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Emerging leadership style of manufacturing engineers towards an increased self-efficacy and operational efficiency

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ABSTRACT

This study examined the relationship between leadership styles and the self-efficacy of manufacturing engineers in an aerospace manufacturing organization. Self-efficacy was defined through key skills such as problem-solving, decision-making, and the ability to innovate, all of which are crucial for operational efficiency. Anchored in the Full Range Leadership Theory and Social Cognitive Theory, the research also incorporated well-known engineering practices such as Lean Manufacturing, Six Sigma (DMAIC), and Kaizen to better understand operational efficiency in the engineering field. A convergent parallel mixed-methods approach was used. On the qualitative side, informal interviews with manufacturing engineers helped pinpoint common leadership behaviors. Meanwhile, quantitative data came from a survey measuring engineers' perceptions of leadership styles and their own self-efficacy. The qualitative results highlighted transformational leadership as the most recognized and positively viewed style, marked by guidance, support, trust-based delegation, and constructive feedback. Transactional leadership also appeared in performance-focused situations, while authoritarian and laissez-faire styles were viewed less favorably. The quantitative results showed high levels of self-efficacy, with transformational and transactional leadership demonstrating positive effects, while authoritarian and laissez-faire styles showed negative effects. The Leadership–Self-Efficacy Synergy Framework illustrates how leadership behaviors foster empowerment, boost self-efficacy, and improve operational efficiency within the aerospace manufacturing sector.

Keywords: Leadership styles, self-efficacy, manufacturing engineers, aerospace manufacturing, operational efficiency, transformational leadership, mixed-methods.

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INTRODUCTION

Leadership is a critical determinant of organizational success, particularly in high stakes environments that demand advanced technical expertise such as aerospace manufacturing.

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Within this context, manufacturing engineers play a vital role in ensuring that operations meet standards of precision, quality, and timely delivery while adhering to stringent safety and efficiency requirements. Despite the recognized importance of leadership in such settings, traditional research has largely treated leadership style and self-efficacy as separate constructs. There remains a limited body of work that examines how leadership styles within aerospace organizations influence engineers' confidence and their capacity to sustain operational efficiency. This study addresses this gap by investigating the interconnection between leadership style and the self-efficacy of manufacturing engineers.

Self-efficacy, as defined by Albert Bandura (1997), refers to an individual's belief in their ability to perform tasks successfully. In aerospace manufacturing, this construct is particularly significant because it directly affects engineers' competencies in problem solving, decision making, and innovation, all of which are essential to achieving operational efficiency. The study is grounded in Social Cognitive Theory, which explains how environmental factors such as leadership behaviors shape individuals' self-efficacy (Bandura, 1986; 1997). In addition, the study incorporates the Full Range Leadership Theory as discussed by Sivarat, Thamma, and Kenaphoom (2021) to examine variations in leadership styles. Operational efficiency is conceptualized not through traditional production metrics but through engineers' key performance indicators, and it is anchored in the principles of Lean Manufacturing (Womack & Jones, 1996) and the Six Sigma DMAIC framework (George, 2000).

The study responds to a clear research gap characterized by the scarcity of empirical investigations that explore the relationship between leadership styles and self-efficacy within technical domains such as manufacturing engineering. Existing literature has predominantly focused on fields such as education, healthcare, and general industrial settings, with limited comparative analyses of different leadership styles. Moreover, there is a notable lack of studies situated in the Philippine context, particularly within the aerospace sector. Many previous studies have also relied exclusively on quantitative approaches, thereby limiting the depth of analysis. In contrast, this study adopts a mixed method approach to provide a more comprehensive examination of the phenomena under investigation.

The study contributes to theoretical development by extending the application of leadership styles within a highly technical aerospace manufacturing environment and by further elaborating the principles of Social Cognitive Theory (Bandura, 1986; 1997). It also offers practical contributions by generating evidence based insights that can inform leadership development initiatives and strategies for enhancing operational efficiency (Rowold & Schilling, 2012). These contributions are intended to bridge the gap between theoretical constructs and real world applications in complex engineering environments.

Guided by these identified gaps and contributions, the study seeks to determine the most prevalent leadership style among superiors of manufacturing engineers within the framework of Full Range Leadership Theory, including Authoritarian Leadership, Transactional Leadership, Transformational Leadership, and Laissez faire Leadership. It also aims to assess the perceived level of self-efficacy among manufacturing engineers in terms of operational efficiency indicators, specifically problem solving technical competency, decision making technical competency, and innovation creation technical competency. Furthermore, the study examines whether significant relationships exist in self-efficacy levels based on the leadership styles experienced by engineers and seeks to develop a framework that promotes synergy between manufacturing engineers and their superiors in order to enhance self-efficacy and improve operational efficiency.

The conceptual framework of the study was developed through a systematic integration of existing literature and theoretical foundations. The process began with an analysis of the Full Range Leadership Theory proposed by Bernard M. Bass and Bruce J. Avolio (1994), which categorizes leadership into transformational, transactional, and laissez faire styles.

Recognizing the relevance of hierarchical control in aerospace manufacturing, authoritarian leadership was incorporated as an additional construct. These leadership styles were identified as the independent variables of the study. The framework is further anchored in Social Cognitive Theory, which emphasizes that individuals' beliefs in their capabilities are influenced by environmental factors such as leadership behaviors, thereby positioning self-efficacy as the mediating variable. To define operational efficiency, the study draws on Lean Manufacturing, Six Sigma through the DMAIC framework, and Kaizen principles, which collectively identify essential competencies required in engineering practice. These competencies are reflected in three key dimensions of self-efficacy, namely problem solving, decision making, and innovation creation, which represent the operational effectiveness of manufacturing engineers.

METHODOLOGY

The study employed a convergent parallel mixed method research design to examine the relationship between leadership styles and the self-efficacy of manufacturing engineers in relation to operational efficiency. This design enabled the simultaneous collection and analysis of qualitative and quantitative data, allowing for a comprehensive understanding of the phenomenon under investigation. Qualitative data were gathered through informal interviews to explore the emerging leadership styles experienced by manufacturing engineers, while quantitative data were obtained through a survey questionnaire to assess perceived leadership styles and levels of self-efficacy. The integration of these data sources facilitated the collection of qualitative insights, systematic data, statistical analysis, and the development of a framework that explains how leadership styles such as transformational, transactional, laissez-faire, and authoritarian relate to self-efficacy in terms of problem-solving, decision-making, and innovation, ultimately contributing to higher operational efficiency among manufacturing engineers.

The study utilized thematic analysis to examine qualitative data obtained from informal interviews, with the objective of identifying patterns and insights related to the emerging leadership styles experienced by manufacturing engineers. For the quantitative component, descriptive statistics were employed to determine the mean values of perceived leadership styles among supervisory and managerial levels within the manufacturing engineering department of the aerospace company. Descriptive statistics were also used to compute the mean levels of perceived self-efficacy among the respondents. Furthermore, correlation analysis was conducted to investigate the relationship between leadership styles and perceived self-efficacy. The integration of these analytical approaches supported the development of a framework that illustrates how leadership styles influence the self-efficacy of manufacturing engineers, resulting in improved operational efficiency.

The study adopted a total enumeration approach for the quantitative component, wherein all manufacturing engineers from the selected aerospace company participated in the data gathering process. For the qualitative component, eleven manufacturing engineers were purposively selected as participants to provide in-depth insights into leadership dynamics within the manufacturing engineering department. The selection of participants was guided by specific criteria to ensure relevance and depth of information. Participants were required to be currently employed as manufacturing engineers in the aerospace company, possess varied experiences in terms of leadership roles and departmental backgrounds, demonstrate familiarity with daily leadership practices that influence problem-solving, decision-making, and innovation tasks, and express willingness to participate in the interview process. These criteria ensured that the selected participants could provide meaningful, relevant, and

experience-based insights aligned with the objectives of the study. For the quantitative aspect, forty-nine manufacturing engineers served as respondents, with the condition that they had not participated in the qualitative interviews. Within the convergent parallel mixed method framework, the qualitative sample provided depth and contextual understanding, while the quantitative sample offered broader coverage and statistical validation.

The study utilized two primary research instruments, namely an interview guide for the qualitative phase and a self-made survey questionnaire for the quantitative phase. The interview guide was structured to address the first research objective, which aimed to identify the emerging leadership styles experienced by manufacturing engineers. It consisted of open-ended questions designed to elicit detailed responses regarding observed leadership behaviors. The survey questionnaire was divided into two parts. The first part assessed the prevalent leadership styles among leaders within the manufacturing engineering department, with five questions assigned to each leadership style category, namely transactional, transformational, laissez-faire, and authoritarian. The Semantic Differential Scale with values ranging from 0–5 was used for scoring, and the results were analyzed using descriptive statistics, specifically the mean. The second part of the questionnaire evaluated the perceived self-efficacy of respondents in terms of problem-solving, decision-making, and innovation, with five questions corresponding to each sub-variable. The same Semantic Differential Scale was applied, and responses were analyzed using descriptive statistics, particularly the mean. The validity of the instrument was established through evaluation by a Subject Matter Expert and a Statistician, while reliability was assessed through pilot testing involving 30 samples, with Cronbach's alpha computed to determine the consistency of the instrument.

The data gathering procedure followed a systematic mixed method approach to examine the emerging leadership styles of manufacturing engineers in relation to self-efficacy and operational efficiency. The process commenced with a comprehensive review of related literature to establish the theoretical foundation and identify relevant variables. An interview guide was developed for use in informal face-to-face discussions to capture qualitative insights into leadership styles experienced by manufacturing engineers. Simultaneously, a survey questionnaire was developed to measure leadership styles and self-efficacy. The questionnaire underwent pre-testing to ensure its validity and reliability. Informal interviews were conducted through face-to-face interactions, while the survey questionnaire was distributed to respondents using an online form. Data collection was completed within a period of 1–2 weeks, during which responses were systematically recorded. Upon completion of data collection, the gathered data were subjected to appropriate statistical analyses.

The data analysis procedures were aligned with the specific objectives of the study and integrated both qualitative and quantitative approaches. To determine the most prevalent leadership style of superiors within the manufacturing engineering department in the context of Full Range Leadership Theory, data from informal interviews and the survey questionnaire were analyzed using thematic analysis for qualitative data and descriptive statistics, particularly the mean, for quantitative continuous data. To assess the perceived level of self-efficacy among manufacturing engineers in terms of problem-solving technical competency, decision-making technical competency, and innovation-creation technical competency, data obtained from the survey questionnaire were analyzed using descriptive statistics, specifically the mean. To examine the presence of significant relationships between leadership styles and self-efficacy levels, data from the survey questionnaire were analyzed using correlation analysis, with a significance level set at $\alpha=0.05$. Finally, the development of a framework to promote synergy between manufacturing engineers and their superiors for increased self-efficacy and improved operational efficiency was based on the integrated results of the first three research objectives, utilizing thematic analysis, descriptive statistics, and correlation analysis.

Ethical considerations were strictly observed to ensure the protection and well-being of all participants involved in the study. Informed consent was obtained from all respondents, ensuring that they were fully aware of the purpose, objectives, and significance of the research, as well as the nature of their participation. The study upheld principles of information privacy and confidentiality by safeguarding the identities of participants and ensuring that all collected data were used solely for research purposes. Furthermore, all questions and data collected were strictly limited to work-related aspects of manufacturing engineers within the aerospace company, thereby minimizing potential risks and ensuring ethical compliance throughout the research process.

RESULTS AND DISCUSSION

This Results and Discussion section is grounded in data collected from a total of sixty participants, consisting of eleven manufacturing engineers in the qualitative phase and forty-nine respondents in the quantitative phase. The study employed a convergent parallel mixed method research design, utilizing purposive sampling for the qualitative component and total enumeration for the quantitative component. Data were gathered through informal interviews guided by an interview protocol and a structured survey questionnaire. Qualitative data were analyzed using thematic analysis based on Braun and Clarke's six phase framework, while quantitative data were examined through descriptive statistics and correlation analysis, with a significance level set at $\alpha = 0.05$. The discussion that follows is directly anchored in the empirical data gathered and is interpreted in alignment with the study's research objectives, ensuring that all findings are contextualized within the theoretical and methodological framework of the study.

The qualitative findings derived from the thematic analysis of eleven participants revealed four dominant leadership styles experienced by manufacturing engineers, namely transformational, transactional, authoritarian, and laissez-faire leadership, consistent with the Full Range Leadership Theory of Bass and Avolio (1994). Transformational leadership emerged as the most dominant theme, accounting for 35 coded statements or 44.4% of the total responses. This theme was characterized by behaviors such as active support, delegative oversight, developmental guidance, empathic consideration, motivational support, respectful engagement, transparent communication, and trust-based delegation. Participant narratives consistently reflected increased confidence and autonomy, as evidenced by statements such as "However, from that, I was able to decide faster and stand on my own" and "If we provide the right answer, she acknowledges it, and if we are wrong, she guides us and helps us correct it and explain why." These findings align with the theoretical assertion of Bass and Avolio (1994) that transformational leadership enhances follower motivation and engagement through individualized consideration and intellectual stimulation. Furthermore, the results support Bandura's (1997) Social Cognitive Theory, which posits that supportive environments strengthen self-efficacy beliefs by reinforcing mastery experiences and positive feedback mechanisms.

Transactional leadership accounted for 19 coded statements or 24.0% of the qualitative data and was reflected in behaviors such as conditional reinforcement, feedback-seeking behavior, performance monitoring, performance-based rewards, and supportive recognition. Participants described leadership practices that emphasized task prioritization and recognition of performance, as illustrated by statements such as "My supervisor depends on what is urgent" and "When it comes to rewards and recognitions, he is consistent." These findings are consistent with Northouse (2025), who defined transactional leadership as a system of contingent reinforcement that clarifies expectations and maintains organizational discipline.

From a self-efficacy perspective, Bandura (1997) emphasized that structured feedback enhances efficacy beliefs by providing clear standards for performance, thereby supporting the positive role of transactional leadership in reinforcing competence in technical environments.

Authoritarian leadership also accounted for 19 coded statements or 24.0% of the responses, highlighting behaviors such as closed communication, directive control without guidance, independent decision-making by leaders, and strict compliance enforcement. Participants expressed concerns regarding limited opportunities for feedback and autonomy, as reflected in statements such as "We cannot provide feedback on what our support needs are" and "Her behavior of becoming strict and bossy." While Dedahanov et al. (2022) suggested that authoritarian leadership may be effective in high control environments requiring rapid decision-making, the findings indicate potential drawbacks in terms of reduced employee confidence and limited opportunities for skill development. This observation is supported by Milojević et al. (2024), who noted that excessive control may hinder creativity and engagement. In line with Bandura (1997), restricted autonomy limits mastery experiences, thereby weakening self-efficacy among employees.

Laissez-faire leadership emerged as the least prominent theme, with 6 coded statements or 7.6% of the qualitative data. This leadership style was characterized by deferred responsibility, hands-off delegation, and minimal supervision. Participants described a lack of guidance and leadership presence, as reflected in statements such as "She does not guide me in my work" and "He is not established as a leader." Although Milojević et al. (2024) suggested that laissez-faire leadership may encourage independence among highly skilled individuals, the findings indicate that insufficient leadership support may lead to ambiguity and reduced coordination. Thanh and Quang (2022) further emphasized that excessive absence of leadership can negatively affect clarity and organizational alignment, particularly in complex technical environments.

The quantitative findings reinforced the patterns observed in the qualitative data. The mean score for transformational leadership was $M = 4.30$, interpreted as To a Very Great Extent (TVGE), indicating that respondents perceived strong presence of supportive and motivational leadership behaviors. Transactional leadership yielded a mean of $M = 4.14$, also interpreted as To a Very Great Extent (TVGE), reflecting the importance of structured performance monitoring and recognition within the organization. In contrast, authoritarian leadership had a mean of $M = 3.08$, interpreted as To a Great Extent (TGE), suggesting moderate use of directive leadership practices. Laissez-faire leadership obtained the lowest mean of $M = 2.82$, interpreted as To a Moderate Extent (TME), indicating limited occurrence of disengaged leadership behaviors. These results align with Bass and Avolio (1994), who emphasized that transformational leadership tends to be more effective in fostering engagement and trust, while transactional leadership supports organizational stability through reinforcement mechanisms.

In terms of self-efficacy, respondents demonstrated high levels across all measured dimensions. Problem-solving self-efficacy obtained a mean of $M = 4.30$, decision-making self-efficacy recorded $M = 4.19$, and innovation-creation self-efficacy achieved $M = 4.25$, all interpreted as To a Very Great Extent (TVGE). These findings indicate that manufacturing engineers possess strong confidence in their technical competencies, which is consistent with Bandura's (1997) assertion that self-efficacy is strengthened in environments that provide support, feedback, and opportunities for mastery. The results further align with Jaafar et al. (2021), who reported that supportive leadership enhances engineers' confidence and performance in demanding technical settings.

The correlation analysis provided empirical evidence of the relationships between leadership styles and self-efficacy indicators. Transformational leadership showed positive correlations with problem-solving ($r = 0.34$), decision-making ($r = 0.21$), and innovation-creation ($r = 0.29$), all statistically significant at $p < 0.05$ with $\alpha = 0.05$, indicating that the null

hypothesis of no relationship is rejected. These results suggest that transformational leadership significantly enhances self-efficacy across multiple domains. Transactional leadership also demonstrated positive correlations with problem-solving ($r = 0.31$), decision-making ($r = 0.23$), and innovation-creation ($r = 0.31$), likewise significant at $p < 0.05$, supporting the conclusion that structured reinforcement and feedback mechanisms contribute positively to self-efficacy. In contrast, authoritarian leadership exhibited negative correlations with problem-solving ($r = –0.18$), decision-making ($r = –0.17$), and innovation-creation ($r = –0.16$), all significant at $p < 0.05$, indicating that increased authoritarian behaviors are associated with reduced self-efficacy. Similarly, laissez-faire leadership showed negative correlations with problem-solving ($r = –0.12$), decision-making ($r = –0.09$), and innovation-creation ($r = –0.11$), also significant at $p < 0.05$, suggesting that lack of leadership engagement diminishes confidence and performance. These findings support Bandura's (1997) assertion that environmental factors such as leadership behaviors play a critical role in shaping self-efficacy beliefs.

The integration of qualitative and quantitative findings demonstrates strong convergence between participants' lived experiences and statistical patterns. Transformational leadership, identified as the most prominent theme qualitatively at 44.4%, also yielded the highest mean score of $M = 4.30$ and positive correlations across all self-efficacy indicators. Transactional leadership, which accounted for 24.0% of qualitative responses, similarly showed high mean values and positive correlations, reinforcing its role in enhancing performance through structure and accountability. Conversely, authoritarian and laissez-faire leadership styles, each accounting for 24.0% and 7.6% of qualitative responses respectively, were associated with lower mean scores and negative correlations with self-efficacy. This triangulation strengthens the validity of the findings, demonstrating that both subjective experiences and quantitative evidence consistently indicate that supportive and structured leadership behaviors enhance self-efficacy; while controlling or disengaged leadership styles undermine it.

The results further validate the theoretical and conceptual frameworks underpinning the study. The Full Range Leadership Theory effectively categorized leadership behaviors observed in the organization, while Social Cognitive Theory explained the mechanism through which these behaviors influence self-efficacy. The empirical evidence confirms that leadership styles function as environmental determinants that shape individual beliefs in capability, which in turn affect operational performance. The alignment between theoretical expectations and empirical findings underscores the robustness of the study's framework and its applicability within a technical aerospace manufacturing context.

Building on these integrated findings, the Leadership Self-Efficacy Synergy Framework was developed to illustrate the dynamic relationship between leadership behaviors, leadership styles, and self-efficacy. The framework highlights how positive leadership behaviors associated with transformational and transactional styles foster empowerment, enhance confidence, and improve operational efficiency. In contrast, negative behaviors linked to authoritarian and laissez-faire styles weaken self-efficacy and hinder performance outcomes. The framework also incorporates a feedback loop in which improved operational efficiency reinforces effective leadership practices, thereby sustaining organizational performance.

In synthesis, the findings demonstrate that transformational leadership, with 44.4% of coded statements and a mean of $M = 4.30$, and transactional leadership, with 24.0% of coded statements and a mean of $M = 4.14$, are the most effective leadership styles in enhancing self-efficacy among manufacturing engineers. These styles exhibit positive and significant correlations with problem-solving, decision-making, and innovation-creation self-efficacy, with r values ranging from 0.21 to 0.34 at $p < 0.05$. In contrast, authoritarian leadership, with a mean of $M = 3.08$, and laissez-faire leadership, with a mean of $M = 2.82$, show negative

relationships with self-efficacy, with r values ranging from –0.09 to –0.18 at $p < 0.05$. These results directly address the research objectives by identifying prevalent leadership styles, assessing self-efficacy levels, establishing significant relationships between variables, and informing the development of a theoretical framework. The study contributes to the field by providing empirically grounded insights into leadership dynamics within aerospace manufacturing and offers a foundation for future research and practical interventions aimed at enhancing leadership effectiveness and operational efficiency.

CONCLUSION

The findings of the study demonstrate that manufacturing engineers experience a combination of leadership styles within their organization, although transformational leadership emerged as the most prevalent and most positively regarded approach. This indicates that leadership behaviors characterized by support, encouragement, trust, and professional development are more strongly recognized by engineers than other leadership patterns. Transactional leadership was also evident, particularly in situations that required structure, accountability, and reinforcement of expected performance. In contrast, authoritarian and laissez-faire leadership styles were viewed less favorably, suggesting that excessive control, limited participation, or insufficient guidance may not be conducive to fostering an effective and empowering work environment for manufacturing engineers. These results affirm that leadership within the context of manufacturing engineering is multifaceted, yet certain styles are more constructive than others in shaping employee experiences and outcomes.

The study further revealed that manufacturing engineers possess high levels of self-efficacy across the core dimensions of problem-solving, decision-making, and innovation. These findings suggest that the respondents generally perceive themselves as capable of managing technical demands, making sound judgments, and contributing innovative solutions within the aerospace manufacturing environment. Such evidence underscores the importance of psychological readiness in engineering work, particularly in settings where precision, operational discipline, and continuous improvement are essential. The results indicate that operational efficiency in aerospace manufacturing is not determined solely by technical systems, procedural controls, or production frameworks, but also by the confidence of engineers in their own capabilities to respond effectively to the challenges of their roles.

Moreover, the study established that leadership style is significantly associated with the self-efficacy of manufacturing engineers. Transformational and transactional leadership styles were found to have a positive influence on self-efficacy, indicating that supportive, developmental, and performance-oriented leadership behaviors help strengthen engineers' confidence in executing work related tasks. On the other hand, authoritarian and laissez-faire leadership styles were associated with lower self-efficacy, suggesting that leadership approaches marked either by excessive control or lack of involvement may weaken employees' sense of competence and autonomy. These conclusions highlight that leadership is not merely an administrative or supervisory function, but a critical environmental factor that shapes the psychological conditions necessary for effective engineering performance. In this regard, the study confirms that the quality of leadership behaviors has direct implications for how engineers perceive their ability to solve problems, make decisions, and innovate in the workplace.

The integration of qualitative and quantitative findings led to the development of the Leadership-Self-Efficacy Synergy Framework, which serves as a central contribution of the study. This framework emphasizes empowerment as the mechanism that links leadership styles, self-efficacy, and operational efficiency. It illustrates that leadership behaviors can improve performance outcomes when they cultivate confidence, autonomy, and professional engagement among manufacturing engineers. The framework therefore provides a meaningful

explanation of how leadership practices influence not only interpersonal dynamics but also the broader operational functioning of aerospace manufacturing organizations. It reinforces the conclusion that effective leadership is essential to creating a workplace climate in which engineers are empowered to perform at high levels and contribute to sustained operational efficiency.

Taken together, the findings lead to the conclusion that transformational leadership stands out as the most effective leadership approach for enhancing engagement, confidence, and professional functioning among manufacturing engineers, while transactional leadership also plays a constructive role when structure and accountability are required. In contrast, overreliance on authoritarian or laissez-faire leadership may inhibit collaboration, reduce autonomy, and limit the development of self-efficacy. The study therefore concludes that improving operational efficiency in aerospace manufacturing depends not only on organizational systems and technical processes but also on leadership practices that strengthen the psychological capacity of engineers to perform effectively. In this sense, the study offers both theoretical and practical significance by showing that leadership and self-efficacy are deeply interconnected elements of engineering performance.

In light of these conclusions, several implications for practice, policy, and future inquiry emerge. Organizational leadership practices should place greater emphasis on leadership behaviors that promote empowerment, guidance, and confidence-building among engineers. Policies within aerospace manufacturing organizations may therefore benefit from explicitly recognizing leadership behavior and self-efficacy as important determinants of engineering performance and from aligning leadership competency frameworks with the Leadership-Self-Efficacy Synergy Framework developed in this study. Academic institutions may also contribute by promoting mixed method approaches in the study of leadership and psychological constructs in engineering settings, as such approaches provide a richer and more comprehensive understanding of workplace dynamics. At the same time, future research should broaden the scope of investigation beyond a single aerospace manufacturing organization and include other engineering roles in order to enhance the applicability of the findings. Additional studies may also examine how perceptions of leadership and self-efficacy relate to objective company KPIs such as defect rates, cycle times, or successful Kaizen projects. Further inquiry into leadership styles not covered in the present study, different levels of leadership from mid-management to senior management to executive roles, and combinations of leadership styles and their effects on self-efficacy would likewise deepen understanding of leadership effectiveness in technical and high stakes environments.

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