
Transformational Leadership and Organizational Agility in the Era of Industry 4.0

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Abstract : This study examines the role of transformational leadership in enhancing organizational agility within the context of Industry 4.0. As organizations face rapidly changing technological landscapes, agility becomes a critical capability for sustaining competitiveness. Using a quantitative approach, data were collected through a survey of 210 mid-level managers and supervisors across manufacturing and service industries in Indonesia. The study employs Structural Equation Modeling (SEM) to assess the relationship between four dimensions of transformational leadership: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, and organizational agility. Results indicate that all dimensions of transformational leadership significantly and positively affect organizational agility, with intellectual stimulation having the strongest influence. The findings suggest that transformational leaders enable organizations to navigate uncertainty, adapt to change, and innovate continuously. This research contributes to the growing literature on agile leadership in digital transformation contexts and provides actionable insights for managers leading in dynamic environments.

Keywords : *transformational leadership, organizational agility, industry 4.0, digital transformation, SEM.*

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INTRODUCTION

The emergence of Industry 4.0 has fundamentally reshaped organizational dynamics, forcing companies to rethink their structures, strategies, and leadership approaches. Technologies such as automation, artificial intelligence, big data, and the Internet of Things have significantly accelerated business processes and created both opportunities and disruptions across industries. In this context, organizational agility—the ability to sense external changes, respond swiftly, and proactively shape market conditions—has become a critical survival mechanism (Teece et al., 2016). Firms that lack agility often find themselves unable to cope with rapid technological shifts and volatile competition. Thus, leadership style plays a central role in equipping organizations with the capabilities needed to thrive. Among various approaches, transformational leadership stands out as a model that fosters change, innovation, and collective engagement, making it highly relevant in the era of digital transformation.



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Transformational leadership, as articulated by Bass and Avolio (1994), rests on four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Leaders who embody these characteristics not only inspire loyalty and trust but also cultivate innovative thinking and long-term commitment among employees. Their ability to challenge conventional assumptions and encourage experimentation helps organizations build resilience in uncertain environments. These behaviors are particularly significant in Industry 4.0, where the speed of technological advancement demands leaders who can mobilize people around a shared vision while simultaneously nurturing creativity and adaptability. Unlike transactional approaches that emphasize compliance and short-term results, transformational leadership provides a deeper and more sustainable influence on organizational culture, thereby enhancing agility and competitiveness.

In Indonesia, the government has actively promoted the integration of Industry 4.0 through initiatives such as the national policy "Making Indonesia 4.0." This policy encourages firms, particularly in manufacturing and services, to adopt advanced technologies to increase productivity and global competitiveness. However, technology adoption alone does not guarantee organizational success. Many companies still struggle with rigid hierarchies, bureaucratic inertia, and leadership gaps that limit their ability to adapt (Van Dun et al., 2023). As a result, the role of leadership, particularly transformational leadership, becomes essential in bridging the gap between digital tools and organizational outcomes. By empowering employees and fostering adaptive learning, transformational leaders can act as catalysts for organizational agility, ensuring that technological adoption is matched with human capability development and strategic flexibility.

Organizational agility itself is a multidimensional construct encompassing rapid decision-making, structural flexibility, learning orientation, and innovation capacity. Doz and Kosonen (2010) argue that agility is not just about moving fast but also about making strategically relevant decisions in uncertain environments. Transformational leaders, through intellectual stimulation, can encourage experimentation and continuous learning, while inspirational motivation builds collective enthusiasm for change. Empirical evidence supports the notion that leadership behaviors strongly influence agility, particularly in sectors undergoing technological turbulence (Alavi et al., 2014). In this regard, transformational leadership provides the cultural foundation for developing adaptive capabilities, making it indispensable in Industry 4.0 environments where uncertainty and complexity dominate.

Although transformational leadership has been extensively linked to innovation, performance, and organizational change, its direct impact on organizational agility in the context of Industry 4.0 remains underexplored. Most existing research emphasizes innovation or change management as leadership outcomes, often overlooking agility as an integrated capability that blends flexibility, speed, and proactivity. This study seeks to address that gap by examining how the dimensions of transformational leadership specifically contribute to building agility. By focusing on this relationship, the research not only expands theoretical discussions but also provides practical implications for organizations navigating digital transformation.

Cultural and regional contexts further add complexity to the leadership-agility nexus. In Southeast Asia, including Indonesia, organizational leadership is often influenced by hierarchical and collectivist norms. Such norms sometimes clash with the participatory and empowering approaches required for agility in Industry 4.0 (Tortorella et al., 2019). This creates both challenges and opportunities for leaders to adapt their



styles. Transformational leadership, which emphasizes empowerment, collaboration, and vision, offers a pathway for Indonesian firms to reconcile traditional cultural patterns with modern organizational demands. Understanding this shift is vital for advancing leadership practices in digitally evolving economies.

Moreover, agility should be viewed as a dynamic capability that evolves over time through ongoing learning and adaptation. Rigby et al. (2016) emphasize that creating an environment of psychological safety, open communication, and cross-functional collaboration is essential for cultivating agility. Transformational leaders play a critical role in shaping such environments, enabling teams to respond flexibly to disruptions and seize emerging opportunities. This perspective highlights that agility is not a fixed attribute but a continuously developing competency, requiring consistent reinforcement by leadership practices.

Finally, sectoral differences highlight that agility manifests differently across industries. In manufacturing, agility may center on supply chain responsiveness and flexible production systems, while in services, the focus lies on customer-centric innovations and rapid service delivery. Despite these differences, leadership remains a central determinant of success across sectors. Given the urgency of technological disruption and market volatility, this study aims to empirically investigate the role of transformational leadership in fostering organizational agility in Indonesia. By analyzing managerial perspectives across diverse industries, the research contributes to theory-building while offering actionable insights for leadership development programs tailored to Industry 4.0 challenges.

RESEARCH METHODS

This research employed a quantitative survey method with a cross-sectional design. The population comprised middle-level managers and supervisors working in manufacturing and service companies undergoing digital transformation in Indonesia. Using purposive sampling, 210 valid responses were obtained through online questionnaires distributed via LinkedIn, email, and professional networks.

The measurement instrument was adapted from established scales. Transformational leadership was assessed using the Multifactor Leadership Questionnaire (MLQ-5X) developed by Bass and Avolio (1994), which includes 20 items measuring four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Organizational agility was measured using an adapted scale from Sharifi and Zhang (2001), covering strategic sensitivity, resource fluidity, and responsiveness.

All items used a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Reliability testing indicated acceptable internal consistency with Cronbach's alpha values above 0.80 for all constructs. Content validity was reviewed by experts in organizational behavior and industrial management.

Data were analyzed using Structural Equation Modeling (SEM) via AMOS 24. The analysis included confirmatory factor analysis (CFA) for model fit, followed by structural model testing. The model fit indicators CFI, TLI, RMSEA, and χ^2/df were used to evaluate the goodness-of-fit. Mediation and multi-group analyses were also conducted to examine moderating effects by sector.

Ethical clearance was obtained, and respondents were informed about the confidentiality and voluntary nature of the study. Participation was anonymous and no identifiable information was collected.



RESULTS AND DISCUSSION

Respondent Characteristics and Descriptive Findings

The descriptive analysis indicates that 56 percent of respondents were employed in the manufacturing sector, while 44 percent worked in service industries. Most respondents held bachelor's degrees and had more than five years of managerial experience. This profile suggests that the sample represents managers with sufficient exposure to organizational change and digital transformation initiatives.

Respondents reported the highest agreement with items related to intellectual stimulation, indicating a strong emphasis on problem solving, critical thinking, and innovation-oriented leadership behaviors. In contrast, individualized consideration received comparatively lower mean scores. This pattern suggests that managers prioritize cognitive and task-related leadership behaviors over individualized mentoring, possibly due to high workload pressures and performance demands in dynamic Industry 4.0 environments.

Table 1. Respondent Profile (n = 210)

Characteristic	Category	Percentage (%)
Industry Sector	Manufacturing	56
	Services	44
Education Level	Bachelor's degree or higher	Majority
Managerial Experience	> 5 years	Majority

These descriptive results provide an important contextual foundation for interpreting the structural model outcomes, as leadership perceptions are shaped by sectoral demands and managerial responsibilities.

Measurement Model Assessment

Confirmatory Factor Analysis was conducted to evaluate the reliability and validity of the measurement model. All standardized factor loadings exceeded the recommended threshold of 0.70, indicating strong convergent validity. Construct reliability was further supported by Cronbach's alpha values above 0.80 for all latent variables.

Model fit indices demonstrated an excellent overall fit between the measurement model and the observed data. The Comparative Fit Index and Tucker-Lewis Index exceeded 0.90, while the RMSEA value remained below 0.05, confirming the robustness of the model structure.

Table 2. Measurement Model Fit Indices

Fit Index	Value	Recommended Threshold
CFI	0.94	≥ 0.90
TLI	0.93	≥ 0.90
RMSEA	0.045	≤ 0.08
χ^2/df	1.85	≤ 3.00

These results confirm that the constructs of transformational leadership and organizational agility are empirically distinct and measured with acceptable precision.

Structural Model Results

The structural model analysis reveals that all four dimensions of transformational leadership exert significant positive effects on organizational agility. This finding confirms the central proposition of the study that leadership behaviors are critical drivers of agility in Industry 4.0 contexts.



Table 3. Structural Path Coefficients

Path	Standardized Coefficient (β)	p-value	Result
Intellectual Stimulation → Organizational Agility	0.39	< 0.001	Significant
Inspirational Motivation → Organizational Agility	0.31	< 0.001	Significant
Idealized Influence → Organizational Agility	0.27	< 0.01	Significant
Individualized Consideration → Organizational Agility	0.23	< 0.05	Significant

Among the leadership dimensions, intellectual stimulation shows the strongest influence on organizational agility. This result highlights the importance of leaders who encourage questioning of established routines, experimentation, and continuous learning. In Industry 4.0 environments characterized by rapid technological change, such cognitive engagement enables organizations to respond more effectively to uncertainty.

Inspirational motivation also demonstrates a substantial effect, indicating that leaders who articulate a clear vision and foster optimism can align employees with strategic objectives and sustain momentum during transformation. Idealized influence strengthens trust and commitment, while individualized consideration supports agility through employee development, although with a comparatively smaller effect size.

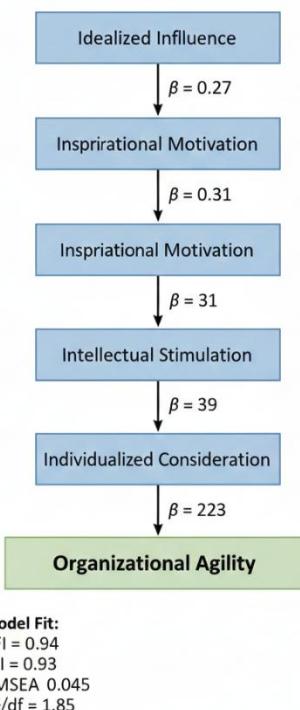


Figure 1. Transformational Leadership Dimensions and Organizational Agility

This figure illustrates the cumulative contribution of transformational leadership dimensions to organizational agility, with intellectual stimulation functioning as the most dominant pathway.

Sectoral Comparison and Discussion

Sectoral analysis indicates that the leadership-agility relationship is slightly stronger in service organizations than in manufacturing firms. This pattern may reflect the service sector's higher dependence on human interaction, rapid customer feedback, and continuous innovation cycles. However, the differences between sectors are not statistically significant, suggesting that transformational leadership exerts a consistent influence across organizational contexts.

From a theoretical perspective, these findings support the dynamic capabilities framework by positioning transformational leadership as an antecedent of organizational agility. Leadership behaviors translate individual cognition, motivation, and trust into collective adaptive capacity. Practically, the results demonstrate that agility cannot be achieved through technological investment alone. Organizations must also cultivate leadership practices that promote learning, empowerment, and strategic alignment.

Overall, the results confirm that transformational leadership is a critical mechanism through which organizations can enhance agility and sustain competitiveness in the era of Industry 4.0.

CONCLUSION

This study demonstrates that transformational leadership plays a decisive role in strengthening organizational agility in the context of Industry 4.0. The empirical results confirm that all four dimensions of transformational leadership idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration have significant and positive effects on organizational agility. These findings indicate that leadership behaviors directly shape an organization's ability to respond quickly, adapt structures, and innovate in environments characterized by technological disruption.

Intellectual stimulation emerges as the strongest predictor of organizational agility. Leaders who encourage critical thinking, experimentation, and learning enable organizations to adjust more effectively to rapid technological and market changes. Inspirational motivation also contributes substantially by aligning employees with a shared vision and sustaining commitment during periods of uncertainty. Idealized influence reinforces trust and credibility, which supports collective acceptance of change, while individualized consideration enhances agility through employee development and support, although with a comparatively smaller effect.

The findings highlight that organizational agility is not solely a product of digital infrastructure or advanced technologies. Agility depends on leadership practices that translate technological adoption into coordinated action and adaptive behavior. Organizations that invest in Industry 4.0 initiatives without parallel leadership development risk underutilizing their technological potential.

From a managerial perspective, firms should integrate transformational leadership competencies into leadership development programs, performance evaluation systems, and succession planning. Such integration ensures that agility becomes embedded in daily managerial practices rather than treated as a temporary response to disruption.

In conclusion, transformational leadership constitutes a strategic capability that enables organizations to adapt, learn, and remain competitive in the era of Industry 4.0. Strengthening this leadership approach is essential for organizations seeking sustainable agility in increasingly volatile and digitalized environments..

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