Sustainable Project Management: Building a Future-Proof Approach for Lasting Success [1]

Dinesh Sharma and Bhavika Nayyar

Abstract

In today's world, as technologies like AI redefine how we build and deploy products, organizations face a critical question - not just how to move faster, but how to build responsibly. With natural resources rapidly depleting, building a sustainable world becomes imperative.

Nearly every system across industries relies on software, making it a key driver of global efficiency. Yet, despite intense focus, software project success rates remain around 30%, leading to massive waste. Compounding this issue is the limited awareness of sustainable execution practices.

This article explores how future-ready, sustainable delivery models can help leaders meet rapid innovation demands while ensuring measurable long-term impact. Traditional project management, defined by cost, scope, and time, fails to account for long-term impact and sustainability.

This paper introduces the Agile Project Management Pyramid, a transformative framework that redefines project constraints to include Sustainability as a core dimension introducing a quantifiable mechanism to measure sustainability performance in agile delivery.

1. Introduction

Traditional project management has long been defined by the Project Management Triangle -Scope, Cost, and Time. However, this model does not account for the pressing need for long-term sustainability in project execution.

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This whitepaper introduces the Agile Project Management Pyramid, an evolved framework that incorporates Sustainability as a fourth critical element. This new approach ensures that projects align with environmental, social, and economic goals while maintaining quality and efficiency.

The Agile Project Management Pyramid framework provides an easy and effective mechanism to integrate and measure sustainability alongside core metrics such as cost, time, scope, and quality.

By adopting the Agile Project Management Pyramid, organizations can future-proof their project delivery methodologies and contribute to long-term corporate and environmental responsibility.

This paper contributes a new Agile Project Management Pyramid framework together with Sustainability Value (SV) and Sustainability Performance Index (EPI), enabling sustainability to be measured alongside traditional project performance indicators.

2. Sustainability and Project Management

Sustainability refers to the ability to maintain or support processes, activities, or systems over the long term in ways that balance environmental, social, and economic considerations. At its core, sustainability is about ensuring that current needs are met without compromising the ability of future generations to meet their own needs.

Sustainable Software Project Management is the practice of managing software development projects in a way that incorporates principles of sustainability—balancing environmental, social, and economic considerations throughout the software lifecycle. This approach goes beyond traditional project management goals of delivering on time, within scope, and on budget, and focuses on reducing the environmental impact, promoting social well-being, and ensuring long-term economic value from software projects.

3. The Need for Sustainable Project Management

As global awareness of environmental and social responsibility grows, sustainable project management has become essential for organizations striving to operate responsibly and achieve long-term success. Sustainable project management is more than just a trend; it represents a critical shift in how projects are planned, executed, and evaluated to ensure

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they minimize environmental impact, promote social equity, and deliver lasting economic value.

Here are some key reasons why sustainable project management is increasingly important:

1. **Environmental**: Sustainable management reduces waste, conserves resources, and lowers emissions, helping organizations minimize their carbon footprint and align with global environmental goals.
2. **Social**: By promoting ethical practices and inclusivity, sustainable project management benefits communities, strengthens stakeholder relationships, and enhances organisational reputation.
3. **Economic**: Sustainability drives cost savings and long-term value by promoting resource efficiency and minimizing waste. It focuses on creating projects that balance short-term costs with long-term benefits, helping organizations avoid costly setbacks, manage risks effectively, and achieve a stable return on investment.

Incorporating sustainability into project management is essential for organizations looking to balance profitability with social and environmental stewardship.

4. Literature Review

Sustainable project management has been shaped by several well-established frameworks. The Triple Bottom Line (TBL) framework introduced by Elkington (1997) emphasizes balancing environmental, social, and economic outcomes, forming a foundation for integrating sustainability into decision-making. The PRiSM™ (Projects Integrating Sustainable Methods) methodology, developed by GPM Global, extends this by embedding sustainability considerations throughout the project lifecycle, focusing on reducing negative environmental impacts and maximizing long-term value.

Standards such as ISO 14001 provide structured environmental management systems that many projects use to set and monitor sustainability objectives. Similarly, the United Nations Sustainable Development Goals (SDGs) offer global targets that influence corporate project KPIs and reporting frameworks. Professional bodies, including the Project Management Institute (PMI), have also developed guidelines for incorporating ESG considerations into project delivery, signaling the growing importance of sustainability as a core project management competency.

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Recent empirical research by Martens and Carvalho (2017) highlights that project managers increasingly integrate environmental and social dimensions into their practice, but often lack operational tools to measure and manage them within agile delivery. Similarly, Armenia et al. (2019) provide a comprehensive conceptual review of sustainable project management, noting the gap between high-level frameworks and execution-level performance metrics.

Kivilä et al. (2017) and Silvius & Schipper (2014) further demonstrate that while sustainability principles are increasingly recognized in project management competencies, their translation into execution-level performance metrics remains limited, particularly in iterative delivery models.

While these frameworks offer valuable strategic direction, most operate at a high level and lack integration with agile delivery models and operational performance metrics. In particular, there is limited guidance on embedding measurable sustainability indicators into agile tracking methods such as Agile Earned Value Management. The Agile Project Management Pyramid addresses this gap by positioning sustainability alongside scope, time, and cost as a core constraint, and introducing the Environmental Performance Index (EPI) to provide a quantifiable, execution-level measure of sustainability performance.

5. Principles of Sustainable Project Management

Following are the key principles of Sustainable Project Management -

1. **Lifecycle Thinking:**
   - Incorporates sustainability considerations from the start of the project to the end of the software's lifecycle, from requirements gathering and design through to deployment, maintenance, and eventual decommissioning or replacement.
   - Early-stage decisions, such as selecting appropriate frameworks or infrastructure, can have long-lasting implications on resource efficiency and maintainability.
2. **Resource Optimization:**
   - Focus on minimizing the consumption of resources, such as computing power, storage, and network bandwidth, both during development and after deployment.

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- Optimizing the development process by reducing unnecessary meetings, long build times, or redundant workstreams, which can lead to energy and time savings.

3. **Green Agile:**
   - Applying Agile principles with a sustainability mindset, such as considering environmental or social impacts during sprint planning, including sustainability metrics in the definition of "Done," or focusing on delivering features that have a positive long-term impact on users and society.
4. **Sustainable Collaboration:**
   - Encouraging virtual collaboration tools and remote working to reduce travel, office space, and energy usage, while ensuring a healthy and sustainable work-life balance for team members.
   - Prioritizing transparency and open communication to foster strong stakeholder relationships, promoting trust and long-term project success.
5. **Sustainable Vendor and Tool Selection:**
   - Choosing development tools, platforms, and third-party software solutions based on their sustainability credentials, such as using open-source software, cloud providers with green initiatives, or software that minimizes hardware requirements.

6. The Agile Project Management Pyramid

Traditional Project Management Triangle:

The Project Management Triangle, also known as the Triple Constraint, consists of three interrelated constraints:

1. **Scope**: What is delivered by the project.
2. **Time**: The duration in which the project needs to be completed.
3. **Cost**: The budget allocated for the project.

The idea is that changes in any of these three constraints will affect the others and ultimately impact **Quality**, which is often seen as the core goal of a project.

Introducing Sustainability:

The inclusion of **Sustainability** as a new constraint recognizes that projects today are increasingly influenced by environmental, social, and governance (ESG) factors. This

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constraint addresses the long-term impact of a project not only on the immediate stakeholders but also on society and the environment.

The Pyramid Structure:

By adding Sustainability and placing it as a layer in the pyramid, you're giving it equal importance alongside Scope, Time, and Cost, but with the understanding that it interacts with all of them. Here's a conceptual view:

1. **Base of the Pyramid**: Scope, Time, and Cost. These are the primary constraints that define the project's feasibility and execution. They form the foundation and are interdependent.
2. **Top of the Pyramid:** Sustainability. This could be seen as the ultimate goal or guiding principle that transcends the immediate project constraints. It aims to balance the traditional project constraints in a way that aligns with broader, long-term objectives, such as environmental preservation, social responsibility, and economic equity.
3. **Center of the Pyramid:** Quality remains at the center because, no matter how well the project balances Scope, Time, Cost, and Sustainability, the quality of the final deliverable should be maintained as the primary focus.

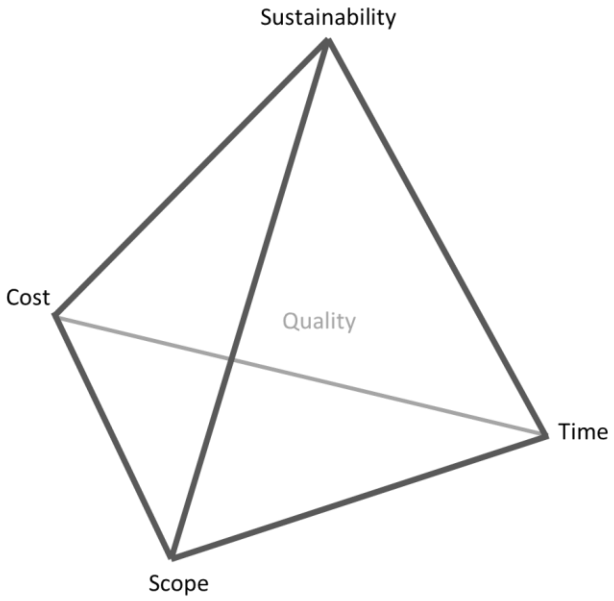

Figure 1. Agile Project Management Pyramid

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7. Modified Agile Earn Value Management

In order to measure additional dimension for Agile Project Management Pyramid the current Simplified Agile EVM7 needs to be modified to include additional metrics for Sustainability to form the modified Agile Earn Value Management. This section describes the same. Following are the steps to arrive at **Sustainability Performance Index** (EPI) which will effectively measure the Sustainability.

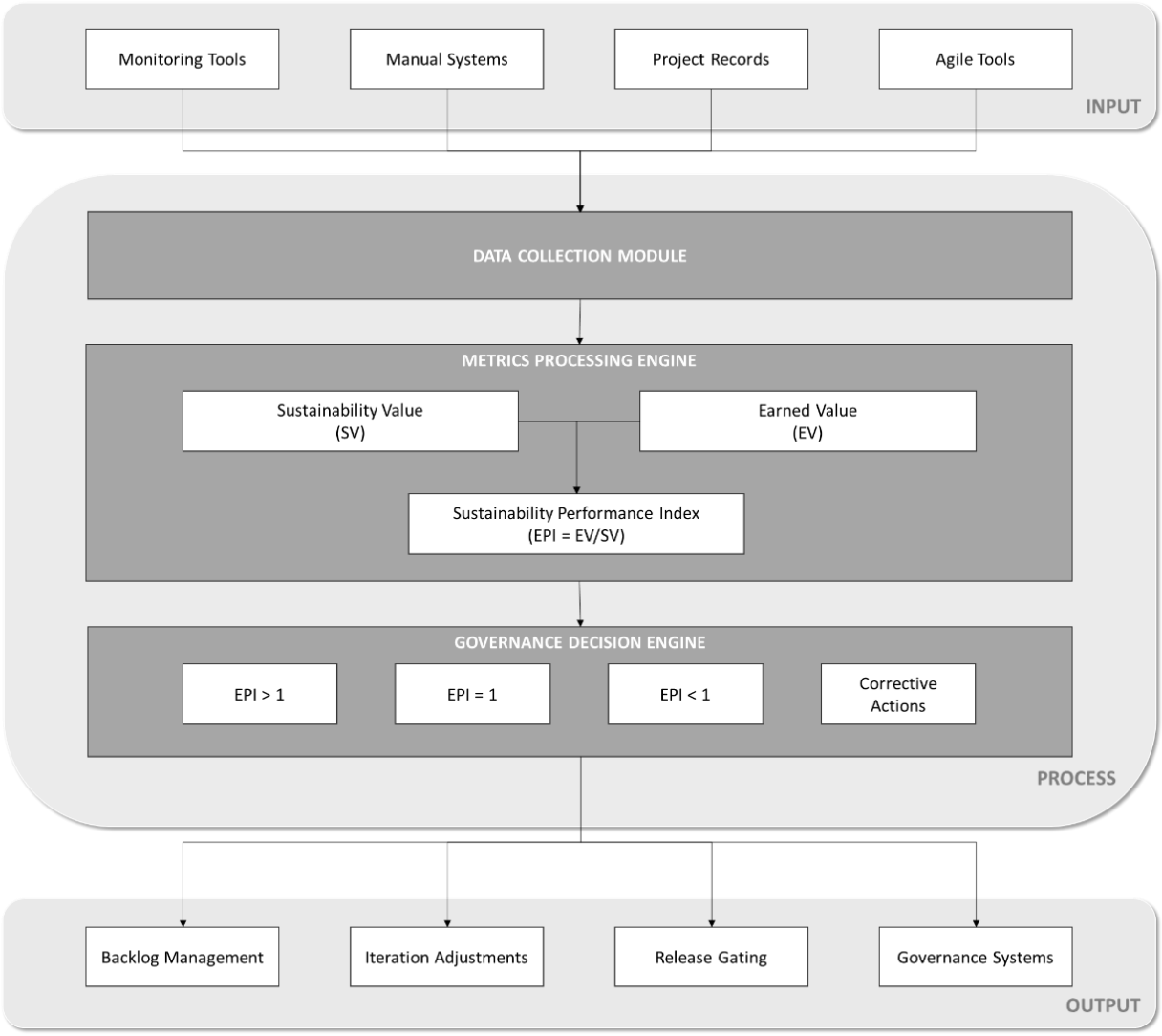

Figure 2. Sustainability Performance Framework

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Core Sustainability metrics

Following are the core set of metrics that can capture quite accurately the sustainability aspects for any project, you may choose the full or subset of these metrics -

#	Metric	Short Description	Suggested Weightage (%)	How to Calculate / Measure	ESG Component
1	Energy Consumption	Measures total energy used by servers, development tools, and infrastructure during software or project lifecycle.	30%	Total kWh used (on-prem/cloud) tracked via monitoring tools (e.g., CloudWatch, RAPL); normalized by function points or user base.	Environmental (E)
2	Carbon Footprint	Measures GHG (Greenhouse Gas) emissions (CO_2e) from energy, travel, infrastructure, and operations – including indirect emissions.	35%	Carbon (CO_2e) = kWh × Grid Emission Factor; or from Scope 1/2/3 calculators (e.g., Cloud Carbon API, GHG Protocol).	Environmental (E)
3	Resource Efficiency	Evaluates efficiency of CPU, memory, and storage utilization for running software or systems.	15%	% improvement or % under budgeted resources using APM tools (e.g., New Relic, Prometheus); CPU hours saved.	Environmental (E)
4	Waste Reduction	Measures code quality, rework, and technical debt that leads to inefficiencies and higher environmental cost.	10%	Metrics like cyclomatic complexity, bugs per KLOC, code churn; measured via SonarQube or static analysis tools.	Governance (G)
5	User Accessibility	Reflects efforts to build inclusive, accessible systems that support	5%	% WCAG 2.1 compliance, screen reader compatibility, satisfaction survey; tools include	Social (S)

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#	Metric	Short Description	Suggested Weightage (%)	How to Calculate / Measure	ESG Component
		users of all abilities and backgrounds.		Lighthouse, Deque axe.	
6	Infrastructure Embodied Impact	Estimates environmental cost of manufacturing, shipping, and disposing hardware/cloud infrastructure used.	5%	Manufacturer data or LCA sources (e.g., kg CO_2e per server/laptop × units used × % project allocation).	Environmental (E)

For all resources used for any project calculate the above metrics. Following are some example resources which might vary from the actual project environment –

Parameter	Laptops (Developer Machines)	Servers / Cloud	Building / Office	Car / Transportation	Home Office Use	Air Travel
Energy Consumption	Energy (kWh) = Instance Energy Coefficient × Instance Hours	Energy (kWh) = Instance Energy Coefficient × Instance Hours	Energy (kWh) = Instance Energy Coefficient × Instance Hours	Energy (kWh) = Instance Energy Coefficient × Instance Hours	Energy (kWh) = Instance Energy Coefficient × Instance Hours	Energy (kWh) = Instance Energy Coefficient × Instance Hours
Carbon Footprint	Carbon (CO_2e) = kWh × Grid Emission Factor	Carbon (CO_2e) = kWh × Grid Emission Factor	Carbon (CO_2e) = kWh × Grid Emission Factor	Carbon (CO_2e) = kWh × Grid Emission Factor	Carbon (CO_2e) = kWh × Grid Emission Factor	Carbon (CO_2e) = kWh × Grid Emission Factor
Resource Efficiency	Average CPU Utilisation	Average CPU Utilisation	NA	NA	NA	NA

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Parameter	Laptops (Developer Machines)	Servers / Cloud	Building / Office	Car / Transportation	Home Office Use	Air Travel
Waste Reduction	Code Efficiency	Code Efficiency	NA	NA	NA	NA
User Accessibility	Accessibility Factor	Accessibility Factor	Accessibility Factor	Accessibility Factor	Accessibility Factor	Accessibility Factor
Infrastructure Embodied Impact	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing

Sustainability Value (SV)

SV is the ratio of the actual sustainability budget consumption score to the sustainability budget allocated to the project.

Formula:

$$SV = \sum \frac{\text{Actual Sustainability Score}_i \text{ (ASS)}}{\text{Allocated Sustainability Budget}_i \text{ (ASB)}} \text{ x Weightage}_i \text{ (w)}$$

Where ASS represents Actual Sustainability Score and ASB represents Allocated Sustainability Budget for each metric.

For each of the Core Sustainability metrics a budget is allocated and the ratio of Actual Sustainability Score to the Allocated budget is weighted averaged to arrive at SV in % terms.

Sustainability Performance Index (EPI)

EPI is calculated by dividing the Earned Value (EV) by the Sustainability Value (SV).

Formula:

EPI=EV/SV

Interpretation:

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- EPI > 1: Indicates that the project is delivering value while considering sustainability. This is a positive zone for sustainability performance.
- EPI = 1: Suggests that the project is delivering value while maintaining sustainability. This is a neutral zone for sustainability performance.
- EPI < 1: Indicates that the project is not delivering adequate value while considering sustainability. This is a negative zone for sustainability performance.

With the existing definition of CPI, SPI, RPI and QPI as defined by SAEVM7, EPI provided a powerful addition to have a complete view of the project with Sustainability covered.

8. Illustrative Example

In one illustrative implementation, the system processes the following metric inputs for an iteration:

- Energy consumption: actual 450 kWh, target 500 kWh
- Carbon footprint: actual 120 kg CO_2, target 150 kg CO_2
- Resource efficiency score: actual 0.82, target 0.80

Normalized ratios are computed as actual ÷ target, producing:

- Energy ratio = 0.90
- Carbon ratio = 0.80
- Resource ratio = 1.025

Applying a subset of the configured metric weights (0.30 for energy consumption, 0.35 for carbon footprint, and 0.15 for resource efficiency), where remaining metrics are not measured during the current execution cycle, produces weighted values: 0.27, 0.28, 0.15375.

Aggregating the weighted values yields a Sustainability Value of 0.70375.

If Earned Value for the iteration is 0.75, the Sustainability Performance Index is calculated as:

$$EPI = 0.75 \div 0.70375 \approx 1.07$$

Because the EPI exceeds a predefined threshold of 1.0, the governance decision engine generates a signal permitting continuation of the current release schedule without corrective action.

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When only a subset of configured metrics is available for a given execution cycle, the metric processing engine may normalize the active weight coefficients such that the sum of the applied weights equals 1.0 prior to computing the Sustainability Value. Alternatively, the Sustainability Value may be computed using the raw configured weights while recording a metric coverage indicator representing the proportion of metrics included in the calculation.

9. Step-by-Step Implementation Approach

1. Define Objectives

- Identify Sustainability Goals: Define sustainability objectives alongside scope, time, and cost.
- Stakeholder Engagement: Align stakeholders on sustainability expectations.
- Enhance Risk Management: Identify sustainability-related risks, plan buffers, and run scenario planning.

2. Plan Agile with Lifecycle Thinking

- Incorporate Lifecycle Thinking: Assess sustainability impacts across all project phases (requirements → decommissioning).
- Decision-Making Framework: Select tools/frameworks with long-term sustainability benefits.
- Optimize Resources: Plan human, tech, and environmental resources efficiently; streamline processes to reduce waste.

3. Embed Sustainability in Agile Execution

- Implement Green Agile Practices: Add sustainability metrics to the Definition of Done; adjust practices in retrospectives.
- Foster Sustainable Collaboration: Use virtual tools to reduce travel; keep communication transparent.
- Select Sustainable Vendors and Tools: Prioritize vendors and solutions with strong sustainability credentials.

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4. Monitor Sustainability Performance

- Define Key Sustainability Metrics: Establish metrics and Sustainability Value (SV).
- Calculate & Monitor EPI: Track the Environmental Performance Index throughout the project.
- Foster Team Alignment: Share EPI/SV regularly; hold workshops for innovation.

5. Continuous Improvement

- Feedback Loops: Integrate learnings after each phase.
- Post-Project Review: Capture final sustainability outcomes and improvement areas for future projects.

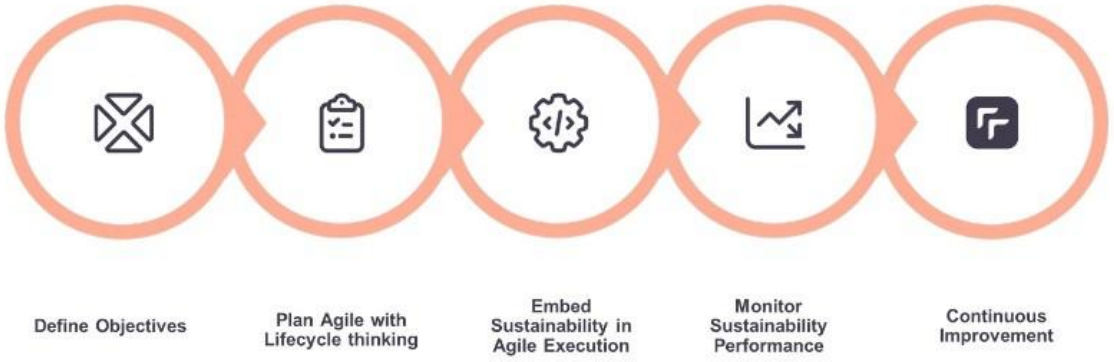

Figure 3. Sustainable Agile Implementation Model

10. Conclusion

Incorporating sustainability into project management through this approach can be transformative for organizations. By integrating lifecycle thinking, optimizing resources, and adopting Green Agile practices, project outcomes and team effectiveness can be enhanced. The successful implementation of the Agile Sustainability Pyramid and Environmental Performance Index (EPI) can lead to high-quality project deliveries while improving sustainability performance.

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This framework provides a practical pathway for organizations to embed sustainability into agile delivery, enabling measurable, responsible, and future-ready project execution in an increasingly sustainability-driven environment.

11. AI Usage Declaration

No generative AI tools were used to create the intellectual content of this paper. AI-assisted tools were used only for editorial review, grammar improvement, and formatting support under author supervision.

12. References

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