THE IMPACT OF SOFTWARE ENGINEERING PROJECT MANAGEMENT, ORGANIZATIONAL SUPPORT, AND SELF-EFFICACY ON EMPLOYEE PERFORMANCE IN THE CHINESE AUTOMOTIVE INDUSTRY

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Abstract

This study examines the effects of Software Engineering Project Management, Organizational Support, and Self-efficacy on Employee Performance in China's automotive industry during its technological transformation. Data were collected from 400 professionals in software, technology, and project management roles using a structured questionnaire with a five-point Likert scale. The instrument demonstrated strong validity and reliability, and data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with ADANCO software.

Results showed that all three variables had significant positive effects on Employee Performance at the level of .001, explaining 75.5% of the variance. Software Engineering Project Management had the strongest influence, followed by Organizational Support and Self-efficacy. The Cohen's f^2 values indicated medium to large effect sizes. The findings underscore the crucial roles of effective project management, supportive organizational environments, and employee confidence in enhancing performance. This study provides new insights by integrating managerial, organizational, and psychological factors to explain employee performance in technology-driven industries.

Keywords: Project Management, Organizational Support, Self-efficacy, Employee Performance, Software Engineering

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Introduction

The global automotive industry is undergoing unprecedented change driven by increasingly advanced technologies, shifting consumer preferences, and stricter environmental regulations. Leading this transformation is China, which has rapidly evolved from an emerging market to the world's largest producer and consumer of automobiles (Barwick et al., 2021). This remarkable rise – where a single industry sector now accounts for nearly 10% of GDP – is increasingly viewed as a deliberate strategic shift toward new energy vehicles (NEVs) and smart, connected systems (Zhao et al., 2019). This trend has placed enormous pressure on manufacturers to innovate continuously, with software engineering emerging as a key differentiator and battleground for competitive leadership. As a result, effective management of complex developments is no longer optional but a strategic necessity. Project management now extends beyond the traditional constraints of time, scope, and cost, becoming a crucial "change agent" essential for managing complexity and fostering innovation to address highly complex challenges (Locatelli et al., 2023; Calderon-Tellez et al., 2024). In this high-pressure environment, employee performance – especially among those in software roles and development – is a critical factor for organizational success. Efficient and effective employee performance is essential for achieving organizational objectives and ensuring long-term survival in a competitive environment (Afrin et al., 2023). Therefore, understanding the factors that influence employee performance in China's technology-driven automotive industry is of significant interest to both industry practitioners and academic researchers.

Although the influences of individual factors such as project management, organizational support, and self-efficacy on performance are well established, there is a significant research gap regarding the integrative and collaborative effects of these factors in the context of software engineering within China's automotive industry. Existing literature often examines these relationships in isolation or within different industrial and cultural settings. For example, research has demonstrated a positive association between formal project management processes and project manager performance (Seboni & Ssegawa, 2022), as well as the influence of agile methodologies on project performance in the IT industry. Similarly, studies have shown that organizational support positively and significantly impacts employee performance, often mediated by a sense of belonging (Chen et al., 2020) and work engagement (Alshaabani et al., 2021). Additionally, self-efficacy is a strong predictor of job performance (Hislop, 2013), as employees' confidence in their abilities is crucial for achieving superior job performance outcomes (Mustafa et al., 2019; Kim, 2023). However, minimal research has explored an integrative model that explains how these three distinct constructs – the structural and process characteristics of project management, the social-emotional context of organizational support, and the psychological resource of self-efficacy – collectively predict employee performance in fast-paced, rapidly developing software sectors within automotive leaders like China. This lack of holistic research is significant, as it leaves a critical gap in understanding how to effectively manage and motivate the modern automotive workforce.

Given the significance outlined above, the researcher aims to address this literature gap by critically analyzing the effects of software engineering project management, organizational support, and self-efficacy on employee performance in China's automotive industry. The objective of this study is to develop and empirically evaluate a comprehensive model explaining the interconnections among these key constructs. At the core of the industry's technological revolution, my colleagues seek insights to help optimize employee performance. The anticipated contributions of this study are as follows. It provides heuristic guidance for industry practitioners, such as project managers and human resource managers in Chinese automotive companies, with actionable results.

This research will enable them to develop more effective project management systems, foster a truly supportive organizational culture, and implement measures that enhance employee self-efficacy, ultimately leading to innovative and successful projects. For academics, this study introduces an original and integrated theoretical model validated in a distinctive and rigorous economic context. It will generate empirical data on the impact of structural, social, and psychological conditions on employee performance, supporting and guiding future research on mediating and moderating effects in this relatively young and dynamic field.

Research Objectives

1. To examine the influence of software engineering project management on employee performance
2. To examine the influence of organizational support on employee performance
3. To examine the influence of self-efficacy on employee performance

Research Hypothesis

H1: Software engineering project management influences employee performance.
H2: Organizational support influences employee performance.
H3: Self-efficacy influences employee performance.

Conceptual Framework

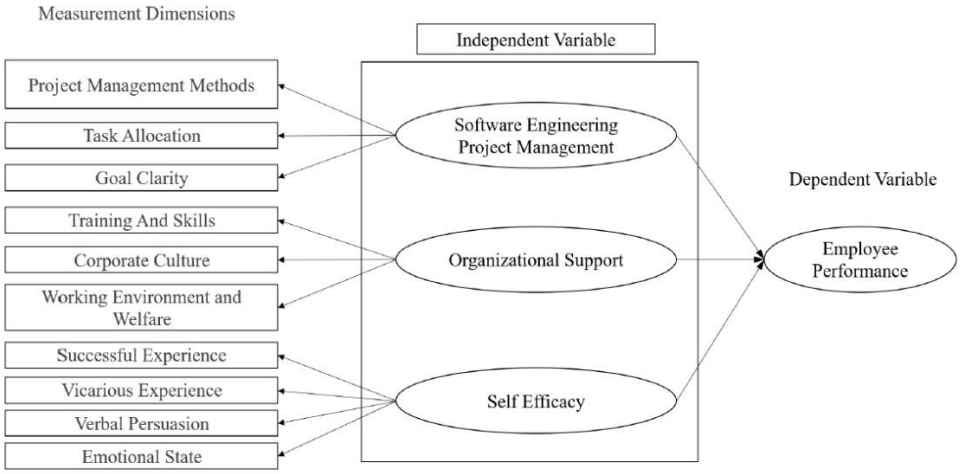

Figure 1 Conceptual framework

Literature Review

Theory and Concepts of Project Management

Project management has developed over more than 50 years into a fully mature and theoretically rigorous discipline (Locatelli et al., 2023). The field has shifted from focusing solely on problem-solving or norm-based knowledge to employing multiple interpretative and emancipatory research methods (Locatelli et al., 2023). In recent decades, project management has adapted to address increasing complexity and uncertainty resulting from society's changing needs (Calderon-Tellez et al., 2024) and the integration of sustainable development principles into project management practices (Moreno-Monsalve et al., 2022). Modern project management has evolved from a tool for controlling scope, time, and cost to an agent of change, driving innovation and transformation to address global challenges such as climate change, pandemics, and poverty (Locatelli et al., 2023). This transformation highlights the shift in project management's role from an operational tool to a strategic asset for organizations and society (Upadhyay et al., 2024; Ghorbani et al., 2022). Therefore, project management is essential for organizational success today, as it enhances efficiency and competitive advantage (Jupir et al., 2022). It serves as a mechanism for delivering the change and innovation needed to respond to global challenges (Locatelli et al., 2023). Additionally, project management plays a crucial role in improving planning, coordination, and knowledge creation within organizations (Upadhyay et al., 2024).

Theory and Concepts of Organizational Support

Organizational support has attracted increasing interest as a key variable in understanding the relationship between employees, organizations, and work situations. The theoretical background of organizational support is rooted in social exchange theory and organizational psychology, which emphasize the reciprocal nature of employees' relationships with organizations and how organizations treat their employees. Early studies in this field examined employees' perceptions of their organization's concern for their welfare and professional development (Aldamman et al., 2019).

Theory and Concepts of Self-efficacy

The construct of self-efficacy has become fundamental in the study of human motivation and behavior change across various domains. Based on social cognitive theory, self-efficacy refers to individuals’ beliefs about their ability to achieve the performance accomplishments required for specific outcomes (Lindquist et al., 2021). This theoretical model has attracted widespread interest in psychology, education, and health sciences for its ability to predict human behavior and performance. The development of self-efficacy theory has provided researchers and practitioners with a greater understanding of how individuals approach goals, tasks, and challenges, and how this influences their motivation and perseverance when facing difficulties (Shorey & Lopez, 2021). Self-efficacy continues to receive increased attention from scientists, clinicians, teachers, and the corporate sector. The

construct has proven particularly useful in examining how people navigate complex life circumstances, manage chronic illness, and, for students, succeed in academic or work settings (Hong et al., 2022). Research has consistently shown that self-efficacy beliefs influence a wide range of human functions, from decision-making and effort in overcoming difficulties to overall performance in areas such as health and academic achievement (Peters et al., 2019). The extensive application of self-efficacy theory across multiple populations and settings has further established its status as a key construct in social science research (Klassen & Klassen, 2018).

Theory and Concepts of Employee Performance

Employee performance is a fundamental concept in organizational behavior and human resource management, attracting significant attention from both academics and practitioners over the past decades. Performance measurement originated in the early 20th century, rooted in the principles of scientific management, but has advanced considerably as it became clear that employees are multidimensional and performance extends beyond productivity measures (Afrin et al., 2023; Li et al., 2019). As technology advances and competition increases dramatically in today's organizations, understanding and enhancing employee performance across different sectors and cultural backgrounds has become even more important (Vuong & Nguyen, 2022; Hermanto & Srimulyani, 2022). The concept of employee performance has evolved from traditional output-oriented perspectives to more inclusive models that incorporate behavior, context, and motivation. Contemporary research highlights the multifaceted nature of performance, emphasizing that it involves more than just task execution and includes adaptive behaviors, innovation, and organizational citizenship (Zhenjing et al., 2022; Anakpo et al., 2023).

Research Methodology

1. The population of this study includes all employees in the automobile industry of the People’s Republic of China who are engaged in the high-technology stage of the industry’s development, particularly those involved in the rapid transformation toward software-enabled and intelligent vehicles. This group comprises professionals such as software engineers, systems developers, IT specialists, R&D personnel, and technical project managers working in both domestic automotive firms and global joint ventures located in industrial centers such as Shanghai, Guangzhou, Beijing, and Chongqing. Due to the vast and dispersed nature of this workforce, the total number of individuals meeting these criteria cannot be precisely determined, making the population effectively indefinite. A total of 400 employees will be selected as the study sample, which is considered appropriate for quantitative analysis using Structural Equation Modeling (SEM), as it exceeds the minimum sample size of 200 recommended by Hair et al. (2010) to ensure statistical stability and robustness. Participants will be drawn from multiple automobile manufacturers to enhance representativeness, with

eligibility limited to professionals currently employed in software, technology, or project management roles for at least one year. Because the population is indefinite and access to this specific professional group is limited, the study uses a non-probability double-sampling method, combining purposive and convenience sampling to deliberately select qualified respondents while ensuring practical feasibility in data collection.

2. The research used a structured questionnaire as the primary instrument for data collection, developed through a rigorous multi-stage process to ensure validity and reliability. Initially, the researcher synthesized theoretical foundations and empirical findings from academic databases such as Scopus, Google Scholar, and Web of Science, focusing on the core variables– software engineering project management, organizational support, self-efficacy, and employee performance– to ensure theoretical grounding and construct relevance. Based on these foundations, a draft questionnaire was created comprising five major sections: demographic information, the independent variables (Software Engineering Project Management, Organizational Support, and Self-Efficacy), and the dependent variable (Employee Performance). Each construct was measured using items adapted from validated scales, modified to fit the context of the Chinese automotive sector. All statements were rated on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), a widely accepted format for assessing attitudes and perceptions. The instrument underwent several stages of expert and practical validation: first, a comprehensive review by the research supervisor, followed by content validation from three domain experts specializing in software project management, organizational psychology, and human resource management. The Index of Item-Objective Congruence (IOC) was calculated for each item, with all retained items exceeding the threshold of 0.50, ensuring content validity. A pilot test involving 30 employees from the target population was then conducted to evaluate reliability and comprehensibility, leading to minor revisions and refinements. Internal consistency reliability, assessed using Cronbach's alpha, yielded coefficients above 0.70 across all constructs, confirming satisfactory reliability. The finalized questionnaire thus demonstrated strong content validity, internal consistency, and contextual relevance, making it an appropriate and dependable instrument for the study's main data collection phase.

3. The data analysis for this study used descriptive and inferential statistical methods. Descriptive statistics, including frequency, percentage, mean, and standard deviation, summarized the demographic characteristics and main research variables. Inferential analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with ADANCO software to examine the hypothesized relationships among software engineering project management, organizational support, self-efficacy, and employee performance. The analysis assessed the measurement model for reliability and validity and evaluated the structural model to determine the significance and strength of the causal relationships among the constructs.

Results

1. Results of the General Information Analysis

The analysis of respondents' general information showed that most software engineers were male, totaling 272 individuals (68.00%). Most respondents were aged 25 to 34 years, accounting for 155 individuals (38.75%). For monthly income, the largest group earned between 20,001 and 30,000 yuan, representing 169 individuals (42.25%). Regarding work experience, 169 respondents (42.25%) had more than 12 years of professional experience. For educational attainment, the majority held a bachelor's degree, totaling 248 individuals (62.00%).

2. Results of Mean and Standard Deviation Analysis

The analysis of the mean and standard deviation of respondents' opinions on Software Engineering Project Management, Organizational Support, Self-efficacy, and Employee Performance showed that, on average, respondents expressed the highest level of agreement with Software Engineering Project Management, followed by Employee Performance, then Self-efficacy, with the lowest mean score for Organizational Support. Table 1 presents the detailed results, indicating that overall, respondents' opinions toward the key constructs were at high to very high levels, reflecting a generally positive perception across all dimensions.

Table 1 Mean and Standard Deviation of Respondents' Opinions

Factors/Variables	$\bar{X}$	SD	Level of opinion
Software Engineering Project Management	**3.62**	**.71**	**High**
- Project Management Methods	3.61	.75	High
- Task Allocation	3.61	.73	High
- Goal Clarity	3.64	.75	High
Organizational Support	**3.55**	**.73**	**High**
- Training And Skills	3.55	.75	High
- Corporate Culture	3.56	.77	High
- Working Environment and Welfare	3.54	.76	High
Self-efficacy	**3.59**	**.67**	**High**
- Successful Experience	3.60	.73	High
- Vicarious Experience	3.59	.71	High
- Verbal Persuasion	3.59	.71	High
- Emotional State	3.57	.72	High
Employee Performance	**3.60**	**.59**	**High**

3. The hypothesis testing

Table 2 Presents the results of structural validity analysis and factor loadings

Factors	Loading	AVE	Dijkstra-Henseler's rho (ρA)	Jöreskog's rho (ρc)	Cronbach's alpha (α)
Software Engineering Project Management		.908	.950	.967	.950
- PMM	.957				
- TA	.950				
- GC	.952				
Organizational Support		.915	.954	.970	.953
- TS	.955				
- CC	.956				
- WE	.959				
Self-Efficacy		.886	.957	.969	.957
- SE	.938				
- VE	.942				
- VP	.938				
- ES	.946				
Employee Performance		.571	.893	.914	.892
- EP1	.783				
- EP2	.754				
- EP3	.788				
- EP4	.757				
- EP5	.758				
- EP6	.696				
- EP7	.769				
- EP8	.734				

Table 2 shows that all observed variables in the model had factor loadings above .50, ranging from .696 to .959, indicating that the indicators for each latent variable were reliable for measurement. For structural validity, Dijkstra-Henseler's rho (ρA) values ranged from .893 to .957, Jöreskog's rho (ρc) values ranged from .914 to .970, and Cronbach's alpha (α) values ranged from .892 to .957. All these values exceeded the .70 threshold, confirming the constructs' reliability. Additionally, the latent variables demonstrated strong discriminant validity, as AVE values exceeded .50, ranging from .571 to .915 (Henseler et al., 2016).

Table 3 Shows a comparison of discriminatory accuracy according to the Fornell-Larcker criterion

Factors	Software Engineering Project Management	Organizational Support	Self-Efficacy	Employee Performance
Software Engineering Project Management	**0.953**			
Organizational Support	0.099	**0.95**6		
Self-Efficacy	0.117	0.079	**0.941**	
Employee Performance	0.483	0.429	0.302	**0.755**

* Note: The values in the diagonal represent the square root of AVE.

Table 3 shows that the model demonstrated discriminant validity, as the square root of the Average Variance Extracted (AVE) was higher than the correlations (r) of each latent variable on the diagonal. The interrelations among the latent variables ranged from 0.079 to 0.483 (Henseler et al., 2016).

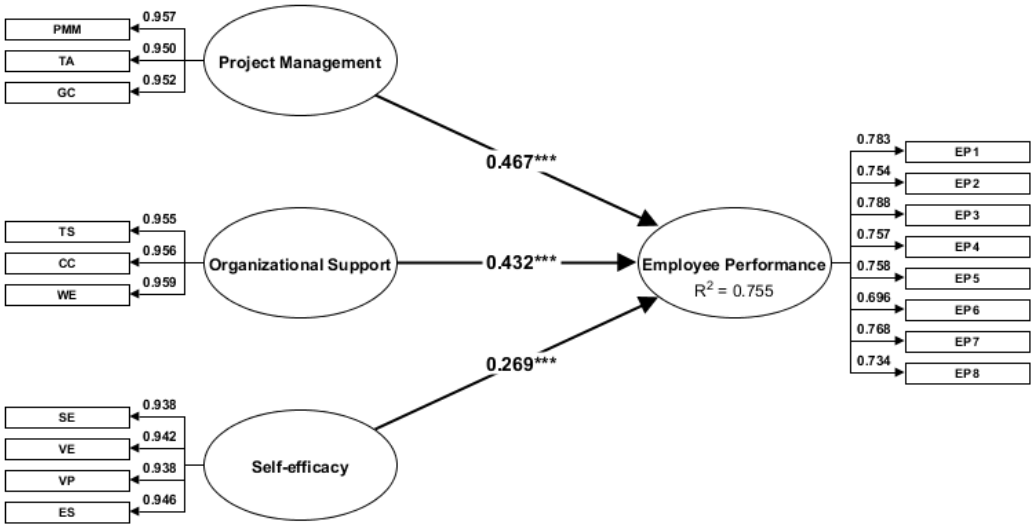

Figure 2 The results of hypothesis testing

Table 4 Coefficient Values for Hypothesis Testing

Factors	Employee Performance (R^2 = 0.755)			
	β	t-test	p-value	Cohen's F^2
Software Engineering Project Management	.467	17.193***	.000	0.740
Organizational Support	.432	15.546***	.000	0.661
Self-efficacy	.269	8.825***	.000	0.251

*** Statistical significance at .001 level

According to Table 4, Software Engineering Project Management, Organizational Support, and Self-efficacy have a positive direct influence on Employee Performance in China's automotive industry, with statistical significance at the .001 level. The model demonstrates a predictive power of 75.5%, indicating strong explanatory capability. Among the three variables, Software Engineering Project Management has the greatest influence, followed by Organizational Support, while Self-efficacy has the least impact. Based on the effect size measured by Cohen's f^2, the model shows a medium to large effect, with values ranging from 0.251 to 0.740, indicating that the relationships among the variables are substantial and meaningful.

Discussion

The results of this study show that software engineering project management, organizational support, and self-efficacy significantly and positively influence employee performance in China's automotive industry, with software engineering project management having the strongest impact. This finding highlights the crucial role of structured project management processes in high-technology organizations where software integration and digital transformation are essential for competitiveness. Effective project management provides clear goal setting, efficient task allocation, and consistent communication across teams, which together improve work quality and coordination. Recent studies have confirmed that project management competence – especially in planning, risk control, and communication– is a key driver of organizational effectiveness and employee productivity in technologically dynamic industries (Khrais & Alkhatib, 2022). Additionally, Al-Nabae (2023) found that in technology-intensive firms, well-developed project management frameworks support innovation, reduce errors, and foster a performance-oriented culture. This is consistent with the context of China's rapidly evolving automotive sector, where software-defined vehicles and intelligent systems require careful coordination among R&D, engineering, and IT functions. Therefore, strong project management practices not only improve operational efficiency but also help employees align their performance with their organizations' strategic innovation goals.

Organizational support demonstrates a substantial positive relationship with employee performance, confirming the importance of supportive workplace environments in motivating employees and sustaining high performance. When organizations provide resources, training, recognition, and emotional support, employees tend to develop a sense of reciprocity and organizational commitment, which boosts work engagement and productivity. Similarly, Kara et al. (2021) found that in knowledge-intensive organizations, perceived organizational support significantly enhances employee performance through the development of organizational identification and trust. Their study showed that when employees perceive strong support from their organization and leadership, they are more likely to feel included, valued, and empowered to perform complex tasks effectively. These findings are consistent

with the current study's results, indicating that organizational support serves not only as a motivational driver but also as a structural mechanism that reinforces employee commitment, collaboration, and high performance in technologically dynamic industries. Sihag (2021) found that perceived organizational support significantly enhances employee engagement and indirectly contributes to improved job satisfaction and performance outcomes. The study showed that when employees in technology-intensive organizations perceive strong support from their employers, they develop higher levels of trust, motivation, and organizational commitment, which ultimately lead to sustained performance and long-term organizational success. This evidence aligns with the present study, underscoring that consistent and visible organizational support functions not only as a direct driver of employee performance but also as a mediating mechanism that strengthens engagement and satisfaction. In the context of China's automotive industry, where technological pressures and innovation demands are high, a supportive and inclusive organizational environment is essential for maintaining workforce resilience, adaptability, and performance stability.

Although self-efficacy showed the smallest influence among the predictors, its role remains psychologically and behaviorally essential to employee performance. Employees who believe in their capabilities are more likely to demonstrate persistence, adaptability, and confidence when facing challenging tasks. This finding aligns with Bandura's social cognitive theory, which asserts that self-efficacy is a core determinant of human agency and effort investment in performance-related contexts. Empirical evidence supports this, showing that self-efficacy enhances not only direct task performance but also adaptive and innovative behaviors critical in dynamic work environments (Li et al., 2019). Additionally, recent research in technology-driven organizations indicates that self-efficacy mediates the relationship between organizational climate and employee innovation, amplifying the impact of external support systems on performance outcomes. In the context of China's automotive transformation toward intelligent and electric vehicles, fostering employee self-efficacy can empower engineers and technical staff to navigate uncertainty, engage in problem-solving, and contribute to sustainable innovation. While its effect size may be smaller compared to managerial and organizational factors, self-efficacy remains an indispensable psychological resource that reinforces performance-enhancing mechanisms within high-tech organizations.

Suggestions

1. Organizations in China's automotive industry should institutionalize systematic software engineering project management practices. Establishing standardized processes and digital monitoring systems can improve coordination, communication, and project efficiency. Well-structured project management enhances goal alignment, reduces operational risks, and enables employees to perform tasks with clarity and accountability, ultimately increasing overall productivity and innovation.

2. Management should reinforce organizational support by providing adequate resources, fair policies, and professional development opportunities. A supportive work environment that values recognition and open communication fosters trust, motivation, and commitment. When employees feel valued and supported, their engagement and performance improve, contributing to sustainable organizational success.

3. Companies should promote employee self-efficacy through empowerment programs, mentoring, and constructive feedback systems. Encouraging participation in decision-making and recognizing individual achievements help employees build confidence and adaptability. Higher self-efficacy increases persistence, creativity, and problem-solving ability, which are essential for success in technology-driven work environments.

4. Integrating project management, organizational support, and self-efficacy development into a unified human resource strategy can create a comprehensive performance enhancement framework. Aligning technical systems, managerial structures, and psychological empowerment will strengthen employee capabilities, foster continuous improvement, and sustain competitiveness in the dynamic automotive industry.

The new body of Knowledge found in this study

The findings of this study add new knowledge to the field of human resource and technology management in the context of China's automotive industry. Specifically, the study integrates project management principles with psychological and organizational constructs to explain employee performance in a software-driven industrial environment. This integration extends existing theories of performance by showing that effective software engineering project management is not only a technical or procedural factor but also a strategic determinant of employee productivity and organizational success. The study provides empirical evidence that systematic project management practices enhance communication, clarity, and alignment between technical and managerial teams, thereby strengthening the link between engineering management processes and human performance outcomes. This insight expands the theoretical understanding of how digital project management frameworks can serve as a foundation for improving workforce efficiency in rapidly transforming industrial sectors.

Additionally, the study enriches the conceptual understanding of organizational support and self-efficacy as complementary mechanisms influencing employee performance. It shows that while organizational support acts as an external enabler by fostering motivation, resource accessibility, and a positive work environment, self-efficacy functions as an internal psychological driver that strengthens persistence, adaptability, and confidence among employees. The coexistence of these two mechanisms provides a balanced model that combines managerial systems with individual cognition, offering a more holistic explanation of performance behavior in high-technology organizations. Consequently, this study advances

the body of knowledge by presenting a multidimensional framework that connects management practices, organizational culture, and psychological empowerment, contributing to the growing discourse on human performance optimization in technologically advanced industries.

Future Research

1. Future studies should examine additional variables such as digital leadership, innovation climate, or work engagement to broaden understanding of factors influencing employee performance in technology-driven industries.

2. Researchers may use longitudinal or mixed method designs to capture the dynamic relationships between project management practices, organizational support, and employee outcomes over time.

3. Comparative studies across different countries or industrial sectors could validate and generalize the proposed model beyond the Chinese automotive industry context.

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