GOLDEN RATIO OF DATA IN SUMMARY
VOLUME 6, ISSUE. 3 (2026)
Website: https://goldenratio.id/index.php/grdis

GOLDEN RATIO
ISSN [Online]: 2776-6411

DATA IN SUMMARY | ACCOUNTING, MANAGEMENT, BUSINESS, ECONOMIC

# The Influence of Technopreneurship-Based Strategic Management on Project Performance at PT Len Industri (Persero)

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**ARTICLE HISTORY**

Received: April 06, 2026
Revised: July 06, 2026
Accepted: July 08, 2026

**DOI**
https://doi.org/10.52970/grdis.v6i3.2201

**ABSTRACT**
This study analyzes the role of technopreneurship-based strategic management in improving the performance of Smart Technology Internet of Things (IoT) E-Bike projects at PT Len Industri (Persero). A quantitative explanatory approach with data triangulation was employed by integrating perception-based assessments with objective project performance indicators derived from Earned Value Management, namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). Data were collected through questionnaires administered to project personnel and from official project reports. The results indicate that technopreneurship-based strategic management is implemented at a high level and has a positive and significant effect on project performance. All dimensions, namely productive, creative, innovative, and dynamic, contribute significantly to improving schedule adherence, cost efficiency, system quality, stakeholder satisfaction, and technological reliability. The consistency between subjective assessments and objective performance indicators confirms that project performance can be empirically verified and is not solely based on perceptions. This study concludes that integrating technopreneurship-oriented management with objective performance measurement enhances the effectiveness, efficiency, and accountability of IoT-based technology project management.

**Keywords:** Technopreneurship, Strategic Management, Project Performance, IoT E-Bike, Earned Value Management.

## I. Introduction

The rapid advancement of digital technologies and intelligent systems has driven significant transformations across various industrial sectors, including transportation through the emergence of Smart Technology and Internet of Things (IoT)-based electric vehicles. IoT technology enables electric vehicles, such as E-Bikes, to be equipped with real-time monitoring systems, intelligent energy management, and cloud-based data integration, thereby enhancing operational efficiency, system reliability, and safety. The complexity of integrating hardware, software, sensors, and analytical systems positions Smart Technology IoT E-Bike development not merely as a technical undertaking but as a strategic project that requires robust managerial approaches and comprehensive performance evaluation. In this context, technology projects can no longer be viewed as short-term operational activities. Instead, they function as strategic instruments that

ISSN [Online]: 2776-6411

determine organizational competitiveness and value creation. Technopreneurship-based strategic management has emerged as a relevant approach by integrating entrepreneurial orientation with technology utilization as the primary driver of innovation and organizational performance. Hitt, Ireland, and Hoskisson (2017) emphasize that strategic management in technology-intensive environments requires adaptive strategies capable of responding to technological dynamics and environmental change. Within the context of technopreneurship, technology is positioned not only as an operational tool but also as a strategic asset that drives innovation, organizational transformation, and continuous improvement in project performance. The success of technopreneurship is closely associated with managerial capability in integrating innovation, technology adoption, and organizational resources. Wahyudin Yahyaa et al. (2025) highlight that such integration fosters organizational ambidexterity, namely the ability to balance the exploitation of existing resources with the exploration of new technology-based opportunities. In Smart Technology IoT E-Bike projects, this balance is reflected in the need to maintain control over project schedules and costs while remaining responsive to technological changes, evolving user requirements, and market dynamics. Complementing this perspective, the dynamic capabilities theory proposed by Teece, Pisano, and Shuen (1997) explains that technology-based organizations must continuously reconfigure their resources and competencies through sensing, seizing, and transforming processes to manage uncertainty in technical specifications and technological risks without compromising project productivity.

Beyond managerial strategy, the success of technopreneurship is also influenced by organizational readiness and supporting infrastructure. Wibowo et al. (2022) introduce the concept of technopreneurial infrastructure, in which technological resources, organizational mechanisms, information systems, and knowledge support function as enablers that accelerate innovation and reduce the risk of project failure. In Smart Technology IoT E-Bike development, challenges such as specification uncertainty, rapid technological change, and budget constraints require an organizational infrastructure that supports rapid adaptation and strategic decision-making. From a project management perspective, technopreneurship-oriented technology projects are typically iterative and data-driven. Mulyana et al. (2025) note that prototyping and minimum viable product (MVP) development enable the continuous validation of technological solutions, while Sa'diya et al. (2025) emphasize that the development of complex IoT systems requires adaptive and responsive entrepreneurial mindsets supported by evidence-based decision-making. Consequently, performance evaluation in such projects should rely not only on subjective perceptions but also on objective performance indicators. Project performance in Smart Technology IoT E-Bike development is commonly assessed using five key dimensions: schedule performance, cost control, system quality, stakeholder satisfaction, and technological system reliability. Schedule adherence is critical because delays may disrupt IoT integration, system testing, and operational implementation (PMBOK Guide, PMI). Cost control is equally essential, particularly in technology projects characterized by evolving hardware, software, sensor, and data infrastructure requirements (Sambasivan & Soon, 2007; Pohan & Wiguna, 2025). System quality determines functional accuracy, data communication stability, and security (Garvin, 1987), whereas stakeholder satisfaction reflects the extent to which project outcomes meet the expectations of management, users, technology partners, and government regulators (Freeman, 1984; Adhika Ramadhan, 2020). Furthermore, technological system reliability, as defined by ISO/IEC 25010, is fundamental to ensuring the stable and sustainable operation of IoT-based vehicles.

Despite the strategic importance of these performance dimensions, many technology project evaluations continue to rely heavily on perception-based assessments, which are inherently subjective and susceptible to bias. To address this limitation, objective performance measurement tools are required. Earned Value Management (EVM) provides widely accepted indicators, namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI), to quantitatively measure schedule achievement and cost efficiency. Moslehabadi (2020) confirms that SPI reflects schedule performance relative to baseline plans, while Wardani and Rahmat (2023) demonstrate that CPI is effective in detecting cost deviations during project implementation. Integrating these indicators is consistent with the principles of technopreneurship by positioning data and technology as the foundation for strategic, evidence-based decision-making.PT Len

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Industri (Persero), as a strategic state-owned enterprise operating in the fields of technology and integrated systems, represents an organizational setting that aligns with the technopreneurship ecosystem. The development of Smart Technology IoT E-Bikes requires management not only to achieve productivity and efficiency but also to foster innovation and adaptability in responding to technological change and project risks. Drawing on technopreneurship theory, organizational ambidexterity, dynamic capabilities, technopreneurial infrastructure, and objective performance evaluation mechanisms, project success is determined not only by technical excellence but also by the integration of managerial strategy, organizational readiness, and data-driven performance control. Based on this background, this study examines the role of technopreneurship-based strategic management in improving the performance of Smart Technology IoT E-Bike projects at PT Len Industri (Persero). Project performance is evaluated across the dimensions of schedule performance, cost control, system quality, stakeholder satisfaction, and technological reliability using a triangulation approach that combines respondents' perceptions with objective EVM-based indicators, namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). This study is expected to contribute theoretically to the literature on technopreneurship and technology project management, while also providing practical insights for improving the governance of IoT-based projects in strategic state-owned enterprises.

## II. Literature Review and Hypothesis Development

This study employed a quantitative explanatory design to examine the effect of technopreneurship-based strategic management on the performance of Smart Technology IoT E-Bike projects at PT Len Industri (Persero). Project performance was measured using a data triangulation approach that combined respondents' perceptions with objective project performance indicators derived from Earned Value Management (EVM), namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). This approach was adopted to enhance analytical validity and reduce the subjectivity associated with perception-based assessments. Primary data were collected through questionnaires using a five-point Likert scale administered to personnel involved in project management. The questionnaires measured technopreneurship-based strategic management and the dimensions of project performance, including schedule performance, cost control, system quality, stakeholder satisfaction, and technological system reliability. Secondary data were obtained from official project reports, including baseline schedules, actual progress records, baseline budgets, and actual cost data, which were used to calculate the SPI and CPI. Data analysis was conducted in three stages. First, descriptive statistics were used to summarize the perception-based data and the distributions of the SPI and CPI. Second, triangulation analysis was performed to compare respondents' perceptions of schedule and cost performance with the actual SPI and CPI values in order to validate the subjective assessments. Third, multiple linear regression analysis was employed to examine the effect of technopreneurship-based strategic management on project performance, with the SPI and CPI serving as supporting objective indicators for interpreting the results. Instrument validity was evaluated through content validity and construct validity, while reliability was assessed using Cronbach's Alpha. Methodological triangulation, which integrated subjective perceptions with objective performance indicators, was applied to ensure that project performance was measured accurately, credibly, and with minimal bias.

## III. Result and Discussion

### 3.1. Overview of Research Findings

The questionnaire results indicate that respondents perceived the implementation of technopreneurship-based strategic management to be at a high level. Positive perceptions were reflected in the organization's ability to utilize technology as a basis for decision-making, its managerial flexibility in

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responding to changes in project specifications, and its effective coordination of IoT system integration within the Smart Technology E-Bike project. Respondents also reported favorable evaluations of project performance across the dimensions of schedule performance, cost control, system quality, stakeholder satisfaction, and technological system reliability. Considering the potential subjectivity of perception-based data, project performance evaluation was strengthened through objective performance indicators derived from Earned Value Management (EVM), namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). The integration of subjective and objective data enhanced the validity of the project performance evaluation.

### 3.2. Descriptive Statistical Results

Descriptive analysis shows that all variables recorded mean values above 4.00, indicating a high level of assessment.

a. Technopreneurship-Based Strategic Management

Respondents provided positive evaluations of technopreneurship-based strategic management practices. The innovative dimension recorded the highest mean score (4.15), followed by the productive (4.12), dynamic (4.10), and creative (4.08) dimensions. These findings indicate that technopreneurship values have been successfully embedded in the management of the Smart Technology IoT E-Bike project, particularly in terms of technology adoption, resource efficiency, adaptability, and creative problem-solving.

b. Project Performance

Project performance was also evaluated positively. Technological system reliability (4.20) and system quality (4.18) obtained the highest mean scores, followed by stakeholder satisfaction (4.10), schedule performance (4.05), and cost control (3.98). These results suggest that the project was not only technically successful but also generated strategic value for the organization and its stakeholders.

### 3.3. Validity and Reliability

All questionnaire items satisfied the validity criterion ($r > 0.30$). Reliability testing produced Cronbach's Alpha values of 0.923 for technopreneurship-based strategic management and 0.887 for project performance, confirming strong internal consistency.

### 3.4. Structural Model Results (PLS-SEM)

PLS-SEM analysis was conducted to examine the influence of the dimensions of technopreneurship-based strategic management on project performance. All dimensions demonstrated positive and significant effects on project performance.

a. Productive → Project Performance ($\beta = 0.281$; $t = 3.214$; $p = 0.001$)
b. Creative → Project Performance ($\beta = 0.237$; $t = 2.869$; $p = 0.004$)
c. Innovative → Project Performance ($\beta = 0.322$; $t = 3.981$; $p < 0.001$)
d. Dynamic → Project Performance ($\beta = 0.268$; $t = 3.102$; $p = 0.002$)

The coefficient of determination ($R^2 = 0.682$) indicates that 68.2% of the variance in project performance is explained by the four dimensions of technopreneurship-based strategic management, demonstrating strong explanatory power. Effect size analysis shows that the innovative dimension has the strongest effect ($f^2 = 0.156$), followed by the productive (0.102), dynamic (0.098), and creative (0.084) dimensions.

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### 3.5. Schedule Performance Triangulation

Respondents reported positive perceptions of project schedule performance, indicating that the integration of hardware, software, and IoT sensors progressed according to plan. The objective SPI values fluctuated around 1.0, suggesting that actual project progress remained consistent with the baseline schedule. The alignment between the perception-based data and the SPI confirms that the respondents' assessments were supported by actual project performance. This finding supports Moslehabadi (2020), who identified the SPI as a reliable indicator of schedule performance. Therefore, technopreneurship-based managerial practices contributed to maintaining project timeliness through data-driven decision-making.

### 3.6. Cost Performance Triangulation

Respondents perceived project cost management to be efficient, particularly regarding IoT component procurement, resource optimization, and risk mitigation related to specification changes. The CPI values were close to or slightly above 1.0, indicating satisfactory cost efficiency without evidence of budget overruns. The consistency between the perception-based data and the CPI values confirms that the assessments of cost performance accurately reflected the actual project conditions. This finding is consistent with Wardani and Rahmat (2023), who identified the CPI as a sensitive indicator for detecting cost deviations and serving as an early warning mechanism in technology projects. These findings empirically demonstrate that technopreneurship-based management supports cost efficiency through technology-oriented and resource-based decision-making.

### 3.7. Integrated Discussion

The triangulation results confirm the following.

a. Positive perceptions of project performance are consistent with objective performance indicators.
b. Schedule and cost performance can be verified both statistically and empirically.
c. Technopreneurship serves as a driver of data-oriented strategic management.

Technopreneurship-based strategic management proves to be effective because the following factors contribute to project success.

a. Technological sensing and seizing capabilities improve schedule adherence and cost efficiency.
b. The use of objective performance data, represented by the SPI and CPI, supports strategic learning and informed managerial decision-making.
c. Organizational ambidexterity maintains a balance between innovation and operational effectiveness in complex IoT-based projects.

Overall, project performance was evaluated not only through subjective assessments but also verified using quantitative indicators that reflected actual project performance. This integrated approach strengthens the objectivity, credibility, and analytical rigor of the study.

### 3.8. Discussion of Findings

a. Effect of the Productive Dimension on Project Performance

The structural model results indicate that the productive dimension has a positive and significant effect on the performance of the Smart Technology IoT E-Bike project ($\beta = 0.281$; $t = 3.214$; $p = 0.001$). This finding suggests that efficient resource utilization, effective time management, and cost control directly enhance project performance. This result confirms that operational effectiveness serves as a fundamental

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foundation for managing IoT-based technology projects, particularly those requiring the integration of hardware, software, and data systems. Therefore, the productive dimension functions as a prerequisite for project success before creative and innovative capabilities can be further developed.

b. Effect of the Creative Dimension on Project Performance

The creative dimension also demonstrates a positive and significant effect on project performance ($\beta = 0.237$; $t = 2.869$; $p = 0.004$). This finding indicates that the project team's ability to generate ideas, develop solutions, and resolve technical challenges contributes substantially to improved project outcomes. Creativity enables flexible responses to technical challenges and evolving user requirements, particularly in the dynamic development of IoT E-Bike systems. Therefore, creativity serves as a critical supporting factor that complements operational efficiency in achieving the success of technology projects.

c. Effect of the Innovative Dimension on Project Performance

Among all dimensions, the innovative dimension demonstrates the strongest influence on project performance ($\beta = 0.322$; $t = 3.981$; $p < 0.001$). This finding indicates that the adoption of advanced technologies, process innovation, and value-added system development are the primary drivers of improvements in the quality and reliability of IoT E-Bike systems. The dominant effect of innovation reinforces the view that Smart Technology and IoT-based projects depend heavily on an organization's capability for continuous innovation. Innovation not only improves technical system quality but also provides strategic advantages in responding to rapid technological change and increasing competitive pressures.

d. Effect of the Dynamic Dimension on Project Performance

The dynamic dimension also exhibits a positive and significant effect on project performance ($\beta = 0.268$; $t = 3.102$; $p = 0.002$). This finding demonstrates that managerial adaptability in responding to changes in project specifications, technological risks, and dynamic project environments contributes directly to project success. In technology projects characterized by high levels of uncertainty, managerial flexibility and responsiveness are essential for maintaining project continuity and effectiveness. Therefore, the dynamic dimension functions as a control mechanism that enables the Smart Technology IoT E-Bike project to remain effective despite changes and emerging risks.

### 3.9. Research Implications

The findings of this study have both practical and theoretical implications. From a practical perspective, they suggest that PT Len Industri (Persero) should continue to strengthen the implementation of technopreneurship-based strategic management in the management of Smart Technology IoT E-Bike projects. Particular emphasis should be placed on enhancing the innovative and dynamic dimensions, as these demonstrate the strongest effects on project performance, while the productive and creative dimensions should be maintained as the operational foundation and drivers of value-added solutions. From a theoretical perspective, this study provides empirical evidence that enriches the literature on the relationship between technopreneurship and technology project performance, particularly in IoT-based industrial contexts. The findings reinforce the relevance of technopreneurship-based strategic management as a conceptual framework for explaining the successful management of complex and dynamic technology projects.

## IV. Conclusion

This study examined the role of technopreneurship-based strategic management in enhancing the performance of the Smart Technology IoT E-Bike project at PT Len Industri (Persero) using a quantitative approach and data triangulation that combined respondents' perceptions with objective project performance

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indicators, namely the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). The findings indicate that the implementation of technopreneurship-based strategic management has reached a high level, as reflected in the effective use of technology to support managerial decision-making, managerial flexibility in responding to changes in project specifications, and efficient cross-functional coordination. These results demonstrate that technopreneurship principles have become an integral foundation for planning, organizing, and controlling technology-based projects. In addition, respondents reported positive evaluations of project performance across the dimensions of schedule performance, cost control, system quality, technological system reliability, and stakeholder satisfaction. These perception-based assessments were supported by objective project performance data, with SPI values remaining stable and close to 1.0 and CPI values indicating satisfactory cost efficiency. The consistency between subjective perceptions and objective performance indicators confirms that project performance was not only perceived positively but was also empirically validated through actual project execution data. Furthermore, the integration of technopreneurship-based strategic management with data-driven performance measurement contributed to improved project outcomes by strengthening strategic sensing and managerial decision-making, thereby enhancing the organization's responsiveness to technical risks and technological changes. At the same time, objective performance monitoring through the SPI and CPI promoted schedule adherence and cost efficiency while minimizing perceptual bias in project evaluation. Overall, this study confirms that valid and credible performance measurement in high-technology projects requires the integration of technopreneurship-based managerial practices with objective evaluation instruments such as the SPI and CPI. This integrated approach ensures that project success is determined not only by innovation and creativity but also by measurable and verifiable control of schedule and cost performance, thereby strengthening the effectiveness, accountability, and sustainability of technology project management.

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