of Applied Professional Studies, College of Integrative Sciences and Arts, Arizona State University, Arizona, United States*

ABSTRACT

Incorporating sustainability into project management is a growing imperative for managers, where performance and long-term resilience must be considered, but current traditional frameworks such as the Triple Bottom Line: People, Planet, Profit don't explicitly consider time. This research presents the 4P Framework, adding Patience to represent long-term orientation, adaptive capacity and innovation continuity. The study utilizes Design Science Research (DSR) to create a dashboard tool embedded with metrics, predictive analysis, and scenario simulation to operationalize the 4P Framework with the infusion of AI. The artifact combines multiple data streams to deliver real-time sustainability information and medium to long-term insights, allowing project managers to consider trade-offs for all four dimensions. A pilot project demonstrates effective visualization of 4P performance, identification of emerging risks and models' long-term outcomes using the dashboard. The research contributes to a new sustainability framework, an operational AI decision-support artifact and a basis for future empirical testing in real-world project contexts.

Keywords: Sustainability; Project Management; Design Science Research; Artificial Intelligence; Decision Support

* Corresponding author: School of Applied Professional Studies, College of Integrative Sciences and Arts, Arizona State University, Arizona, United States
idris.adelakun@asu.edu (I.A. Adelakun)

JEL Classification: Q01, H43, 022

DOI: 10.62433/josdi.v4i1.78

Received: March, 2026 | 1st Revision: April 2026 | Accepted: June, 2026

1. INTRODUCTION

The In the field of project management, sustainability has emerged as a strategic priority, emphasizing the need for organizations to align economic, environmental, and social goals with their project management processes and plans, fostering long-term sustainability and resilience. The Triple Bottom Line (TBL) approach is the one adopted for supporting the decision making for sustainability (People, Planet, Profit). The framework, however, doesn't explicitly include the temporal aspect of sustainability, including resilience, adaptability, and long-term value creation.

In today's context of increasingly complex and uncertain project environments, there is a need for increasing sustainability frameworks with long-term perspectives. At the same time, advances in Artificial Intelligence (AI) provide new opportunities to support project managers through predictive analytics, scenario modeling, and real-time sustainability assessment (Jariwala, 2024). Despite all these advances, it is not until recently that project management tools began to incorporate sustainability aspects into a long-term resilience decision support framework.

According to recent studies about sustainable project management, there still are fundamental gaps when incorporating sustainability principles and concepts into project decision-making that commonly utilizes key performance indicators related to shorter-term goals (cost, time and scope) with little consideration for longer-term resilience and adaptive capacity of project outcomes (Silvius & Schipper, 2014). Orieno et al. (2025) conducted a systematic literature review about sustainable project management practices including operationalizing sustainability into projects, tools used to implement sustainability considerations such as life cycle assessment, stakeholder engagement, sustainability balanced scorecards. Case study-based research by Brent & Labuschagne (2005) found that while there is significant value in incorporating social life cycle assessment in project and product delivery, there is still limited data available on social footprints and project-level data which limits the ability to fully assess social impacts. This limits the ability for quantitative social impact assessment to be used in industrial life cycle management. On the other hand, literature has shown the benefits of using AI and data science to help monitor, optimize, and make predictions to aid in decision-making in projects (Abioye et al., 2021; Adebayo et al., 2025; Abdelalim et al., 2024). However, there is still a lack of work combining sustainability, resilience, and AI into one project management dashboard.

To address this gap, this paper seeks to introduce the 4P Framework, which builds off of the established Triple Bottom Line (TBL) of People, Planet, Profit by adding Patience as a pillar of sustainability that encompasses principles of long-term thinking, resilience, and adaptive capacity. Following guidelines of Design Science Research (DSR) proposed by Hevner et al. (2004), this paper seeks to create an AI-powered dashboard that can help support project decisions by providing sustainability metrics, prediction, and what-if scenario simulation.

The research aims to answer three questions: how long-term resilience can be embedded in sustainability frameworks, how the Patience dimension can be operationalized through measurable indicators, and how AI-driven dashboards can improve sustainability-oriented decision-making.

The study contributes theoretically by extending the TBL framework and practically by developing an AI-enabled decision-support artifact. Results from a pilot implementation demonstrate the dashboard's ability to visualize sustainability performance, identify emerging risks, and support long-term project evaluation.

The subsequent sections of this paper are organized as follows. Section 2 presents a review of the literature, focusing on sustainability in project management, long term value creation and AI. Section 3 outlines the research methods on the DSR. The results are presented and discussed in the Section 4 highlighting the dashboard functionalities and pilot testing. Finally, Section 5 concludes the study by discussing its limitations and providing recommendations for further research.

2. LITERATURE REVIEW

2.1 Sustainability in Project Management and the Triple Bottom Line

Sustainability has gained greater significance in the realm of project management, as companies look to meet economic objectives while taking care of the environment and social responsibilities. The TBL concept, which combines People, Planet and Profit, is one of the most popular concepts used as a guide for sustainable development and organizational decisions (Pereira & Martins, 2021). The framework promotes the ability of organizations to think about social, environmental, and economic outcomes, and does not just pay attention to financial outcomes.

Although it is widely used, researchers have recognized that there are some disadvantages to the TBL approach. These include the lack of measurability for intangible social and environmental impacts, lack of integration between all three pillars, and the focus of the framework mainly on reporting processes - not strategic decisions (Goh, 2020). Most significantly, the TBL framework is silent on temporal aspects like long-term resilience, adaptive capacity and creation of intergenerational value.

2.2 Temporal Sustainability, Organizational Resilience, and Long-Term Value

The degree of uncertainty in projects has grown, seeing them increasingly set in a world of fast technological, environmental and social change. Sustainability, therefore, needs to be considered as a process, as well as a set of results. Whyte and Nussbaum (2020) suggest that the decisions made during a project have implications that will carry beyond the project's completion to the sustainability and continuity of operations and the transformation of the organization.

Additionally, sustainability practices have been shown to help build organizational resilience through their ability to improve an organization's adaptability and long-term survival (Ortiz-de-Mandojana & Bansal, 2016). Nevertheless, there is a less robust mechanism in current sustainability frameworks to integrate temporal aspects into the project decision-making processes. This restriction underscores the importance of adding another dimension of sustainability to explicitly represent the concept of long-term thinking and resilience.

2.3 The concept of Patience as a Fourth Sustainability Pillar

In order to fill the gap over time in existing sustainability models, a fourth sustainability pillar, Patience, is proposed. Patience is an organization's ability to focus on long-term value creation, resilience, adaptability and sustainable outcomes over short term gains. The idea is in line with strategic resilience theory and forward-looking consequences in project decisions making (Ortiz-de-Mandojana & Bansal, 2016).

The proposed 4P framework combines Patience with the previous People, Planet and Profit to translate sustainability into a more holistic approach with the needs of the organization considered now and in the future.

2.4 Artificial Intelligence and Sustainable Project Decision-Making

As AI technologies become more prevalent, they are reshaping decision-making in different organizational roles, such as project management. AI can handle massive amounts of data, uncover patterns, forecast future results, and facilitate scenario analysis, improving the quality and timeliness of decision-making (Aljohani, 2025).

By 2030, project management is expected to see significant transformation as a result of integrating predictive intelligence and automation, according to Hughes et al. (2025). But the authors note that the ability to make ethical decisions, be creative and emotionally intelligent will continue to be important. In a similar vein, Urbanovič and Holubčík (2026) emphasize the potential of AI in risk detection, optimization of resources, and project predictions.

While these developments have been made, many AI-powered project management tools today only address a part of the sustainability aspect and do not offer a comprehensive picture of sustainable performance. Additionally, most systems do not explicitly consider long-term resilience explicitly in project decision support.

2.5 Recent Advances in AI and Sustainability Research

The possibilities of how AI could help achieve sustainability goals have garnered more interest in recent years. AI is known for its innovative, efficient, and eco-friendly applications, but there are mixed findings on its actual impacts. For instance, Kartal et al., (2025) investigated the impact of AI-related patents, energy transition, stringent environmental policies, income and energy usage on the environmental sustainability of China and found that AI-related patents were not effective in improving environmental sustainability outcomes. Their findings reveal that technological innovation alone is not enough, and has to be accompanied by robust environmental policy and complementary sustainability efforts, if environmental gains are to be achieved. Likewise, Toderas (2025) identified that while AI has the potential to contribute to sustainability in various ways, including climate action, resource management, and environmental protection, its real potential hinges on responsible implementation and governance, which must consider ecological, ethical, and socio-economic risks and sustainability considerations. In addition, Hlabisa (2025) argued that although AI is often promoted as a tool for ecological sustainability, its substantial energy, water, material, and land requirements create environmental trade-offs that must be considered when evaluating its overall sustainability impact. All these studies indicate that AI will have a role to play in sustainable development but can have the greatest impact if underpinned by the right policies, governance frameworks and sustainability-focused approaches.

Also, Kartal et al. (2026) analyzed the correlation between CO_2 emissions and energy consumption sub-types in the United States, taking into account the moderating impact of AI-related patents and energy-related R&D investments. AI-driven innovation has the potential to have a meaningful impact on environmental impact, especially when integrated with the use of renewable energy and technology investments. Furthermore, patents related to artificial intelligence (AI) had greater moderating effects on emission reduction than traditional R&D investments.

In a continuation of this trend, Kartal et al. (2026) also investigated the effects of AI robotics, energy transition, energy use, and economic expansion on environmental degradation in top Asian economies. Their findings show that technologies enabled by AI and renewable energy can play a role in improving the environment in certain contexts, but not in others.

Collectively, these works showcase the increasing role of AI in sustainability research. They mainly target national, environmental and energy sector results, however. Very little research has focused on the use of AI at the project level, especially when it comes to the integration of sustainability metrics and predictive analytics with long-term resilience factors in an integrated decision-support system.

2.6 Overall Literature Evaluation and Research Gap

The literature reviewed reveals three broad areas of studies. First, sustainability frameworks like the Triple Bottom Line focus on the social, environmental and economic aspects in organization decision making (Pereira & Martins, 2021). Second, the literature on resilience emphasizes the need to be adaptable in the long term, maintain organizational continuity, and create value in an uncertain environment (Ortiz-de-Mandojana & Bansal, 2016; Whyte & Nussbaum, 2020). Thirdly, recent studies on the relationship between AI innovation, AI-related patents, robotics, predictive analytics, and intelligent systems with environmental and sustainability performance reveal the potential of these technologies (Kartal et al., 2025; Kartal et al., 2026).

Progress has been made but there are important gaps in research. Temporal dimension, including long-term resilience, adaptive capacity and value creation, is not explicit in the existing sustainability frameworks. Moreover, the recent literature on AI and sustainability typically focuses on the environmental level, rather than on the project level, with the exception of a handful of exceptions. Existing project management tools also tend to assess sustainability aspects separately and fail to combine sustainability performance data, predictive analytics and long-term resilience in one single decision support application.

Hence, a significant gap exists in the development of practical AI-enabled tools to operationalize sustainability frameworks in the field of project management. To address this gap, the present study introduces the 4P Framework, which builds on the Triple Bottom Line and adds a fourth dimension, Patience, and creates a machine learning based dashboard that combines sustainability indicators, predictive analysis and scenario simulation to facilitate sustainable project decision making.

3. METHODOLOGY

3.1 Design Science Research Approach

This study uses the DSR methodology in which new artifacts are designed and pilot-tested to address existing problems. The research objectives are the design of a new decision-support tool and the extension of theory on sustainability frameworks, which are suitable for DSR.

3.2 Problem Identification

From a review of sustainability frameworks and project management approaches, it became clear that there is a lack of a time dimension in current models and a lack of tools that incorporate sustainability in decision making.

3.3 Objectives of the Artifact

The dashboard was created to:

- operationalize the 4P Framework
- include real-time sustainability metrics in the integration
- implement predictive analytics for future forecasting
- support scenario simulation for evaluating trade-offs
- ensure transparency of AI outputs with explainable outputs

3.4 Artifact Design and Development

A low-code application development platform with AI support was used to build the dashboard prototype, allowing for quick prototyping, interactive dashboard creation, and seamless deployment of integrated analytics. The platform allowed for the integration of structured enterprise information and unstructured stakeholder and sensor information into a one-source, one-decision environment.

The following features were included in the design of the artifacts:

- predictive analytics and KPI monitoring features
- interactive sustainability performance assessor visualizations
- automated data integration and workflow management.

There are real-time monitoring features for strategic decision making. It was developed in an iterative approach that matched the DSR methodology, where the system functionality and usability was continuously evaluated, user feedback was incorporated, and improvements were made.

Forecasting and anomaly detection features were included in the dashboard environment where applicable to enable performance monitoring, resilience analysis and long-term sustainability assessment of organizations under the 4P framework.

3.5 Demonstration

Using pilot project data, the artifact was demonstrated based on the following:

- dashboard functionality

- predictive model behavior
- scenario simulation outputs
- internal consistency of 4P metrics

3.6 Evaluation

The Evaluation in DSR can be analytical, descriptive, or experimental. Given the fact that the dashboard is not yet implemented in the field, evaluation was carried out by means of:

- functional analysis
- internal logic assessment
- scenario-based demonstration
- Placing a focus on design goals

3.7 Data and Metrics

Structured (ERP, CRM) as well as unstructured (stakeholder feedback, sensors) data fed into the dashboard. The indicators for Key 4P are:

***Table 1: 4P** Framework Metrics*

Dimension	Core Metrics	Measurement Approach	Data Sources
People	Team satisfaction, diversity index, skill development	Surveys, HR analytics (Net Promoter Score, training hours)	Internal HR systems, pulse surveys
Planet	Carbon footprint, resource efficiency, waste reduction	LCA tools, IoT sensors (tCO2e, % recycled)	Environmental sensors, supply chain data
Profit	ROI, revenue growth, budget variance	Financial KPIs, NPV calculations	ERP, project accounting software
Patience	Long-term resilience score, stakeholder trust index, innovation pipeline health	Predictive modeling (scenario survival probability >5 years), trust surveys, patent/R&D pipeline metrics	Longitudinal data, AI forecasting models

***Source:** (Authors' illustration)*

Table 1 is crucial for the construct validity and for transparency of method. In each 4P indicator, the measurement approaches and data sources are listed (columns 3 and 4), guaranteeing that the metrics displayed in the dashboard are based on accepted analytical techniques and have a known data stream. This sort of detail is necessary in DSR to show that the artifact is operational and can be reproduced.

4. RESULTS AND DISCUSSION

4.1 Dashboard Functionality

The prototype dashboard integrates real-time monitoring, predictive risk alerts, and scenario simulation capabilities based on the proposed 4P Framework. Also, users can modify project parameters and immediately observe the resulting effects on the People, Planet, Profit, and Patience dimensions. To evaluate the functionality of the dashboard, a pilot test was conducted using selected sustainability metrics.

Table 2 presents the key metrics generated during the pilot test. The results indicate strong performance in the People dimension, particularly in skill development and stakeholder-related indicators. The Planet dimension showed moderate performance, with resource efficiency performing better than waste reduction and carbon-footprint measures. The Profit dimension revealed challenges related to budget adherence, while the Patience dimension highlighted opportunities to strengthen innovation capacity and long-term resilience. Overall, the table demonstrates that the dashboard can identify strengths, weaknesses, and trade-offs across the four sustainability dimensions.

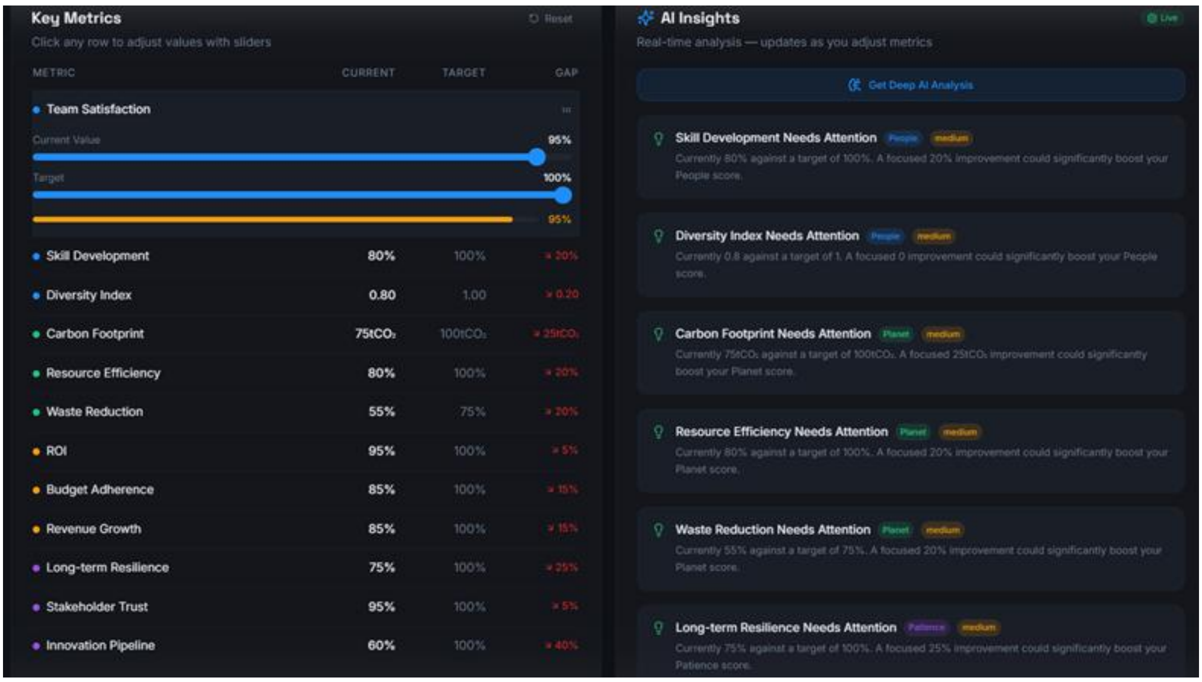
Table 2. *Key Metrics for the Pilot-Tested Project*

Dimension	Metric	Result	Observation
People	Team Satisfaction	95%	Below target by 5%
People	Skill Development	80%	Below target by 20%
People	Diversity Index	0.8	Moderate diversity performance
Planet	Waste Reduction	55%	Below environmental target
Planet	Carbon Footprint	75 tCO_2	Further reductions required
Planet	Resource Efficiency	80%	Relatively strong performance
Profit	Budget Adherence	-15%	Cost-control issues identified
Profit	ROI	Moderate	Resource inefficiencies observed
Patience	Innovation Pipeline	60%	Innovation capability requires improvement
Patience	Long-Term Resilience	75%	Moderate preparedness
Patience	Stakeholder Trust	High	Continued monitoring recommended

Source: *(Authors' illustration)*

The prototype dashboard includes interactive scenario sliders and predictive risk alerts, and real-time 4P dashboards. Users have the ability to make changes to variables and see the effects immediately in all Ps. Prototype dashboard was created with the help of an actual application. The figure 1 below shows the results for the pilot tested metrics.

Fig. 1. *Key Metrics for the Pilot-Tested Project*



Source: *Generated by the author using AI-assisted visualization tools based on pilot project data*

4.2 Pilot Test Findings

The pilot test results showed that there were many strengths and areas for improvement in the four dimensions of the 4P framework. For the People (Human Capital) dimension, skill development scored 80%, which is 20% short of the target. There were opportunities for increased workforce diversity and inclusion as measured by a diversity index of 0.8.

The achievement of waste reduction in the Planet (Environmental Performance) dimension was 55% (20% short of the project target). The carbon footprint was at 75 tCO_2 and the resource efficiency was relatively good at 80% but there is a need to further reduce the environmental impact.

The project had a budget adherence deficit of 15% in the Profit (Financial Performance) dimension, which indicates issues with controlling costs in the project. Furthermore, inefficiencies in the use of resources negatively affected return on investment (ROI).

In the dimension of Patience (Long-Term Resilience), the innovation pipeline scored 60%, suggesting a need to improve the innovation capabilities. The overall level of long-term resilience was rated at 75%, indicating moderate preparedness of the organization to face future challenges. Overall the level of trust from stakeholders was good, but was noted as a risk to be monitored to keep stakeholders confident and supportive.

These findings align with the dashboard's cross-dimensional insights. The AI insights highlight that the organization is performing well overall but is being held back by slow innovation and skill gaps.

Fig. 2. *4P Sustainability Dashboard for the Pilot-Tested Project*

Source: *Generated by the author using AI-assisted visualization tools based on pilot project data*

The output of the pilot-tested 4P Sustainability Dashboard (People, Planet, Profit and Patience) is shown in Figure 2. The dashboard does so by adding the selected core metrics into composite performance scores, thus giving a multidimensional assessment of sustainability performance.

The People dimension recorded a score of 85/100, which reflects good results on the aspect of team satisfaction, diversity and skills development. This indicates they have a positive work culture, and they are investing in employees and their development.

The Planet dimension received a score of 76/100, which was considered as moderate to strong. The metrics reflect progress in reducing carbon footprint, enhancing resource efficiency and minimizing waste generation, but there is scope to make further improvements in the environment.

The Profit dimension had the top score of 88/100, reflecting good financial and business performance. Generally, the higher scores are in return on investment (ROI), revenue growth and budget management, the more financially sustainable the organization is and the more efficient it is operating.

The Patience dimension had a score of 77/100, indicating good long-term sustainability capacity. This dimension reflects resilience over time, stakeholder trust and a healthy pipeline of innovation which indicates that the organization has put in place a reasonable framework for future adaptability and strategic continuity.

The performance trend analysis also shows an overall positive trajectory over time in all four dimensions, indicating an improvement in sustainability performance over time. Furthermore, the radar chart representation provides a fairly even sustainability rating, with Profit and People having a higher level of performance and Planet and Patience requiring improvement in the future.

In summary, the pilot tested metrics support the use of the 4P framework as a multi-dimensional instrument to measure the performance of organizational sustainability, in both social, environmental, economic and long-term strategic areas. However, further testing should be conducted on various projects for further analysis.

4.3 Scenario Simulator Results

The strategy decisions in the 4P dashboard were tested using the scenario simulator to see how these decisions affect the short-term performance and the long-term sustainability outcomes. It mimics the effects of strategic decision making on all 4Ps. The users can choose a scenario and tweak values to see trade-offs.

Fig. 3*. Scenario Simulator*

Source: *Generated by the author using AI-assisted visualization tools based on pilot project data*

How the Simulator Works

1. Each scenario simulates reallocating project resources differently.

2. This bar chart represents the estimated 4P scores for each scenario.

3. Make comparisons to the “Baseline” to explore the compromises between dimensions.

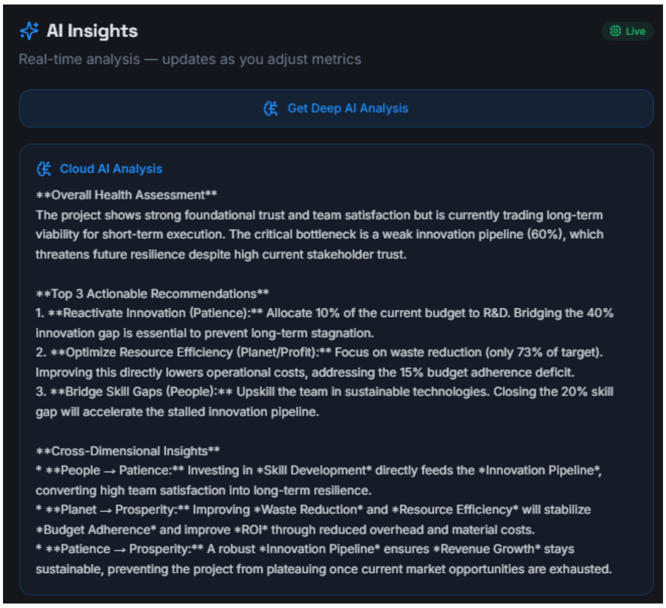
4. Use the number inputs to fine tune any scenario's projected impact.

5. In real projects, these projections would be driven by AI models, which would have been trained with historical data.

4.4 AI Generated Insights

Using AI, the 4P dashboard generated a series of diagnostic insights, showing the strengths, weaknesses, and long-term risks of the cost reduction project. These insights were generated using predictive analytics, anomaly detection and cross dimensional reasoning on the People, Planet, Profit and Patience dimensions. The figure below shows the AI insights.

Fig. 4. *AI Insights*



Source: *Generated by the author using AI-assisted visualization tools based on pilot project data*

The AI system has determined that the project is well developed in terms of the short-term performance and has a lack of sustainability in the long term. Fostering a high level of trust and satisfaction through the project, however, it is making a tradeoff between viability in the long-term and execution in the short-term. This indicates that the project is running well, but the innovation and resilience measures are declining over time.

4.5 Discussion of Findings

The findings show the potential for implementing the proposed 4P Framework at an operational level using an AI-powered dashboard. The pilot test showed that the project had a relatively high score in People and Profit, but not so in the Planet and Patience dimensions. The results indicate that although the short-term cost-saving measures might have adverse impact on innovation capacity, they could also have a negative impact on long-term resilience.

The scenario simulation further revealed the trade-offs between sustainability aspects. While financially focused strategies improved short-term profitability, but it showed a decline in environmental performance and long-term resilience. The results point to the notion that sustainability assessment should go beyond just economic measures and explicitly include time.

Additionally, the insights generated through the AI also highlighted the significance of predictive analytics in detecting potential threats and aiding in proactive decision-making. The dashboard allows project managers to gain a broader perspective on sustainability performance and future impacts by combining sustainability metrics with forecasting features.

4.6 Theoretical Implications

This study has three contributions to the sustainability and project management literature. It extends the TBL framework and introduce a new element, Patience, which stands for long-term resilience, adaptability, and sustained value creation to the mix, and is measurable. Secondly, it illustrates the way in which DSR can be applied to create sustainability artifacts that are infused with

AI. Thirdly, it connects sustainability theory and project governance, incorporating long-term foresight into project decision-making through the power of AI.

4.7 Practical and Policy Implications

On the practical side, the dashboard provides a framework for organizations to track their sustainability performance on social, environmental, financial and long-term resilience aspects. The dashboard will help project managers find trade-offs, predict risks and make better strategic decisions.

Policy should promote the use of tools and methods for sustainability assessment supported by AI, which foster transparency and accountability, and long-term planning. Policymakers should also consider adding indicators for resilience to sustainability reporting frameworks and project governance processes. Additionally, there is a need for investments in digital infrastructure, data governance, and explainable AI mechanisms to guarantee that AI sustainability solutions are reliable and responsible.

5. CONCLUSION

This study extended the TBL with long-term resilience and adaptive capacity of the 4P Framework, and added a fourth dimension of the Patience. An AI-powered dashboard was created as a DSR approach to operationalize the framework using sustainability metrics, predictive analytics and scenario simulation.

During the pilot evaluation, the dashboard proved its utility in guiding project decision making for sustainability, through the ability to highlight trade-offs between the dimensions of People, Planet, Profit and Patience, and its forward-looking ability. The results suggest that incorporating AI in sustainability assessments can help improve organizational resiliency and strategic foresight.

This study has some limitations. First, the dashboard was tested for efficacy in a pilot setting instead of in a large-scale organizational implementation. Second, results are from simulated and pilot-tested data, which could be limiting to generalizability. Thirdly, the Patience dimension needs longitudinal validation in order to prove its reliability and predictive reliability in time. Lastly, the functionality of the dashboard is driven by the quality and availability of the data sources within the organizations and the interoperability of those sources.

Future studies should conduct empirical testing in real industry and project setting with real datasets in the future. It is imperative to conduct a longitudinal research to evaluate the stability of Patience-related indicators and their relationship with long-term project success. Further studies could also explore the use of more sophisticated AI tools, like machine learning or generative AI, to boost the precision of forecasting and decision-making in sustainability management systems.

Author Contributions: The authors jointly contributed to the research, review, and preparation of this manuscript.

Funding: This research received no external funding

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

Abdelalim, A. M., Essawy, A., Alnaser, A. A., Shibeika, A., & Sherif, A. (2024). Digital trio: Integration of BIM, EIR, and IoT for facilities management of mega construction projects. *Sustainability, 16*(15), 6348. https://doi.org/10.3390/su16156348

Abioye, S. O., Oyedele, L. O., Akanbi, L. A., Ajayi, A., Delgado, J. M. D., Bilal, M., Akinade, O. O., & Ahmed, A. (2021). Artificial intelligence in the construction industry: A review of present status, opportunities and future challenges. *Journal of Building Engineering, 44*, 103299. https://doi.org/10.1016/j.jobe.2021.103299

Adebayo, Y., Udoh, P., Kamudyariwa, X. B., & Osobajo, O. A. (2025). Artificial intelligence in construction project management: A structured literature review of its evolution in application and future trends. Digital, 5(3), 26. https://doi.org/10.3390/digital5030026

Aljohani, A. (2025). A decision-support framework for evaluating AI-enabled ESG strategies in the context of sustainable manufacturing systems. Sci Rep 15, 23864 (2025). https://doi.org/10.1038/s41598-025-09569-9

Brent, A.C., & Labuschagne, C. (2006). Social indicators for sustainable project and technology life cycle management in the process industry. *International Journal of Life Cycle Assessment, 11*(1), 3-15. doi: 10.1065/lca2006.01.233

Goh, C. S., Chong, H.-Y., Jack, L., & Mohd Faris, A. F. (2020). Revisiting triple bottom line within the context of sustainable construction: A systematic review. *Journal of Cleaner Production, 252*, Article 119884. https://doi.org/10.1016/j.jclepro.2019.119884

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 75-105. https://doi.org/10.2307/25148625

Hlabisa, S. (2025). The ecology of artificial intelligence: Energy, water, materials, and land limits of digital systems. *Carbon Neutral Systems, 1,*19, 1-20. https://doi.org/10.1007/s44438-025-00018-8

Hughes, L., Kiani Mavi, R., Aghajani, M., Fitzpatrick, K., Gunaratne, S. M., Hosseini Shekarabi, S. A., Hughes, R., Khanfar, A., Khatavakhotan, A., Kiani Mavi, N., Li, K., Mahmoud, M., Malik, T., Mutasa, S., Nafar, F., Yates, R., Alahmade, R., Jeon, I., & Dwivedi, Y. K. (2025). Impact of artificial intelligence on project management (PM): Multi-expert perspectives on advancing knowledge and driving innovation toward PM2030. *Journal of Innovation & Knowledge, 10*(5), 1-30. https://doi.org/10.1016/j.jik.2025.100772

Jariwala, M. (2024). Integrating artificial intelligence to enhance sustainability in project management practices. International Journal of Computer Applications, 186(20), 35-42 https://doi.org/10.5120/ijca2024923627

Kartal, M. T., Kim, E., Mukhtarov, S., Taşkın, D., Kirikkaleli, D., Kılıç Depren, S., & Park, J. (2025). Effect of AI-related patents, energy transition, environmental policy stringency, income, and energy consumption sub-types on environmental sustainability: Evidence from China by KRLS approach. *Journal of Environmental Management, 395,* 127924. https://doi.org/10.1016/j.jenvman.2025.127924

Kartal, M. T., Kim, E., Mukhtarov, S., Taşkın, D., Kirikkaleli, D., Kılıç Depren, S., & Park, J. (2026). Relationship between CO_2 emissions and energy consumption sub-types under impact of AI-related patents and energy-related R&D investments: Evidence from the USA by novel quantile-based methods. *Journal of Cleaner Production, 538*, 147299. https://doi.org/10.1016/j.jclepro.2026.147299

Kartal, M. T., Kim, E., Kirikkaleli, D., Kılıç Depren, S., Ayhan, F., & Park, J. (2026). Exploring impact of AI robotics, energy transition, energy utilization, and economic growth on environmental degradation: Evidence from leading Asian countries by KRLS model. *Geoscience Frontiers, 17*(4), 102302. https://doi.org/10.1016/j.gsf.2026.102302

Orieno, O. H., Ndubuisi, N. L., Eyo-Udo, N. L., & Biu, P. W. (2025). Sustainability in project management: A comprehensive review. *World Journal of Advanced Research and Reviews, 21*(1), 656-677. https://doi.org/10.30574/wjarr.2024.21.1.0060

Ortiz-de-Mandojana, N., & Bansal, P. (2016). The long-term benefits of organizational resilience through sustainable business practices. *Strategic Management Journal*, 37(8), 1615–1631.

Pereira, T. H. M., & Martins, H. C. (2021). *People, planet, and profit: Bibliometric analysis of triple bottom line theory*. *Journal of Management and Sustainability, 11*(1), 64–73. https://doi.org/10.5539/jms.v11n1p64

Silvius, A. J. G., & Schipper, R. P. J. (2014). Sustainability in project management: A literature review and impact analysis. *Social Business, 4*(1), 63-96. https://doi.org/10.1362/204440814X13948909253866

Toderas, M. (2025). Artificial intelligence for sustainability: A systematic review and critical analysis of AI applications, challenges, and future directions. *Sustainability, 17*(17), 8049. https://doi.org/10.3390/su17178049

Urbanovič, M., & Holubčík, M. (2026). Artificial intelligence in managerial decision-making for sustainable business models: A systematic literature review. *Systems, 14*, 245. https://doi.org/10.3390/systems14030245

Whyte, J., & Nussbaum, T. (2020). *Transition and temporalities: Spanning temporal boundaries as projects end and operations begin*. *Project Management Journal, 51*(5), 504–522. https://doi.org/10.1177/8756972820919002