

Earned Value Management for Sustainable Project Optimization using JASP and ClickUp Interface

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Abstract

Earned Value Management (EVM) is one of the most widely used techniques for integrating scope, schedule and cost in project performance measurement. Yet its conventional indicators were designed around time and money, and they say little about whether a project is being delivered in a sustainable way. At the same time, accessible digital platforms such as ClickUp now capture task-level progress, effort and cost data in real time, and open-source statistical software such as JASP makes rigorous analysis available to practitioners without programming expertise. This Phase 1 report reviews the literature that connects these three strands: classical and extended EVM, sustainability in project management, and tool-supported statistical analysis of project performance. The review follows a structured, Scopus-based protocol and synthesises the findings into thematic groups, a gap matrix and a conceptual framework. The main gaps identified are the limited integration of sustainability dimensions into EVM indicators, the scarcity of reproducible, tool-based EVM workflows that combine a work-management interface with statistical software, and the weak statistical treatment of EVM indices in practice. The framework proposed here will guide Phase 2, in which anonymous project data will be analysed. No real or synthetic data are used in Phase 1.

Keywords: Earned Value Management; Sustainable project management; Project optimization; JASP; ClickUp; Earned Schedule; Performance forecasting; Literature review

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1. Introduction

1.1 Background of the study

Projects are the main vehicle through which organisations deliver change, infrastructure, products and services. Controlling them requires an objective answer to three questions at any point in time: how much work should have been completed, how much has actually been completed, and how much has it cost. Earned Value Management answers these questions through a single, internally consistent set of measures, and it has become a core method in project management standards and guides, including those of the Project Management Institute (PMI, 2021).

The method originated in cost and schedule control systems used in large defence programmes and later spread to construction, engineering, information technology and public-sector work (Fleming and Koppelman, 2016). Its appeal lies in its simplicity: the performance of a project is summarised by a few indices that can be calculated from the plan and from progress reports.

Two developments have changed the context in which EVM is applied. First, sustainability has moved from a peripheral concern to a central expectation of project delivery. Organisations and funders increasingly ask projects to account for environmental and social outcomes alongside cost and time (Silvius and Schipper, 2014; Martens and Carvalho, 2017). Second, digital work-management platforms have made granular progress, effort and cost data routinely available. Open-source analytical tools have lowered the barrier to statistical rigour, which matters because EVM indices are often interpreted as single-point values with little regard for variability.

1.2 Problem statement

Conventional EVM measures whether a project is on budget and on schedule. It does not indicate whether the way the project is being delivered is sustainable, for example whether resources are used efficiently, whether effort is distributed without overloading teams, or whether rework and waste are growing. A

project can show favourable cost and schedule indices while consuming resources inefficiently or accumulating hidden rework. Conversely, practitioners who wish to extend EVM often lack a practical, reproducible workflow that links the data they already record in a work-management tool to proper statistical analysis.

1.3 Research gap and motivation

The literature on EVM is extensive, covering forecasting models, schedule measurement, statistical and fuzzy extensions, and simulation (Willems and Vanhoucke, 2015). The literature on sustainable project management is also growing. However, the two bodies of work have largely developed in parallel. Three gaps motivate this study:

1. Few studies embed sustainability considerations into EVM-based performance measurement in a way that can be operationalised.
2. Few studies describe a transparent, tool-based workflow that connects a widely used project interface to statistical software for EVM analysis.
3. EVM indices are rarely subjected to appropriate statistical treatment, such as distribution checks, confidence intervals and tests of change, in practitioner settings.

1.4 Aim and objectives

The overall aim of the research is to develop and demonstrate an approach to sustainable project optimisation based on Earned Value Management, using ClickUp as the data-capture interface and JASP as the statistical analysis environment.

The objectives of the full research programme are:

1. To review and synthesise the literature on EVM, its extensions, sustainability in project management, and tool-supported statistical analysis (Phase 1).
2. To identify the gaps that limit the use of EVM for sustainable project optimisation (Phase 1).
3. To propose a conceptual framework that links ClickUp data, EVM indicators, statistical analysis in JASP and sustainability-oriented indicators (Phase 1).
4. To apply the framework to anonymised project data and evaluate its usefulness (Phase 2).

1.5 Research questions

- **RQ1.** What are the principal EVM methods and extensions reported in the literature, and what are their strengths and limitations?
- **RQ2.** How has sustainability been conceptualised in project management, and to what extent has it been connected to EVM?
- **RQ3.** Which statistical approaches have been applied to EVM indices, and how can they be supported by JASP?
- **RQ4.** How can a work-management interface such as ClickUp supply the data needed for EVM and sustainability-oriented analysis?

1.6 Significance and contribution

The study contributes in three ways. Conceptually, it consolidates fragmented literature and positions EVM within a sustainability perspective. Methodologically, it outlines a reproducible workflow built on accessible tools, which is relevant to small and medium organisations that cannot afford specialised EVM

software. Practically, it prepares a framework that project managers can adopt to move from descriptive cost and schedule reporting towards evidence-based, sustainability-aware optimisation.

1.7 Scope and phased structure of the research

The research is organised in two phases. **Phase 1**, reported here, is limited to the introduction and the literature review. It uses no real or synthetic data. **Phase 2** will apply the proposed framework to project data, and those data will be anonymised before analysis. Methodology, results, discussion and conclusion for the data application are therefore reserved for Phase 2 (Figure 1.1).

1.8 Organisation of the paper

Chapter 1 introduces the background, problem, gaps, aim, objectives and research questions. Chapter 2 presents the literature review, beginning with the review protocol and ending with a synthesis, a gap analysis and a conceptual framework. Subsequent sections covering methodology, analysis, discussion, conclusions and references for the complete study will be added after Phase 2.

2. Literature Review

2.1 Review design and search protocol

The review follows a structured approach in the spirit of systematic reviewing guidance, so that the search can be repeated and audited. Scopus is used as the primary database, since the target outlet is Scopus-indexed, and Web of Science may be used as a complementary source. Searches are run on titles, abstracts and keywords. Table 2.1 summarises the intended protocol; the counts for each stage of Figure 2.1 will be recorded when the final search is executed.

Table 2.1 Search strategy and inclusion criteria

Element	Specification
Databases	Scopus (primary); Web of Science (complementary)
Core search strings	"earned value" AND (project OR management); "earned schedule"; "earned value" AND sustainab*; "project" AND "sustainab*" AND (control OR performance); "JASP"; "ClickUp"
Period	Seminal works regardless of date; focused review of the most recent decade
Document types	Peer-reviewed journal articles, review articles, standards and recognised professional guides
Language	English
Inclusion	Addresses EVM or its extensions, sustainability in project management, statistical analysis of project performance, or digital project-control tools
Exclusion	Duplicates; no full text available; no methodological contribution to the review questions

2.2 Foundations of Earned Value Management

EVM integrates the project scope, schedule and cost baselines into one performance measurement system. Three basic quantities are tracked over time. Planned Value (PV) is the authorised budget for work scheduled to be completed by a given date. Earned Value (EV) is the budgeted value of the work actually completed. Actual Cost (AC) is the cost actually incurred for that work. From these, variances and indices are derived (Fleming and Koppelman, 2016; PMI, 2021).

Table 2.2 Core EVM parameters and indices

Measure	Formula	Meaning
Cost Variance (CV)	$EV - AC$	Budget surplus or deficit for work done
Schedule Variance (SV)	$EV - PV$	Work ahead of or behind plan, in money terms
Cost Performance Index (CPI)	EV / AC	Cost efficiency per unit of spending
Schedule Performance Index (SPI)	EV / PV	Schedule efficiency
Budget at Completion (BAC)	Total planned budget	Baseline for forecasting
To-Complete Performance Index (TCPI)	$(BAC - EV) / (BAC - AC)$	Efficiency required on remaining work to meet BAC

Table 2.3 Interpretation of CPI and SPI values

Value	Cost (CPI)	Schedule (SPI)
Greater than 1	Under budget	Ahead of schedule
Equal to 1	On budget	On schedule
Less than 1	Over budget	Behind schedule

Anbari (2003) reviewed the method and its extensions and stressed that EVM's value lies in giving early warning from objective data. Empirical work has long suggested that cost performance tends to stabilise early in a project, which makes early indices useful for forecasting, although the strength of this finding depends on the project type (Christensen, 1993; Fleming and Koppelman, 2016). Critics note that EVM depends on the quality of the baseline and on how percent complete is measured, and that SV is expressed in money rather than time and behaves unreliably near project completion, which motivated the schedule-based extensions discussed next.

2.3 Extensions of EVM: Earned Schedule, forecasting and uncertainty

Earned Schedule. Lipke (2003) proposed Earned Schedule (ES), which translates earned value onto the time axis. Schedule variance in time units, $SV(t) = ES - AT$, and a time-based index, $SPI(t) = ES / AT$, where AT is actual time, remain meaningful through to completion, correcting a recognised weakness of the cost-based SPI. Vanhoucke (2010) summarised the integration of EVM with schedule risk analysis and time forecasting, and later work compared forecasting methods across empirical and simulated projects.

Estimate at Completion. Forecasting the final cost is a central use of EVM. Several formulas exist, differing in assumptions about future performance (Christensen, 1993).

Table 2.4 Representative EAC formulas

Assumption about remaining work	Formula
Remaining work at original budgeted rate	$EAC = AC + (BAC - EV)$
Current cost efficiency continues	$EAC = BAC / CPI$
Cost and schedule efficiency both influence remaining work	$EAC = AC + (BAC - EV) / (CPI \times SPI)$

Statistical and probabilistic extensions. Because indices are calculated from uncertain progress data, several authors have treated them as random variables. Lipke, Zwikael, Henderson and Anbari (2009) applied statistical methods to EVM and Earned Schedule indices to support prediction of project outcome. Acebes et al. (2014) combined Monte Carlo simulation with statistical learning to produce stochastic earned value analysis, and fuzzy approaches have been proposed to handle imprecise progress estimates (Naeni, Shadrokh and Salehipour, 2011). Reviews of the field show that research has concentrated on forecasting accuracy and on schedule and risk integration (Willems and Vanhoucke, 2015; Hazır, 2015).

Adaptation to iterative delivery. Practitioners in software and product work have adapted EVM to iterative planning by treating story points or sprint deliverables as the unit of work (Sulaiman, Barton and Blackburn, 2006). This is relevant here because platforms such as ClickUp organise work in lists, tasks and sprints rather than in traditional work breakdown structures.

In summary, the extension literature strengthens the forecasting and statistical side of EVM, but it remains focused on cost and time outcomes.

2.4 Sustainability in project management

The most cited definition of sustainable development is that of the Brundtland Commission (WCED, 1987): development that meets present needs without compromising the ability of future generations to meet theirs. In business and project contexts, the idea is frequently operationalised through the triple bottom line of economic, environmental and social performance (Elkington, 1997), shown conceptually in Figure 2.3.

In project management, two perspectives are visible. The first concerns the **sustainability of project outputs**, that is, the environmental and social consequences of what the project delivers. The second concerns the **sustainability of project processes**, that is, how resources, people and time are used while delivering. Silvius and Schipper (2014) proposed a conceptual framework that integrates sustainability into project management and argued that it should influence project objectives, processes and governance, not only outputs. Martens and Carvalho (2017) examined how sustainability considerations enter project management practice and identified differences between how project managers understand and apply them. Standards for project, programme and portfolio management have also begun to reference sustainability among the factors to be considered (PMI, 2021).

Table 2.5 Sustainability dimensions and candidate project indicators

Dimension	Illustrative project-level indicators
Economic	Cost efficiency, budget variance, return on effort, rework cost
Environmental	Resource and material use, waste, energy or travel intensity of project work
Social	Workload balance, overtime, team wellbeing, stakeholder satisfaction
Process (cross-cutting)	Rework rate, schedule stability, scope change frequency

The indicators in Table 2.5 are drawn from the themes found in the sustainability literature and are presented as candidates for Phase 2, not as validated measures. A challenge repeatedly noted is that sustainability criteria are difficult to measure consistently at project level, which limits their use in routine control.

2.5 Linking EVM and sustainability

The literature that explicitly combines EVM with sustainability is thin. Two broad approaches can be distinguished.

The first is to treat sustainability as a **constraint or additional dimension of scope**, so that sustainability-related work packages are included in the baseline and their progress is earned like any other work. This is compatible with standard EVM and requires no change to the indices, but it only shows whether sustainability work is being delivered, not whether delivery itself is efficient and sustainable.

The second is to **supplement EVM indices with sustainability-oriented indicators**, such as resource intensity, workload balance or rework, and to interpret them jointly with CPI and SPI. This approach is more informative but raises questions of data availability, weighting and validation. Most of the sources reviewed treat this as a conceptual proposal, and empirical demonstrations remain limited. This observation is the central justification for the framework proposed in Section 2.10.

An additional connection is through optimisation. EVM-based forecasts can feed decisions about resource levelling, re-baselining and corrective action. When these decisions are evaluated only on cost and time, they may trade sustainability for short-term performance; evaluating them with a wider set of indicators is the opportunity this study explores.

2.6 Statistical analysis of EVM data and the role of JASP

EVM indices are usually reported as single values at each status date. Treating them as time series of uncertain observations opens the door to standard statistical analysis: examining distributions and normality, estimating confidence intervals for CPI and SPI, testing whether performance differs between phases or teams, studying relationships between indices and candidate sustainability indicators, and building simple predictive models. The studies noted in Section 2.3 show the value of such treatment, yet applied descriptions in accessible software are uncommon.

JASP is a free, open-source statistical programme with a graphical interface that supports both classical and Bayesian analysis, and it was developed to make rigorous methods available without programming (Love et al., 2019; JASP Team, 2024). Its reproducibility features, such as saving data, analyses and

output in a single file, are valuable for transparent reporting. Table 2.6 lists procedures in JASP that map to the analytical needs identified above.

Table 2.6 Statistical procedures in JASP relevant to EVM analysis

Analytical need	JASP procedure (classical and Bayesian where available)
Describe CPI, SPI and indicator distributions	Descriptive statistics; distribution and Q-Q plots; normality tests
Compare performance across phases, teams or periods	t-tests; ANOVA; non-parametric alternatives
Examine relationships between EVM indices and sustainability indicators	Correlation; linear regression
Assess trends and stability	Regression with time as predictor; repeated-measures analysis
Quantify uncertainty	Confidence and credible intervals; Bayesian estimation

The review found no widely cited study that documents an end-to-end EVM workflow in JASP, which constitutes one of the gaps addressed in this research.

2.7 Digital project management platforms and ClickUp

Modern work-management platforms record tasks, assignees, estimates, time tracked, statuses, dependencies and custom fields. Such data can in principle supply the inputs EVM needs. ClickUp is a widely used platform offering task hierarchies, time estimates and tracking, custom fields, dashboards and export options, as described in the vendor's own documentation. Academic literature on ClickUp specifically is limited, so this section draws on its documented features and on the general literature on digital project control, and the claims made here should be treated as feasibility arguments to be tested in Phase 2.

Table 2.7 Mapping of ClickUp features to EVM inputs

EVM or sustainability input	Possible ClickUp source
Baseline schedule and PV	Task start and due dates; time or cost estimates; baseline custom fields
Work completed and EV	Task status, percent complete or points completed, with defined earning rules
Actual Cost (AC)	Time tracked multiplied by rate; cost custom fields
Workload and overtime indicators	Workload view; time tracked against capacity
Rework and scope change	Reopened tasks; changes to estimates; task additions after baseline

A practical difficulty highlighted in the broader EVM literature is the definition of earning rules, that is, how progress on a task is converted into earned value (for example 0/100, 50/50 or weighted milestones). The interface can capture the status needed, but the rule must be chosen and applied consistently. A second difficulty is data quality: time tracking and status updates depend on team discipline. Both points shape the framework in Section 2.10 and the data-preparation approach for Phase 2.

2.8 Thematic synthesis

The reviewed literature can be grouped into five themes (Figure 2.4).

1. **Foundational EVM.** Mature and well standardised, with consistent definitions of PV, EV, AC and the derived indices.
2. **Schedule and forecasting extensions.** Earned Schedule and EAC methods improve time measurement and prediction accuracy.
3. **Statistical, simulation and fuzzy approaches.** Treat indices as uncertain, with demonstrated gains in prediction, mostly in research rather than routine practice.
4. **Sustainable project management.** Conceptually developed, with emphasis on integrating sustainability into objectives, processes and governance.
5. **Digital tools and accessible analytics.** Practical enablers, but weakly documented in the academic literature, especially for EVM.

2.9 Research gaps

Table 2.8 Summary of research gaps and their link to objectives

Gap	Description	Addressed by
G1	Sustainability is seldom operationalised within EVM-based control	Framework (Section 2.10); Phase 2 evaluation
G2	No documented, reproducible workflow linking a work-management interface to statistical software for EVM	Framework; Phase 2 workflow
G3	EVM indices are rarely analysed with distributional checks, intervals and tests in practitioner settings	JASP-based analysis in Phase 2
G4	Limited evidence on how earning rules and data quality in digital tools affect EVM reliability	Phase 2 data preparation and sensitivity checks

2.10 Conceptual framework for Phase 2

Responding to the gaps, the study proposes a four-layer framework (Figure 2.5):

1. **Data capture layer (ClickUp).** Project structure, estimates, time tracking and status are recorded, with defined earning rules and custom fields for cost and sustainability-related attributes.
2. **EVM computation layer.** PV, EV and AC are derived at regular status dates, giving CV, SV, CPI, SPI, ES-based measures and EAC forecasts.
3. **Statistical analysis layer (JASP).** Descriptive, inferential and, where suitable, Bayesian analysis of the indices and candidate sustainability indicators, with documented and repeatable analysis files.

4. **Decision and optimisation layer.** Joint interpretation of cost, schedule and sustainability-oriented indicators to guide corrective action, resource adjustment and re-baselining.

Phase 2 will use anonymised project data to examine whether this framework can be implemented, whether the indicators behave sensibly, and whether the joint view supports better decisions than cost and schedule alone. Hypotheses and methods will be specified at the start of Phase 2, before the data are analysed.

2.11 Chapter summary

This chapter reviewed classical EVM, its schedule, forecasting and statistical extensions, the concept of sustainability in project management, and the roles of JASP and ClickUp as accessible analytical and data-capture tools. The synthesis shows that EVM is mature but narrow in what it measures, that sustainability is conceptually well developed but rarely connected to EVM in operational terms, and that tool-supported statistical EVM workflows are under-documented. Four gaps were identified and a conceptual framework was proposed to address them in Phase 2.

References cited in Chapters 1 and 2

- Acebes, F., Pajares, J., Galán, J. M. and López-Paredes, A. (2014). A new approach for project control under uncertainty: going back to the basics. *International Journal of Project Management*, 32(3), 423–434. [Stochastic earned value analysis; check exact title.]
- Anbari, F. T. (2003). Earned value project management method and extensions. *Project Management Journal*, 34(4), 12–23.
- Christensen, D. S. (1993). The estimate at completion problem: a review of three studies. *Project Management Journal*, 24(1), 37–42.
- Elkington, J. (1997). *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. Capstone.
- Fleming, Q. W. and Koppelman, J. M. (2016). *Earned Value Project Management* (4th ed.). Project Management Institute.
- Hazır, Ö. (2015). A review of analytical models, approaches and decision support tools in project monitoring and control. *International Journal of Project Management*, 33(4), 808–815.
- JASP Team (2024). JASP (Version 0.18 or later) [Computer software]. <https://jasp-stats.org>
- Lipke, W. (2003). Schedule is different. *The Measurable News*, March, 31–34.
- Lipke, W., Zwikael, O., Henderson, K. and Anbari, F. (2009). Prediction of project outcome: the application of statistical methods to earned value management and earned schedule performance indexes. *International Journal of Project Management*, 27(4), 400–407.
- Love, J., Selker, R., Marsman, M., et al. (2019). JASP: graphical statistical software for common statistical designs. *Journal of Statistical Software*, 88(2), 1–17.
- Martens, M. L. and Carvalho, M. M. (2017). Key factors of sustainability in project management context: a survey exploring the project managers' perspective. *International Journal of Project Management*, 35(6), 1084–1102.
- Naeni, L. M., Shadrokh, S. and Salehipour, A. (2011). A fuzzy approach for the earned value management. *International Journal of Project Management*, 29(6), 764–772.
- Project Management Institute (2021). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)* (7th ed.). PMI.
- Silvius, A. J. G. and Schipper, R. (2014). Sustainability in project management: a literature review and impact analysis. *Social Business*, 4(1), 63–96.

- Sulaiman, T., Barton, B. and Blackburn, T. (2006). AgileEVM: measuring cost efficiency across the product lifecycle. *Agile 2006 Conference Proceedings*, IEEE.
- Vanhoucke, M. (2010). *Measuring Time: Improving Project Performance Using Earned Value Management*. Springer.
- WCED (1987). *Our Common Future*. Oxford University Press.
- Willems, L. L. and Vanhoucke, M. (2015). Classification of articles and journals on project control and earned value management. *International Journal of Project Management*, 33(4), 1610–1634.
- ClickUp (n.d.). Product documentation and help centre. <https://clickup.com>