

The Influence of Factors on Innovation Management and Sustainable Performance Effectiveness: An Empirical Study of the Metropolitan Electricity Authority *

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Abstract

This study aims to examine the factors influencing innovation management and sustainable performance effectiveness of the Metropolitan Electricity Authority. Data were collected from 606 employees of the Metropolitan Electricity Authority and analyzed using structural equation modeling (SEM). In addition, qualitative data were obtained through in-depth interviews with eight senior executives to validate and provide deeper explanations of the quantitative findings.

The results reveal that creative leadership, organizational culture, innovative behavior, and innovation management are significantly and positively related to sustainable performance effectiveness. Organizational culture exerts direct influences on creative leadership, innovative behavior, and innovation management. Moreover, innovation management functions as a key organizational mechanism that links leadership capability, organizational culture, and innovative behavior to sustainable performance effectiveness in the Metropolitan Electricity Authority.

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1. Introduction

The Sustainable Development Goals (SDGs), adopted by the United Nations General Assembly, provide a global framework for advancing social, economic, and environmental sustainability. As a member state, Thailand has incorporated the SDGs into its national development agenda, emphasizing the role of effective organizational performance in both public and private sectors as a key mechanism for achieving sustainable development goals (Office of the National Economic and Social Development Council, 2024). In this context, organizational leaders increasingly adopt the SDGs as a strategic framework to guide decision-making and achieve both short- and long-term objectives amid dynamic and uncertain environments (Gibson, Ivancevich, & Donnelly, 2000).

Thailand's state-owned enterprises (SOEs), operating under the State Enterprise Master Plan, have aligned their missions with the 20-Year National Strategy and the SDGs. This alignment emphasizes strengthening organizational capacity through cultivating a sense of ownership among employees and executives, alongside human capital development through continuous learning and upskilling (State Enterprise Policy Office, 2017). These efforts support Thailand 4.0, which positions technology- and innovation-driven growth as the primary pathway toward enhanced competitiveness and sustainable economic development (Ministry of Industry, 2023). Consequently, innovation and technology have become strategic imperatives for Thai SOEs in improving organizational performance and achieving sustainability.

Within this framework, the Metropolitan Electricity Authority (MEA) plays a critical role as a key SOE responsible for delivering essential public services. Operating under the State Enterprise Master Plan, the MEA has adopted innovation



management as a central strategy to enhance efficiency and sustainable performance. The organization has articulated an innovation management policy encompassing five core dimensions: smart electricity systems, digital service systems, integrated service businesses, organizational development, and information technology, with the overarching goal of supporting a modern metropolis and improving citizens' quality of life (Metropolitan Electricity Authority, 2024b).

In an era characterized by rapid technological change and innovation-driven competition, organizations must foster environments that encourage employee creativity, collaboration, and continuous learning. Modern human resources are therefore expected to possess competencies in communication, creativity, adaptability, and teamwork, all of which contribute to innovation management and organizational effectiveness (Phongphankae & Chanthuek, 2017; Morakot, 2019). Knowledge sharing and collective learning have likewise been recognized as essential foundations for developing innovative services and management practices (Wilaipan & Phanthalai, 2017).

Innovation management requires not only systems and processes but also behavioral and cultural transformation within organizations. Prior studies suggest that organizational culture shapes behavioral norms, facilitates learning and knowledge exchange, and enables effective collaboration in problem-solving (Snowden, 2002; Schermerhorn, Hunt, & Osborn, 2003). However, organizational cultures that were once effective may eventually constrain adaptability and performance if they fail to evolve in response to environmental change (Eppard, 2004). Leadership therefore plays a crucial role in cultivating an innovative climate, motivating employees, and sustaining commitment to organizational goals (Joongjai & Techawattanasiridamrong, 2020).

Creative leadership, in particular, has been identified as a key driver of innovative organizational cultures, enabling organizations to develop distinct



capabilities and achieve sustainable competitive advantage (Morakot, 2019; Thongtha, 2019). For the MEA, which possesses a long-established organizational culture, a large workforce, and complex operational structures inherent to SOEs, managing innovation to achieve sustainable performance remains a significant managerial challenge.

Despite the increasing emphasis on innovation management in public organizations, several critical issues remain insufficiently addressed. In practice, the MEA faces challenges related to adapting its organizational culture to rapid technological change, fostering innovative behavior among employees within a structured bureaucratic system, and aligning leadership practices with innovation-driven strategies. These challenges highlight the need to better understand how key organizational factors interact to support innovation management and sustainable performance. From an academic perspective, although prior studies have examined organizational culture, leadership, and innovative behavior, limited research has integrated these factors within a comprehensive framework that explains their combined influence on innovation management and sustainable performance effectiveness, particularly in the context of state-owned enterprises in developing countries.

Accordingly, this study examines the influence of organizational culture, creative leadership, and innovative behavior on the sustainable performance of the MEA, with innovation management serving as a mediating mechanism. The findings are expected to contribute both theoretical insights to the literature on innovation management and practical implications for policymakers and executives seeking to enhance sustainable performance within state-owned enterprises.



2. Research Objectives

Given the operational context of the Metropolitan Electricity Authority (MEA) and existing gaps in the academic literature, this study aims to examine the relationships and causal influences among key organizational and innovation-related factors. The specific research objectives are as follows:

2.1 To examine the relationships among creative leadership, organizational culture, innovative behavior, innovation management, and sustainable performance effectiveness of the MEA.

2.2 To investigate the influence of creative leadership, organizational culture, and innovative behavior on innovation management and sustainable performance effectiveness of the MEA.

3. Research Methodology

This study employed a mixed-methods research design with a predominant quantitative approach to examine the relationships among creative leadership, organizational culture, innovative behavior, innovation management, and sustainable performance within the Metropolitan Electricity Authority (MEA). Quantitative data constituted the primary source of analysis, while qualitative data obtained from in-depth interviews with executives were subsequently used to validate and enrich the quantitative findings.

3.1 Population and Sample

The study population consisted of 10,060 employees of the Metropolitan Electricity Authority (Metropolitan Electricity Authority, 2024a). The sample size was determined using Yamane's (1973) formula at a 95% confidence level, which suggested a minimum required sample of approximately 385 respondents. However, to enhance the robustness of the analysis and ensure adequate representation across all district offices, the sample size was increased to 630 respondents. The sample comprised 630 operational-level employees from 18 district offices, with



respondents allocated across districts using a quota sampling approach, resulting in approximately 35 respondents per district to ensure proportional representation of operational units. The selection of respondents was conducted using non-probability convenience sampling (Malhotra, 2010). A total of 630 questionnaires were distributed, of which 606 valid questionnaires were returned and used for data analysis. The study consistently uses 606 as the final sample size for statistical analysis. This sample size is considered adequate for structural equation modeling (SEM), in accordance with Hair, Anderson, Tatham, & Black (1995) recommendation of a minimum of 200–300 cases.

3.2 Research Instrument

The research instrument was a structured questionnaire developed based on the operational definitions of the study variables. Responses were measured using a five-point Likert scale. Content validity was assessed by five experts using the Index of Item-Objective Congruence (IOC), yielding an overall IOC value of 0.983, which exceeds the acceptable threshold of 0.60 (Rovinelli & Hambleton, 1977). Reliability testing was conducted with 30 respondents who were not included in the main sample, resulting in a Cronbach's alpha coefficient of 0.987, exceeding the recommended criterion of 0.70 (Nunnally, 1978).

3.3 Ethical Considerations

Ethical approval for the study was obtained from the Human Research Ethics Committee of Western University (Certification No.: WTU 2566–0084; Project Code: HE-WTU 2566–0084).

3.4 Data Analysis

Quantitative data were analyzed using descriptive statistics, including means and standard deviations, and structural equation modeling (SEM). SEM analysis was performed using AMOS version 22.0 to examine both direct and indirect relationships among observed and latent variables.



3.5 Qualitative Validation

For qualitative validation, in-depth interviews were conducted with eight senior executives of the MEA, comprising one Deputy Governor, four Assistant Governors, and three District Directors. The qualitative data were analyzed using content analysis to validate and further interpret the quantitative findings.

4. Research Findings

4.1 Descriptive Statistics and Correlation Analysis

The analysis of relationships among the key variables revealed statistically significant positive correlations across all constructs examined in this study. As presented in Table 1, the correlation coefficients among organizational culture, creative leadership, innovative behavior, innovation management, and sustainable performance effectiveness ranged from 0.554 to 0.799 at the 0.01 significance level. These results indicate strong and meaningful associations among the study variables, providing initial empirical support for the proposed conceptual framework.

In particular, organizational culture demonstrated strong correlations with creative leadership, innovative behavior, and innovation management, suggesting that cultural factors play a critical role in shaping leadership practices and employees' innovation-related behaviors. Innovation management was also strongly correlated with sustainable performance effectiveness, highlighting its potential role as a key mechanism linking organizational factors to sustainability outcomes.

**Table 1** Correlation Matrix of the Study Variables

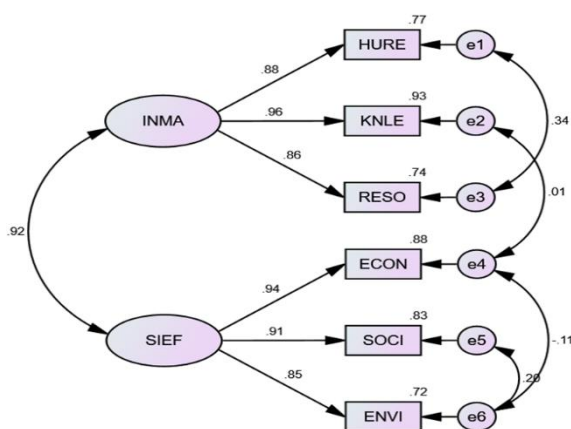
	HURE	KNLE	RESO	ECON	SOCI	ENVI
HURE	1					
KNLE	0.745**	1				
RESO	0.739**	0.729**	1			
ECON	0.749**	0.731**	0.749**	1		
SOCI	0.731**	0.709**	0.719**	0.757**	1	
ENVI	0.699**	0.749**	0.677**	0.779**	0.719**	1
Mean	4.09	4.13	4.03	4.19	4.24	4.17
S.D.	0.76	0.69	0.75	0.70	0.72	0.80
Bartlett's test of sphericity Chi-Square = 3942.050, df = 15, p = 0.000, KMO = .910						

** p < 0.01

4.2 Measurement Model Assessment

To assess the adequacy of the measurement model, confirmatory factor analysis (CFA) was conducted for the constructs of innovation management and sustainable performance effectiveness. The results indicate that the measurement model achieved a good fit with the empirical data. As shown in Figure 1, all observed variables loaded significantly on their respective latent constructs at the 0.01 level, with standardized factor loadings exceeding acceptable thresholds.

Furthermore, the model fit indices satisfied established criteria, confirming the construct validity and reliability of the measurement model. These findings suggest that the observed variables appropriately represent the underlying constructs and provide a sound basis for subsequent structural model analysis.



Chi-square=5.147 , df=4 , P-value=.273 , Chi-square/df=1.287,

GFI=.997 , AGFI=.985 , CFI=1.000, RMR=.002 , RMSEA=.022

Figure 1. Measurement Model of Innovation Management and Sustainable Performance Effectiveness

4.3 Structural Model and Model Fit

The structural equation modeling (SEM) analysis was conducted to examine the causal relationships among organizational culture, creative leadership, innovative behavior, innovation management, and sustainable performance effectiveness. The results indicate that the hypothesized structural model demonstrated an excellent fit with the empirical data.

As summarized in Table 2, the goodness-of-fit indices met or exceeded recommended thresholds, with a chi-square/df ratio below 2.00, RMSEA and RMR values below 0.05, and GFI, AGFI, NFI, and IFI values approaching or exceeding 0.95. These results confirm that the proposed model is consistent with the observed data and suitable for hypothesis testing.

**Table 2** Goodness-of-Fit Indices of the Structural Model

Goodness-of-Fit Index	Criteria	Measured Value	Assessment
χ^2/df (83.200/78)	< 2.00	1.067	Acceptable
CFI	≥ 0.95	1.000	Acceptable
GFI	≥ 0.95	0.985	Acceptable
AGFI	≥ 0.90	0.967	Acceptable
RMSEA	< 0.05	0.010	Acceptable
RMR	< 0.05	0.005	Acceptable

4.4 Hypothesis Testing Results

The results of hypothesis testing, based on standardized path coefficients derived from the structural model, are presented in Table 3 and illustrated in Figure 2.

Sustainable performance effectiveness (SIEF) in this study was conceptualized as a multidimensional construct comprising economic performance (ECON), social performance (SOC), and environmental performance (ENVI). In addition, key organizational capability variables include human resource development (HURE), knowledge learning (KNLE), and resource management (RESO), while innovation management (INMA) serves as a central mediating mechanism linking organizational factors to sustainable performance outcomes. These constructs collectively reflect the organization's capability to achieve sustainable performance in alignment with the triple bottom line perspective.

The findings reveal that organizational culture has significant direct effects on creative leadership and innovative behavior, supporting Hypotheses H1 and H2. Organizational culture also exerts a significant direct influence on innovation management, providing support for Hypothesis H6. These results underscore the foundational role of organizational culture in shaping leadership practices, employee behaviors, and innovation-related processes within the MEA.



Creative leadership was found to have a significant direct effect on innovation management, supporting Hypothesis H4. However, its direct effect on innovative behavior was not statistically significant, leading to the rejection of Hypothesis H3. This result suggests that creative leadership influences innovation primarily through organizational systems and management processes rather than through direct behavioral stimulation.

Innovative behavior demonstrated a significant direct influence on innovation management, supporting Hypothesis H5. This finding highlights the importance of employees' proactive engagement in idea generation, championing, and application as a critical driver of effective innovation management.

Finally, innovation management was found to have a strong and significant direct effect on sustainable performance effectiveness, supporting Hypothesis H7. This result confirms that innovation management serves as a key mechanism through which organizational and behavioral factors are translated into sustainable outcomes across economic, social, and environmental dimensions.

Table 3 Path Coefficients and Hypothesis Testing Results

	CRLE	INBE	INMA	SIEF
ORCU	0.88**	0.84**	0.33**	-
CRLE	-	0.05	0.20**	-
INBE	-	-	0.45**	-
INMA			-	0.93**
Statistical Value Chi-square=83.200, df=78, p-value=0.323, CFI=1.000, FI=0.985, AGFI = 0.967, RMR = 0.005, RMSEA = 0.010				

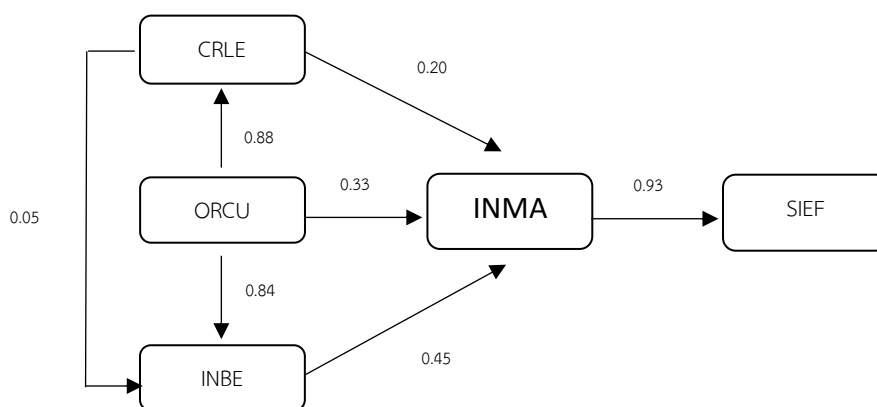


Figure 2. Hypothesis Model Showing the Influence of Factors on Innovation

4.5 Qualitative Validation of the Quantitative Findings

The qualitative findings obtained from in-depth interviews with senior MEA executives further validate and enrich the quantitative results. The executives consistently emphasized that the MEA's strong organizational culture, characterized by shared values, continuous learning, and adaptability, plays a central role in shaping creative leadership and innovative behavior. They also highlighted that innovation management functions as a practical mechanism through which leadership vision and employee creativity are translated into tangible improvements in service quality and sustainable performance.

Overall, the qualitative evidence aligns closely with the SEM results, reinforcing the robustness of the proposed model and confirming the critical role of innovation management in driving sustainable performance within the MEA.

5. Discussion

The findings of this study provide important insights into the relationships among organizational culture, creative leadership, innovative behavior, innovation management, and sustainable performance effectiveness within the Metropolitan Electricity Authority (MEA). By integrating quantitative results from structural



equation modeling with qualitative evidence from executive interviews, the study offers a comprehensive understanding of how innovation-driven mechanisms operate in the context of a large state-owned enterprise.

5.1 Organizational Culture as a Foundation for Innovation and Leadership

The results indicate that organizational culture plays a foundational role in shaping creative leadership, innovative behavior, and innovation management. This finding is consistent with organizational culture theory, which emphasizes that shared values, norms, and beliefs influence both leadership practices and employee behaviors (Schermerhorn, Hunt, & Osborn, 2003). In line with Snowden (2002), organizational culture functions as a social mechanism that facilitates learning, sense-making, and coordinated action within organizations.

In the MEA context, a strong and deeply embedded organizational culture appears to guide leadership orientation and employee conduct toward innovation-related objectives. This finding supports prior studies suggesting that innovation-oriented cultures encourage participation, adaptability, and openness to change, all of which are critical for sustaining innovation in complex and regulated organizational environments (Szabo & Csontos, 2016; Wilaipan & Kiangkraiyo, 2017).

Furthermore, not all types of organizational culture equally support creative leadership and innovative behavior. Drawing on the Competing Values Framework (Cameron & Quinn, 2011), cultures characterized by flexibility and innovation-particularly adhocracy culture-are more likely to foster experimentation, risk-taking, and openness to new ideas, thereby enhancing innovative behavior. In contrast, cultures emphasizing control and stability, such as hierarchy culture, may constrain creativity and limit innovation effectiveness. This distinction helps explain the context-dependent role of organizational culture in shaping innovation outcomes within the MEA.



5.2 Creative Leadership and Innovation Management

The findings further demonstrate that creative leadership significantly influences innovation management, highlighting the strategic role of leaders in enabling innovation processes. This result aligns with previous research emphasizing that leaders contribute to innovation not only through direct interaction with employees but also by shaping vision, allocating resources, and establishing structures that support innovation (Joongjai & Techawattanasiridamrong, 2020)

However, the absence of a significant direct effect of creative leadership on innovative behavior suggests that leadership influence in the MEA operates primarily at the systemic level rather than through direct behavioral stimulation. This finding contrasts with studies conducted in more flexible organizational settings but is consistent with the contingency perspective proposed by Gibson, Ivancevich, & Donnelly (2000), which argues that leadership effectiveness is shaped by organizational structure and context. In highly institutionalized state-owned enterprises, creative leadership appears to exert its influence through innovation governance and management systems.

5.3 Innovative Behavior as a Micro-Level Driver of Innovation

The results indicate that innovative behavior has a significant direct influence on innovation management, underscoring the importance of employees' creative actions in strengthening organizational innovation capability. This finding supports the micro-foundations perspective of innovation, which views employees' idea generation, championing, and implementation as essential inputs to innovation management processes (Sundgren & Styhre, 2007).

Within the MEA, innovative behavior serves as a critical linkage between organizational culture and formal innovation mechanisms. Employees' willingness to engage in creative problem-solving and apply new ideas contributes directly to the effectiveness of innovation management, reinforcing the argument that innovation is both a bottom-up and top-down process.



5.4 Innovation Management and Sustainable Performance Effectiveness

Most importantly, the findings confirm that innovation management has a strong and significant direct effect on sustainable performance effectiveness across economic, social, and environmental dimensions. This result is consistent with sustainability-oriented innovation literature, which emphasizes that systematic innovation management is essential for achieving long-term organizational performance and sustainable value creation (Thongtha, 2019).

In the MEA context, innovation management enables the organization to translate leadership capabilities, organizational culture, and employee creativity into tangible outcomes, such as improved service quality, operational efficiency, and contributions to broader societal and environmental goals. This finding highlights innovation management as a central mechanism linking organizational and behavioral factors to sustainability outcomes in state-owned enterprises.

5.5 Integrated Perspective and Theoretical Implications

Taken together, the discussion demonstrates that sustainable performance within the MEA is achieved through the integration of organizational culture, creative leadership, and innovative behavior, with innovation management acting as the key mediating mechanism. These findings extend existing theories by reaffirming organizational culture as a core antecedent of innovation, redefining creative leadership as a system-oriented influence in institutionalized organizations, and positioning innovative behavior as a critical micro-level driver of innovation management.

In addition, this study contributes to the literature by clarifying that the effectiveness of organizational culture in promoting innovation depends on its underlying characteristics. Specifically, cultures that emphasize flexibility, learning, and adaptability are more conducive to fostering creative leadership and innovative behavior than those that prioritize control and stability. This nuanced



understanding provides a more refined explanation of how cultural configurations influence innovation processes in large, complex organizations.

By situating these relationships within the context of a large public utility organization, this study contributes to innovation management and sustainability theory by illustrating how established theoretical frameworks operate and interact in state-owned enterprises. The findings therefore offer valuable insights for both scholars and practitioners seeking to understand and enhance sustainable performance through innovation in public-sector organizations. These findings also provide practical implications for innovation policy design in large public-sector organizations.

6. Knowledge of Research

Based on the synthesis of quantitative and qualitative research findings obtained from the Metropolitan Electricity Authority (MEA), together with a comparison with related studies discussed in the discussion section, this study generates new knowledge that clearly reflects a process-based mechanism of innovation management leading to sustainable performance effectiveness within the MEA. The derived knowledge not only explains causal relationships among key variables but also elucidates the role of innovation management as an integrative mechanism that systematically connects human, cultural, and managerial dimensions. Accordingly, the knowledge contribution of this research is presented in the form of a process-oriented model to explicitly illustrate the sequence and interrelationships among the core components. (Figure 3)

The model illustrates the process-based relationships among the principal elements identified in this research. The process begins with organizational culture, which serves as a foundational element of the MEA by shaping shared values, norms, and a working environment that supports learning and innovation. Such an



organizational culture facilitates the development of creative leadership and innovative behavior among employees, which are mutually reinforcing. Creative leadership at the MEA operates at the system level through strategic direction setting, resource support, and the design of organizational mechanisms, while innovative behavior reflects employees' active participation at the operational level in initiating and improving work practices.

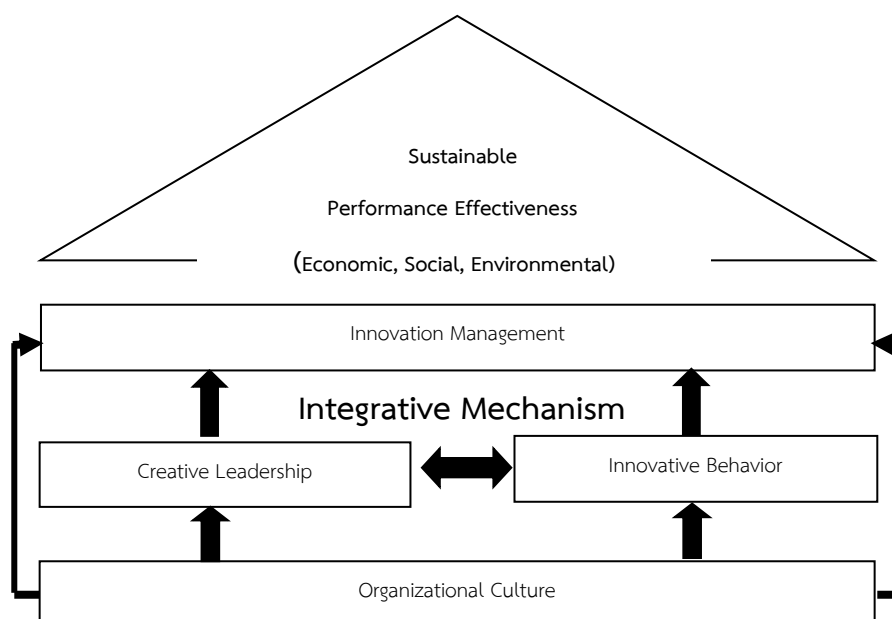


Figure 3. Innovation Management Mechanism Model toward Sustainable Performance Effectiveness of the Metropolitan Electricity Authority (MEA)

The model illustrates the process-based relationships among the principal elements identified in this research. The process begins with organizational culture, which serves as a foundational element of the MEA by shaping shared values, norms, and a working environment that supports learning and innovation. Such an organizational culture facilitates the development of creative leadership and



innovative behavior among employees, which are mutually reinforcing. Creative leadership at the MEA operates at the system level through strategic direction setting, resource support, and the design of organizational mechanisms, while innovative behavior reflects employees' active participation at the operational level in initiating and improving work practices.

A key contribution of this research lies in identifying innovation management within the MEA as an integrative mechanism that links organizational culture, creative leadership, and innovative behavior into a coherent and actionable system. Empirical evidence from the study demonstrates that when innovation management is clearly defined and effectively implemented, it enables the MEA to transform human potential and organizational values into tangible outcomes. These outcomes include improvements in work processes, the development of public utility services, and enhanced efficiency in fulfilling the MEA's electricity service mission.

The ultimate outcome of this process is sustainable performance effectiveness of the Metropolitan Electricity Authority, encompassing economic, social, and environmental dimensions. The proposed knowledge model therefore highlights that advancing organizational sustainability within the MEA cannot rely on any single factor in isolation. Instead, it requires the systematic integration of organizational culture, creative leadership, innovative behavior, and innovation management as a central mechanism that connects all elements into a unified and sustainable performance framework.

This study contributes to innovation management literature by explicitly demonstrating how innovation management operates as an integrative mechanism that systematically transforms leadership capability, organizational culture, and innovative behavior into sustainable performance effectiveness within the context of a large public utility organization such as the Metropolitan Electricity Authority.



7. Recommendations for the Application of Research Findings

7.1 Policy Implications

The findings highlight innovation management as a key integrative mechanism linking leadership, organizational culture, and innovative behavior to sustainable performance. Government agencies and state-owned enterprises should therefore embed innovation management systematically within organizational strategies and position innovation as a long-term agenda. Policies should also promote learning-oriented and change-supportive organizational cultures, while emphasizing the development of creative leadership at the system level to ensure sustainable innovation outcomes.

7.2 Practical Implications

Organizational leaders may utilize the findings to develop innovation management systems that coherently integrate people, processes, and organizational culture. Leaders should adopt facilitative roles that encourage learning, experimentation, and creativity, rather than relying on directive control. Innovation management systems can further serve as practical tools for transforming employees' creative potential into tangible organizational outcomes, thereby enhancing operational effectiveness and sustainability.

7.3 Suggestions for Future Research

Future research should expand the study to other public-sector or state-owned organizations to test the generalizability of the proposed model. Additional organizational factors, such as digital technology or human resource management systems, may also be examined. Longitudinal or in-depth qualitative studies could further enrich understanding of innovation management processes and organizational sustainability over time.



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