



Beyond Human-Centred Leadership Theory: Digital Leadership, Artificial Intelligence and the Governance of Hybrid Human-Machine Organisations

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Abstract

Leadership scholarship has developed sophisticated explanations of transformational, transactional, servant, authentic, adaptive, distributed, strategic, and ethical leadership. Yet the accelerating diffusion of artificial intelligence (AI), generative artificial intelligence (GenAI), automation, robotics, algorithmic management, and autonomous systems is altering the technological environment within which leadership occurs. This conceptual study critically examines the contemporary leadership literature and argues that digital leadership should no longer be treated as a peripheral technological extension of conventional leadership. Instead, digital leadership should be conceptualised as an increasingly foundational leadership capability for organisations operating within intelligent, automated, data-intensive, and human-machine environments. Using an integrative and comparative literature-review approach, this paper synthesises classical leadership theories with research on e-leadership, digital transformation, dynamic capabilities, strategic leadership, AI-enabled management, and human-AI collaboration. The current study develops the Digital-Artificial Intelligence Leadership Integration Framework (DAILIF), which conceptualises future leadership through eight interdependent domains: digital vision, technological intelligence, human-AI orchestration, algorithmic judgement, digital ethics and governance, workforce transformation, cyber-resilience, and continuous technological adaptation. This paper argues that AI will not simply become another tool available to leaders; it will increasingly participate in analysis, prediction, communication, coordination, evaluation, resource allocation, and organisational decision-making. Leadership, therefore, will progressively involve governing hybrid systems consisting of human workers, intelligent technologies, automated processes, robots, algorithms, and autonomous agents. Comparative analysis indicates that digital leadership requirements differ between advanced and developing economies because technological infrastructure, institutional capacity, digital inequality, organisational resources, and workforce readiness condition AI adoption. The present study concludes that leadership theory must evolve from predominantly human-to-human models

towards socio-technical and human-AI models capable of explaining leadership within intelligent organisations beyond 2035.

Keywords: digital leadership; artificial intelligence; automation; generative AI; leadership theory; robotics; algorithmic leadership; human-AI collaboration; digital transformation; future of leadership; intelligent organisation.

Introduction

Leadership has historically been conceptualised principally as a human relational process through which individuals influence other individuals and groups towards the achievement of shared organisational objectives. Transformational leadership emphasises inspiration, intellectual stimulation, idealised influence, and individual consideration, while transactional leadership emphasises exchanges, performance expectations, rewards, and corrective action (Bass, 1985; Bass & Avolio, 1994). Servant leadership foregrounds service, follower development, stewardship, and ethical responsibility, whereas authentic leadership emphasises self-awareness, relational transparency, internalised moral perspectives, and balanced processing (Avolio & Gardner, 2005; Greenleaf, 1977). Adaptive leadership addresses the mobilisation of individuals confronting difficult and changing circumstances, and strategic leadership examines the capacity of senior leaders to influence organisational direction, capabilities, resources, and long-term performance (Boal & Hooijberg, 2001; Heifetz et al., 2009). These theoretical traditions have generated substantial insight into interpersonal influence and organisational behaviour. However, most were developed when organisational intelligence, communication, analysis, decision-making, and agency were assumed to reside predominantly within human beings.

The technological environment confronting twenty-first-century organisations fundamentally challenges this assumption. Artificial intelligence can analyse large datasets, generate strategic alternatives, predict customer behaviour, produce documents, evaluate performance, identify anomalies, recommend personnel decisions, automate workflows, communicate with employees and customers, and increasingly execute multi-stage activities through autonomous or semi-autonomous systems. Generative AI extends these capabilities into domains previously considered highly dependent on human cognition, including language, coding, design, knowledge synthesis, problem-solving, and decision support. Robotics simultaneously extends automation into physical environments, while algorithmic management systems increasingly participate in scheduling, task allocation, monitoring, performance assessment, and workforce coordination. Technology is consequently moving from being an instrument used within organisations towards becoming an increasingly active participant in organisational processes. Leadership theory must therefore consider what leadership means when cognition, coordination, information processing, and limited forms of agency are distributed between human and artificial actors.

Digital leadership scholarship provides an important foundation for this transition. Avolio et al. (2000) introduced the concept of e-leadership as a social influence process mediated by advanced information technology and argued through Adaptive Structuration Theory that technology and leadership could transform one another. Their contribution was remarkably prescient because it

rejected the assumption that technology merely provides a neutral communication channel. Avolio et al. (2014) subsequently revisited e-leadership as virtual teams, mobile technologies, and digital communication became increasingly embedded within organisational life. Yet the technological environment contemplated by early e-leadership research was still principally one in which humans communicated with other humans through technology. Contemporary AI introduces a qualitatively different possibility: technology increasingly analyses, recommends, communicates, evaluates, generates, predicts, and sometimes acts alongside human participants.

Recent digital leadership research reflects this transition but remains fragmented. A systematic review published by Liu et al. (2024) synthesised 53 studies and identified vision motivation, digital empowerment, innovation and entrepreneurship, cross-boundary collaboration, and dynamic adaptation as central characteristics of digital leadership. The review further identified digital strategic thinking, digital insight, digital change, and digital talent development as important dimensions of the construct. Digital leadership was associated with organisational transformation and innovation, team effectiveness, and employee creativity, yet the authors concluded that the knowledge base remained scattered and required further theoretical development. Research therefore increasingly acknowledges that technological transformation requires particular leadership capabilities without fully repositioning digital leadership at the centre of general leadership scholarship. This conceptual separation becomes progressively less defensible as digital technologies become inseparable from organisational strategy and everyday management.

AI intensifies the theoretical problem because it affects not merely how leaders communicate but what leaders know, how they decide, whom or what they manage, and how organisational authority is exercised. A systematic review of AI and top management identified three major research clusters concerning AI-driven leadership skills, managerial AI adoption, and the strategic use of AI, illustrating the growing intersection between leadership and intelligent technologies. Contemporary research also indicates that different forms of AI may alter the strategic capabilities required of senior managers. The leader of the intelligent organisation must understand not only human motivation and organisational strategy but data, algorithms, automation, technological risk, AI governance, cyber-resilience, and human-machine collaboration. Digital competence therefore moves from an optional specialist capability towards an increasingly fundamental component of leadership competence.

This paper argues that leadership scholarship is approaching a theoretical discontinuity. Leadership theories constructed for predominantly human organisations cannot simply be discarded because motivation, ethics, trust, relationships, culture, communication, and human meaning remain essential. However, they require integration within a broader socio-technical understanding of leadership in which organisational outcomes increasingly emerge from interactions among leaders, followers, algorithms, automated processes, digital platforms, robots, and intelligent agents. The future leader will therefore not merely lead people who use technology. Increasingly, the leader will be responsible for leading people through technology, leading organisations with technology, governing technology that influences people, and orchestrating systems in which humans and intelligent machines jointly produce organisational outcomes.

Research Problem

The principal research problem addressed by this study is the growing mismatch between conventional leadership theory and the technological architecture of contemporary organisations. Much mainstream leadership scholarship remains organised around human characteristics, behaviours, relationships, power, motivation, identity, values, teams, culture, and strategy. These remain essential, but intelligent technologies increasingly influence each of these dimensions. Algorithms mediate communication, digital platforms shape organisational visibility, predictive systems inform strategy, AI participates in recruitment and performance analysis, and automation redistributes responsibilities between workers and machines. Leadership consequently occurs within technologically constituted environments rather than merely using technologies as external instruments. A leadership framework that ignores this transformation risks becoming progressively disconnected from organisational reality.

The problem is not that leadership scholarship has entirely ignored technology. E-leadership has existed for more than two decades, and digital leadership has emerged as a distinct research field. However, the literature frequently remains compartmentalised within digital transformation, information systems, educational technology, innovation management, or specialist organisational contexts. A 2024 systematic review explicitly characterised digital leadership scholarship as scattered despite increasing academic attention (Liu et al., 2024). A 2025 systematic review of digital leadership in academic environments similarly emphasised the growing importance of governance, connectedness, technological understanding, organisational culture, and national cultural context. The existence of these studies demonstrates growing scholarly recognition while simultaneously revealing insufficient integration with general leadership theory.

The arrival of GenAI creates additional urgency because leadership now confronts technologies capable of performing activities conventionally regarded as managerial cognition. An AI system can synthesise organisational data, prepare forecasts, identify risks, compare strategic scenarios, generate communications, evaluate market trends, summarise meetings, recommend resource allocation, and monitor performance. As autonomous agents develop, systems may increasingly initiate and execute workflows with limited human intervention. The theoretical distinction between a technological tool and an organisational actor consequently becomes less straightforward. Leadership scholarship requires conceptual frameworks capable of explaining authority, accountability, trust, delegation, judgement, and control when artificial systems participate directly in organisational decision processes.

Research Gap

The first major gap concerns the incomplete integration of digital leadership with established leadership theories. Transformational leadership provides powerful explanations of vision and organisational change but offers limited explicit guidance concerning algorithmic governance, AI literacy, cybersecurity, or human-AI workforce design. Servant leadership emphasises human welfare but does not explain how leaders should govern automated systems capable of affecting employees' opportunities and working conditions. Authentic leadership foregrounds transparency

and moral consistency but predates organisational environments where algorithmic opacity itself becomes a leadership problem. Adaptive leadership provides valuable concepts for navigating uncertainty but does not specifically conceptualise autonomous technologies as components of organisational adaptation. Digital leadership therefore requires integration with rather than replacement of established leadership traditions.

A second gap concerns the conceptual transition from digitally mediated leadership to AI-augmented leadership. Traditional e-leadership research examined environments in which technology mediated communication among human participants (Avolio et al., 2000, 2014). Contemporary AI increasingly contributes cognitive output rather than merely transmitting human output. This distinction is theoretically consequential. Email changes the medium through which a leader communicates, whereas an AI system can generate the communication itself, recommend what should be communicated, determine which stakeholders require attention, analyse their responses, and suggest subsequent actions. The technology therefore enters portions of the leadership process rather than merely supporting its transmission.

A third gap concerns robotics and automation. Digital leadership scholarship has frequently concentrated on digital transformation, virtual teams, digital communication, organisational innovation, and information technologies. Yet intelligent organisations increasingly combine software AI with robotic and automated systems capable of executing physical or administrative work. Leaders may consequently manage hybrid workforces containing permanent employees, contractors, remote workers, AI agents, robotic systems, automated workflows, and algorithmic platforms. Conventional span-of-control concepts become increasingly complicated when one manager can supervise technological systems performing work previously requiring large numbers of employees. The leadership implications of such hybrid organisational structures remain insufficiently theorised.

A fourth gap concerns developing economies. Digital leadership research is disproportionately informed by technologically advanced organisational settings, although digital transformation operates under considerably different conditions where infrastructure, broadband availability, technological investment, institutional capacity, workforce skills, and cybersecurity resources are constrained. Digital leadership in a high-income multinational corporation cannot simply be assumed to function identically within a Caribbean public agency, African university, small manufacturing firm, or developing-country healthcare organisation. National culture, institutional capacity, digital inequality, and economic development therefore require incorporation into digital leadership theory. Comparative scholarship must move beyond universal models derived predominantly from advanced economies.

Aim and Research Questions

The principal aim of this study is to develop a futuristic, theoretically integrated conceptualisation of digital leadership appropriate for organisations operating under conditions of AI, automation, robotics, algorithmic management, and continuing digital transformation. The study evaluates established leadership theories, identifies their continuing contributions and technological limitations, and proposes an integrative framework for future leadership research.

Digital leadership is treated neither as technological proficiency nor as the management of an information-technology department. Instead, it is conceptualised as a multidimensional leadership capability involving strategic, technological, ethical, human, organisational, and adaptive dimensions. Particular attention is directed towards human-AI complementarity because future organisational performance will increasingly depend on the allocation of activities between human and artificial capabilities. The analysis consequently addresses the following research questions.

1. To what extent do established leadership theories adequately address the technological characteristics of intelligent organisations?
2. How should digital leadership be conceptualised in the age of AI, automation, robotics, and autonomous systems?
3. How will AI alter leadership decision-making, communication, strategy, workforce management, power, accountability, and organisational control?
4. Which digital leadership competencies are likely to become essential between 2030 and 2040?
5. How should leadership theory incorporate human-AI collaboration and hybrid human-machine organisational systems?
6. How are digital leadership requirements likely to differ between developed and developing economies?
7. What theoretical and empirical research agenda should guide future digital leadership scholarship?

Methodology

This study employs a critical integrative literature-review methodology. An integrative approach is appropriate because the research problem crosses leadership theory, organisational behaviour, strategic management, information systems, AI, digital transformation, workforce automation, and technology governance. Classical leadership scholarship was examined to establish the conceptual assumptions underlying transformational, transactional, servant, authentic, adaptive, distributed, and strategic leadership. These perspectives were comparatively evaluated against e-leadership and contemporary digital leadership research. Recent systematic reviews were prioritised to establish the current boundaries and deficiencies of digital leadership scholarship. Emerging studies concerning AI and senior management were subsequently incorporated to extend the analysis towards intelligent organisations.

The review is conceptual rather than meta-analytic because the objective is theoretical integration and future model development rather than estimation of a common effect size. Recent literature receives particular emphasis because GenAI capabilities have developed rapidly and organisational technologies available after 2022 differ materially from the technologies underpinning earlier e-leadership research. Nevertheless, foundational studies are retained where they establish theoretical trajectories essential for understanding contemporary developments. The analysis uses comparison across leadership theories and economic environments as its principal interpretative strategy. The resulting framework should therefore be understood as a theoretically derived model requiring subsequent quantitative and qualitative validation.

The Evolution of Leadership Theory

From Trait Leadership to Behaviour and Contingency

Early leadership scholarship frequently sought characteristics differentiating leaders from non-leaders. Trait approaches concentrated on intelligence, confidence, determination, sociability, integrity, and other individual characteristics, while behavioural research shifted attention towards what leaders actually did. Contingency perspectives subsequently demonstrated that leadership effectiveness depends on the interaction between leadership characteristics and situational conditions. These developments progressively moved scholarship away from universal assumptions towards contextual understanding. However, the relevant “situation” remained predominantly social and organisational. Technology rarely constituted an active theoretical dimension.

The digital age changes the nature of context itself. Leaders increasingly operate within digitally constructed environments where information flows, organisational visibility, communication speed, surveillance capacity, and decision processes are technologically mediated. Context is therefore partly technological rather than merely environmental or interpersonal. A contingency approach appropriate for contemporary organisations must ask not only whether a leadership style matches followers and organisational conditions but whether it matches the technological architecture through which work occurs. Leadership effectiveness may increasingly depend on alignment among human capability, organisational strategy, and technological maturity.

Transformational Leadership

Transformational leadership remains relevant because digital transformation requires vision, intellectual stimulation, organisational change, and employee mobilisation. Leaders must communicate why AI adoption is necessary, overcome resistance, encourage experimentation, and establish organisational confidence during uncertainty. These requirements correspond strongly with transformational leadership principles (Bass, 1985). Digital leadership research similarly identifies vision, motivation and innovation as central characteristics, suggesting considerable theoretical overlap. Transformational leadership therefore provides an important human foundation for digital leadership.

Nevertheless, transformational leadership alone is insufficient. A charismatic leader may inspire an organisation to adopt AI while lacking the technological understanding necessary to distinguish a valuable system from an expensive technological fashion. Vision without technological literacy can produce poor investment, cybersecurity exposure, algorithmic discrimination, and strategic dependency. Digital leadership therefore adds technological judgement to transformational vision. The digital leader must know enough about technology to ask the right questions even where technical specialists possess deeper engineering expertise.

Transactional Leadership

Transactional leadership is similarly transformed by algorithmic management. Performance measurement, rewards, scheduling, workflow allocation, monitoring, and corrective feedback can

increasingly be automated. In warehouses, logistics systems, platform work, customer service, and digitally monitored workplaces, algorithms can perform activities historically associated with transactional supervision. This suggests that transactional leadership may be among the first leadership functions partially delegated to machines. Human managers could consequently spend less time monitoring routine performance and more time handling exceptions, development, strategy, relationships, and judgement.

The development also creates ethical concerns. Automated performance systems can produce technologically efficient but psychologically damaging workplaces if optimisation occurs without sufficient attention to dignity, autonomy, fairness, and context. Digital leaders must consequently govern algorithmic transactional systems rather than merely adopting them. Human leadership becomes important where automated systems produce disputed or consequential decisions. The future of transactional leadership may therefore involve machines performing transactions under human ethical and strategic supervision.

Servant Leadership

Servant leadership provides an important counterbalance to technologically deterministic digital transformation. Organisations can adopt AI principally to reduce costs and increase surveillance, or they can employ it to remove repetitive work, improve employee capability, expand accessibility, and enhance human welfare. Servant leadership emphasises that technological efficiency should not become an end independent of human development. Digital leaders should therefore ask not merely whether a system increases productivity but whether it improves the quality and dignity of work. This perspective becomes important when automation threatens employment or fundamentally changes professional identities.

Authentic and Ethical Leadership

Authentic and ethical leadership become more rather than less important in AI-intensive environments. AI introduces concerns involving explainability, privacy, misinformation, deepfakes, bias, surveillance, intellectual property, automated discrimination, and responsibility for machine-generated decisions. Leaders cannot delegate moral accountability simply because an algorithm produced a recommendation. Organisational trust may depend increasingly on leaders explaining when AI is being used, what data inform decisions, which safeguards exist, and how individuals can challenge automated outcomes. Transparency therefore acquires a technological dimension.

Adaptive Leadership

Adaptive leadership aligns strongly with digital environments because technological development generates continuous uncertainty rather than one-time organisational change. AI adoption is not a project that organisations simply complete. Models improve, regulations change, cyber threats evolve, competitors innovate, employee capabilities develop, and customer expectations shift continually. Digital leadership consequently requires persistent organisational adaptation. The leader's task becomes building institutions capable of repeatedly learning and reconfiguring rather than successfully managing a single transformation.

From E-Leadership to Digital Leadership

Avolio et al. (2000) provided one of the earliest systematic conceptualisations of e-leadership, defining it through the interaction between social influence and advanced information technology. Their Adaptive Structuration Theory framework recognised that technology influences organisational structures while organisational actors simultaneously shape how technology is used. This reciprocal perspective remains exceptionally relevant. Technology does not independently determine organisational outcomes because leaders decide which technologies to adopt, how they are configured, who receives access, what rules govern their use, and which organisational objectives they serve. Yet once embedded, technologies reshape communication, authority, visibility, coordination, and organisational possibilities.

By 2014, e-leadership scholarship increasingly addressed virtual teams, geographically distributed work, mobile technologies, and electronically mediated relationships (Avolio et al., 2014). These developments were important but remained predominantly concerned with **human leadership transmitted through digital environments**. Contemporary digital leadership expands beyond transmission towards organisational transformation. Digital leaders shape strategy, capabilities, culture, talent, innovation, and organisational architecture in response to technological change. Recent systematic research identifies digital strategic thinking, digital insight, digital change, and digital talent development as core dimensions (Liu et al., 2024). Digital leadership therefore represents a broader construct than remote or electronically mediated leadership.

AI now requires another conceptual transition. The progression can be represented as:

Traditional Leadership → E-Leadership → Digital Leadership → AI-Augmented Leadership → Hybrid Human-Machine Leadership

Traditional leadership assumes primarily face-to-face or conventional organisational relationships. E-leadership introduces technologically mediated influence. Digital leadership integrates technology with organisational strategy and transformation. AI-augmented leadership incorporates artificial intelligence into cognition, analysis, communication, and decision-making. Hybrid human-machine leadership represents the emerging stage in which organisational activities are intentionally distributed among human workers, algorithms, AI agents, robotic systems, and automated processes.

Defining Digital Leadership for the AI Era

Digital leadership may therefore be defined as:

A strategic, ethical, adaptive and technologically informed process through which leaders mobilise human and artificial capabilities, govern digital systems, develop organisational intelligence, and orchestrate human-machine collaboration to achieve sustainable organisational and societal objectives under conditions of continuous technological change.

This definition deliberately differs from definitions equating digital leadership with technology use. A chief executive who frequently uses AI software is not necessarily a digital leader. Digital

leadership concerns the ability to understand technological possibilities, translate them into organisational strategy, restructure work appropriately, govern risks, develop employees, maintain ethical responsibility, and continuously adapt organisational capabilities. It combines technological understanding with human leadership. Digital leadership is consequently neither computer science nor conventional leadership with digital vocabulary attached.

The definition also introduces artificial capability as an organisational resource requiring leadership. Classical leadership theory assumes that leaders mobilise people and resources. Intelligent organisations add algorithms capable of cognition-like activities and autonomous systems capable of limited action. Leadership therefore increasingly involves deciding what should remain human, what should become automated, where human-AI collaboration provides superior outcomes, and what activities should never be delegated completely to machines. This allocation function becomes one of the defining responsibilities of future leaders.

The Digital-Artificial Intelligence Leadership Integration Framework

This study proposes the **Digital-Artificial Intelligence Leadership Integration Framework (DAILIF)** as a theoretical model for leadership within intelligent organisations.

Table 1: The Eight Dimensions of Digital-AI Leadership

Dimension	Central leadership question	Principal capability
Digital vision	Where should technology take the organisation?	Strategic foresight
Technological intelligence	What can and cannot the technology reliably do?	AI/digital literacy
Human-AI orchestration	Which tasks belong to humans, AI, or collaboration?	Work redesign
Algorithmic judgement	When should AI recommendations be accepted or challenged?	Critical decision-making
Digital ethics and governance	What should technology be permitted to do?	Ethical governance
Workforce transformation	How should people develop as technology changes work?	Reskilling/change leadership
Cyber-resilience	How can digitally dependent organisations remain secure?	Risk leadership
Continuous technological adaptation	How can organisations repeatedly adjust?	Dynamic capability

These dimensions are interdependent rather than sequential. A technologically sophisticated organisation without ethical governance can generate significant social and reputational harm. An ethically responsible organisation without technological intelligence can become uncompetitive or dependent on vendors it cannot effectively evaluate. A visionary organisation without workforce transformation can generate employee resistance and skills shortages. Similarly, AI adoption without cyber-resilience can increase organisational vulnerability. Effective digital leadership therefore requires simultaneous technological, human, strategic, ethical, and adaptive capability.

Digital Vision

Vision has long occupied a central position within transformational and strategic leadership. Digital vision differs from generic organisational vision because leaders must anticipate how technologies alter customers, competitors, operations, skills, products, services, and business models. The question is no longer merely whether an organisation should “use AI”. Leaders must determine where intelligent systems create meaningful value and where technological adoption would merely imitate competitors. Strategic digital leadership therefore requires distinguishing technological possibility from strategic necessity. Organisations can waste enormous resources adopting fashionable technologies without clearly defined organisational problems.

Digital vision also requires temporal sophistication. Leaders must simultaneously manage technologies producing value today, emerging technologies requiring experimentation, and longer-term developments capable of disrupting the organisation's existing model. Excessive focus on immediate return can leave organisations strategically unprepared, while excessive futuristic experimentation can divert resources from current operations. Digital leaders therefore require portfolio thinking. Some technological initiatives should improve efficiency, others should build capabilities, and others should function as strategic options against uncertain futures.

Technological Intelligence

Leaders do not need to become machine-learning engineers, but technological illiteracy is increasingly incompatible with strategic leadership. Senior executives make decisions concerning AI investment, data infrastructure, cybersecurity, automation, vendors, cloud systems, workforce restructuring, and technology governance. Executives who do not understand basic technological concepts become excessively dependent on consultants, vendors, or technical departments. This creates information asymmetry at precisely the point where technology becomes central to organisational strategy. Digital literacy must therefore become part of executive literacy alongside finance, strategy, human resources, and operations.

Recent scholarship supports this direction. Research examining AI and top-management leadership identifies AI-driven leadership skills, adoption factors, and strategic AI utilisation as important emerging research clusters. A structured review of leadership competencies in the AI era identified 24 relevant competencies comprising both personality traits and skills and emphasised communication, cross-functional collaboration, and human-machine symbiosis. These findings demonstrate that technological leadership does not displace traditional human competence. Instead, the emerging requirement is a **dual literacy** in human organisations and intelligent technologies.

Human-AI Orchestration

Human-AI orchestration may become the defining leadership capability of the next two decades. Organisations will increasingly ask whether tasks should be undertaken by humans alone, machines alone, or human-machine teams. These decisions should not be made solely based on technological feasibility. Leaders must consider quality, cost, accountability, employee

development, customer preference, risk, privacy, ethics, and organisational resilience. The cheapest automated solution may not always represent the strongest organisational solution.

Human-AI orchestration therefore transforms workforce planning. Traditional workforce planning asks how many people and which skills an organisation requires. Future workforce planning must additionally determine how much artificial capability the organisation requires and how that capability should interact with human talent. A department may contain 20 employees supported by AI systems performing work previously requiring 40 people, or 40 employees whose AI augmentation allows the organisation to enter markets previously requiring 80. Automation does not therefore dictate a single employment outcome. Leadership decisions determine whether productivity gains become redundancy, growth, improved services, reduced working time, higher wages, or increased profitability.

Algorithmic Judgement

AI can generate recommendations but cannot eliminate organisational responsibility. Leaders must therefore develop what this study terms algorithmic judgement: the capacity to determine when machine-generated analysis deserves confidence and when human intervention is necessary. This requires understanding model limitations, data quality, probability, uncertainty, bias, hallucination, contextual mismatch, and the consequences of false positives and false negatives. Blind acceptance of algorithmic output constitutes technological dependence rather than digital leadership. Equally, rejecting accurate algorithmic recommendations merely because they originate from machines represents technologically uninformed leadership.

Algorithmic judgement also involves epistemic humility. Human leaders possess cognitive biases, political interests, limited information, fatigue, and imperfect memory, meaning human judgement should not automatically be romanticised as superior. AI can reveal patterns humans overlook and challenge managerial intuition. The strongest decision system may therefore involve productive disagreement between human and artificial reasoning. Future leadership research should investigate not simply whether humans or AI make better decisions but which configurations of human-AI decision-making perform best under different organisational conditions.

Digital Ethics and Governance

AI creates leadership responsibilities that cannot be delegated entirely to information-technology departments. Decisions concerning employee surveillance, automated recruitment, predictive performance management, customer profiling, facial recognition, biometric systems, algorithmic pricing, and generative content contain ethical implications. A technically successful system can simultaneously be organisationally unjust. Leaders therefore require governance frameworks specifying acceptable uses, prohibited applications, accountability structures, human oversight, audit requirements, and escalation procedures. Digital ethics must become an operational component of leadership rather than a philosophical afterthought.

Responsibility becomes important where algorithms produce harmful outcomes. Organisations cannot credibly argue that “the AI decided” because organisations choose to deploy systems and

determine the authority granted to them. Human leaders remain responsible for establishing boundaries around artificial decision-making. Future leadership legitimacy may depend partly on the capacity to demonstrate responsible technological governance. Digital leadership without ethical leadership is therefore theoretically incomplete.

Automation and the Changing Meaning of Management

Automation changes management because many traditional supervisory functions are themselves automatable. Scheduling, workflow allocation, performance monitoring, report generation, forecasting, inventory management, compliance checking, and routine communication can increasingly be performed algorithmically. Middle managers historically served partly as information conduits between senior leadership and operational workers. Digital platforms reduce this information-intermediation requirement because senior executives can access real-time organisational data directly. AI further compresses managerial information processing by summarising complex organisational conditions. Some traditional middle-management functions may consequently decline.

However, this does not imply the disappearance of management. Instead, management moves from information transmission towards interpretation, exception handling, coaching, integration, conflict resolution, innovation, and judgement. Managers may supervise larger or more technologically complex spans of activity because automated systems absorb routine coordination. Their teams may simultaneously become more heterogeneous, containing human employees, contractors, remote specialists, and AI agents. The future manager therefore becomes less a controller of routine processes and more an architect of socio-technical systems.

Robotics and Physical Leadership Environments

Robotics extends digital leadership beyond knowledge work. Manufacturing, logistics, healthcare, agriculture, construction, hospitality, mining, security, and transportation increasingly combine human workers with robotic systems. Leaders in such environments must make decisions concerning safety, job redesign, maintenance, worker acceptance, training, productivity, and ethical boundaries. Employees may fear robots not because they dislike technology but because automation changes job security, occupational identity, autonomy, and bargaining power. Successful robotic adoption therefore requires change leadership rather than engineering alone.

Physical human-robot collaboration also raises distinctive leadership questions. A leader must establish when workers can override robotic systems, how responsibility is allocated when accidents occur, and whether productivity targets encourage unsafe interaction. Leadership must therefore operate across technical, psychological, operational, and ethical dimensions simultaneously. Robotics illustrates why digital leadership cannot remain synonymous with social-media competence or remote communication. The construct must encompass leadership of technologically transformed production systems.

Digital Leadership and Organisational Culture

Technology adoption ultimately interacts with culture. Organisations characterised by fear of failure may purchase sophisticated AI systems while employees avoid experimentation. Highly hierarchical organisations may prevent junior technologically skilled employees from challenging senior leaders possessing weaker digital competence. Conversely, organisations celebrating technology uncritically may suppress legitimate concerns about privacy, bias, safety, or workforce consequences. Digital culture therefore requires both experimentation and disciplined scepticism. Leaders must create psychological safety for technological learning without normalising irresponsible deployment.

The relationship is reciprocal because technology itself changes culture. Remote collaboration alters social relationships, digital monitoring changes perceptions of trust, automated performance systems influence employee autonomy, and AI-generated communication may change expectations concerning speed and availability. Digital leaders therefore do not simply “manage culture during transformation”; they must understand how technological architecture produces cultural effects. Leadership and technology jointly constitute organisational experience.

Digital Leadership in Higher Education

Universities provide an important setting because they simultaneously produce future leaders and experience digital disruption themselves. A 2025 systematic review of 50 studies concerning digital leadership in academic environments identified leadership, governance, connectedness, relational capital, organisational culture, and technological understanding as important dimensions of successful transformation. The review also highlighted the importance of national culture, indicating that digital leadership cannot be assumed to operate identically across institutional environments. Higher-education leaders therefore require more than administrative competence. They must understand how AI affects teaching, assessment, research, academic integrity, administration, student services, and future graduate employment.

University leadership provides a revealing test of digital leadership because universities are knowledge institutions confronting technologies capable of generating knowledge-like outputs. Presidents, vice-chancellors, deans, department heads, and academic leaders must determine how AI should be integrated without undermining genuine learning. Prohibiting technology entirely is increasingly unrealistic, while unrestricted substitution of AI for intellectual work undermines education itself. Digital leadership consequently requires establishing an institutional philosophy of human-AI learning. Universities that fail to resolve this problem risk graduating students with credentials but insufficient independent intellectual competence.

Developed Versus Developing Economy Comparison

Digital leadership cannot be universalised without recognising structural differences between countries. Leaders in advanced economies generally operate with stronger broadband infrastructure, greater cloud access, larger technological budgets, more mature cybersecurity systems, and deeper pools of digital talent. Their primary leadership challenge may therefore concern selecting among competing technologies, governing rapid adoption, managing

workforce displacement, and integrating complex AI systems. Leaders in developing economies often confront more fundamental constraints involving infrastructure, affordability, technological skills, vendor dependency, unreliable connectivity, and limited institutional resources. The same leadership recommendation can consequently produce different outcomes under different technological conditions.

Table 2: Comparative Digital Leadership Challenges

Dimension	Advanced economies	Developing economies
Digital infrastructure	Generally strong	Uneven
AI investment capacity	High	More constrained
Digital talent	Greater availability	Scarcity can be substantial
Adoption speed	Rapid	Uneven
Cybersecurity capacity	Relatively mature	Frequently constrained
Workforce displacement concern	High	Growing
Digital exclusion	Present but smaller	Potentially substantial
Vendor dependency	Moderate	Potentially high
Leadership priority	Governance and optimisation	Capability building and inclusion
Strategic danger	Over-automation	Technological exclusion
Key requirement	Responsible AI orchestration	Inclusive digital transformation

Developing-country digital leadership therefore requires particular attention to inclusion. Leaders cannot assume every employee possesses reliable connectivity, modern equipment, AI literacy, or equivalent technological experience. Rapid digitisation can unintentionally deepen organisational inequality between technologically sophisticated workers and those with weaker access or training. Digital transformation without capability development can therefore create a two-tier workforce. Inclusive digital leadership requires bringing employees through technological change rather than merely purchasing technology.

Digital Leadership in the Caribbean and Jamaica

The Caribbean represents an especially important environment for digital leadership because small economies face global technological transformation without possessing the financial and technological scale of major industrial powers. Leaders in government, universities, healthcare, banking, tourism, business-process outsourcing, manufacturing, and other sectors must increasingly make strategic decisions concerning technologies largely developed outside the region. Technological dependency creates leadership risks because organisations can become reliant on vendors whose systems they cannot independently evaluate. Digital leadership in small states therefore requires technological literacy, procurement intelligence, cybersecurity awareness, data governance, and regional cooperation. Leadership education that ignores these capabilities risks preparing executives for organisational environments that are rapidly disappearing.

For Jamaica, digital leadership should become a component of both public- and private-sector leadership development. Government leaders increasingly oversee digital public services, electronic records, data systems, cybersecurity, automated processes, and potentially AI-supported policy analysis. Educational leaders must govern AI-assisted teaching and assessment. Healthcare leaders must evaluate digital health and AI-supported clinical systems. Corporate leaders must determine where automation improves competitiveness without unnecessarily destroying human capability. Digital leadership is consequently not an information-technology issue but a national leadership issue.

The development challenge is important because technological adoption can either reduce or deepen inequality. Large Jamaican organisations may possess resources to adopt advanced systems while small firms fall behind. Urban professionals may acquire AI competence more rapidly than workers with weaker technological access. Public institutions can similarly create exclusion if digital services replace human channels without considering citizens possessing limited digital capability. Digital leadership in developing societies must therefore incorporate digital justice alongside digital transformation. Technological progress should be evaluated partly by who benefits and who becomes excluded.

The Digital Leader of 2035

The leader of 2035 will likely operate within organisations containing significantly more artificial capability than contemporary institutions. AI agents may schedule work, prepare reports, conduct research, monitor projects, communicate with customers, analyse competitors, and execute routine administrative processes. Robots may perform increasing portions of physical work. Digital twins may allow leaders to simulate organisational scenarios before implementation. Predictive systems may continuously forecast risks and opportunities.

Yet increased technological intelligence does not diminish the need for human leadership. It changes where human leadership creates value. When information becomes abundant, interpretation becomes scarce. When routine decisions become automated, exceptional judgement becomes more important. When machines optimise efficiency, humans must determine purpose. When algorithms allocate resources, leaders must determine fairness. When technology increases organisational power, leadership must determine its legitimate boundaries.

The leader of 2035 therefore requires a combination of technological sophistication and deeply human capability. Empathy without technological understanding will be insufficient, but technological intelligence without empathy will also be insufficient. Strategic vision must coexist with data literacy. Decisiveness must coexist with algorithmic scepticism. Innovation must coexist with governance. Efficiency must coexist with dignity.

The Digital Leader of 2040 and Beyond

Beyond 2040, leadership may increasingly concern **orchestration rather than supervision**. Traditional organisations distribute work among departments and individuals. Intelligent organisations may dynamically allocate work among humans, AI agents, robotic systems, contractors, platforms, and external technological services. Organisational boundaries may

become more fluid as autonomous systems coordinate activities across firms. Leaders will consequently need to govern ecosystems rather than merely hierarchical organisations. Authority itself may become increasingly distributed across technological and human nodes.

This development raises a fundamental theoretical question: can artificial intelligence itself exercise leadership? AI can already influence behaviour, provide recommendations, communicate persuasively, allocate tasks, and shape decisions. If leadership is defined solely as social influence towards objectives, sophisticated artificial systems may eventually satisfy portions of the behavioural definition. Yet leadership also contains moral responsibility, legitimacy, meaning, identity, accountability, and social recognition. Whether machines can genuinely “lead” therefore depends partly on how leadership itself is theoretically defined. Future scholarship should not avoid this question merely because it challenges anthropocentric assumptions.

A more plausible near-term model is artificial leadership functionality under human leadership accountability. AI may increasingly perform leadership-like activities without receiving ultimate institutional legitimacy. A system might recommend resource allocation, coach employees, generate feedback, or coordinate projects while human executives remain responsible for objectives and consequences. This arrangement resembles delegated managerial agency rather than autonomous legitimate leadership. Leadership theory will therefore need to distinguish leadership functions from leadership accountability. This distinction may become one of the most important conceptual developments in future leadership scholarship.

Proposed Digital Leadership Propositions

The DAILIF model produces several propositions for empirical testing.

P1: Digital leadership capability will positively predict organisational digital-transformation performance.

P2: Technological intelligence will positively moderate the relationship between transformational leadership and successful AI adoption.

P3: Human-AI orchestration capability will positively predict productivity and organisational adaptability.

P4: Algorithmic judgement will reduce decision errors associated with excessive reliance on AI-generated recommendations.

P5: Digital ethical governance will positively predict employee trust during AI implementation.

P6: Workforce-development capability will moderate the relationship between automation intensity and employee resistance.

P7: Cyber-resilience capability will positively moderate the relationship between digital dependence and organisational resilience.

P8: Digital leadership will positively predict organisational dynamic capabilities.

P9: The relationship between digital leadership and organisational performance will be stronger where technological intensity is high.

P10: Digital inequality will negatively moderate the relationship between digital leadership and organisational transformation within developing economies.

P11: Human-centred digital leadership will produce stronger employee outcomes than technology-centred digital leadership.

P12: Hybrid human-AI decision structures will outperform exclusively human or excessively automated structures when task uncertainty is high and appropriate human oversight is maintained.

These propositions provide opportunities to move digital leadership scholarship beyond descriptive competency lists towards testable theory. Structural equation modelling could evaluate relationships among digital leadership, AI readiness, organisational culture, innovation, trust, employee adaptability, and performance. Multilevel modelling could distinguish leader-, team-, organisational-, and national-level effects. Longitudinal research would be especially valuable because technological adoption and leadership capability develop dynamically. Comparative studies between advanced and developing economies could test whether infrastructure and institutional capacity moderate digital leadership outcomes. Such research would provide stronger empirical foundations for digital leadership theory.

Digital Leadership Measurement

Future scholarship requires validated measurement instruments capable of distinguishing digital leadership from general technological competence. A Digital Leadership Scale should not merely ask whether leaders use technology. It should measure digital vision, technological judgement, human-AI orchestration, algorithmic scrutiny, ethical governance, workforce transformation, cyber-risk awareness, and adaptive capacity. Construct validity would require demonstrating that digital leadership is related to but empirically distinct from transformational, strategic, adaptive, and ethical leadership. Without such measurement development, digital leadership risks becoming an attractive but theoretically imprecise label.

A proposed second-order construct can be represented as:

$$DL = f(DV, TI, HAO, AJ, DEG, WT, CR, CTA)$$

where:

DL = Digital Leadership

DV = Digital Vision

TI = Technological Intelligence

HAO = Human-AI Orchestration

AJ = Algorithmic Judgement

DEG = Digital Ethics and Governance

WT = Workforce Transformation

CR = Cyber-Resilience

CTA = Continuous Technological Adaptation.

Subsequent quantitative research could operationalise each construct through multiple Likert-scale indicators. Exploratory factor analysis could initially assess dimensional structure, followed by confirmatory factor analysis and structural equation modelling. Measurement invariance testing would be important for cross-cultural comparison. Such an approach could eventually establish digital leadership as a measurable theoretical construct rather than a general managerial metaphor.

Implications for Leadership Education

Business schools and leadership-development programmes require substantial curricular reconsideration. Traditional leadership education emphasises communication, motivation, conflict management, strategic planning, organisational behaviour, finance, and decision-making. These remain essential but are no longer sufficient. Leaders require a foundational understanding of AI, data, algorithms, cybersecurity, automation, digital ethics, platform economics, technological strategy, and human-machine systems. Technological topics should therefore not remain isolated within information-systems departments.

MBA, public-administration, educational-leadership, healthcare-management, and executive programmes should incorporate digital leadership as a core rather than optional subject. Students should evaluate AI-supported decisions, analyse automation cases, design human-AI workflows, assess algorithmic risks, respond to cyber incidents, and develop digital-transformation strategies. Leadership simulations could include teams containing artificial agents. Ethical case studies should examine automated recruitment, surveillance, predictive analytics, algorithmic discrimination, and machine-generated misinformation. Future leadership education must prepare leaders for organisational realities rather than preserve disciplinary boundaries inherited from the twentieth century.

Discussion

The central argument emerging from this analysis is that digital leadership can no longer reasonably remain peripheral to mainstream leadership discourse. Technology has moved from the organisational background towards the centre of strategy, communication, knowledge production, operations, workforce management, and decision-making. Leadership theory that conceptualises technology merely as contextual infrastructure increasingly overlooks a central determinant of organisational behaviour. Digital leadership is not simply another leadership style comparable with democratic or autocratic leadership. It represents a cross-cutting leadership capability that modifies how multiple established leadership theories operate under technologically intensive conditions.

Transformational leadership, for example, remains valuable but becomes digitally transformed when leaders mobilise organisations around AI-enabled strategic change. Ethical leadership becomes digital ethical leadership when decisions involve algorithmic bias, privacy, automated surveillance, and AI accountability. Adaptive leadership becomes digitally adaptive leadership

where organisations continuously reconfigure around technological disruption. Strategic leadership becomes AI-enabled strategic leadership when executives integrate machine-generated intelligence into long-term decisions. Servant leadership acquires new relevance when leaders decide whether automation will principally increase shareholder efficiency or improve human work.

This suggests that digital leadership should not necessarily compete with established theories for conceptual dominance. Its greater theoretical contribution may be integrative. Digitalisation changes the environment in which transformational, ethical, adaptive, strategic, and servant leadership occur. Digital leadership therefore supplies technological dimensions largely missing from theories developed before intelligent systems became organisationally pervasive. The emerging theoretical architecture should combine human influence theories with socio-technical understanding. Leadership scholarship must move from explaining leaders and followers towards explaining leaders, followers, technologies, algorithms, institutions, and their interactions.

AI adds further theoretical urgency because artificial systems increasingly participate in processes historically classified as leadership or management. They can monitor, evaluate, communicate, recommend, allocate, predict, and coordinate. This does not mean AI possesses moral legitimacy equivalent to human leaders. It does mean leadership processes can no longer be analysed accurately without considering artificial participation. The leadership unit of analysis must consequently expand beyond individual leaders.

The Way Forward

The priority is theoretical integration. Digital leadership should be incorporated explicitly into mainstream leadership textbooks, research programmes, leadership-development curricula, and organisational competency frameworks. Treating digital leadership as a specialist concern for chief information officers is increasingly anachronistic. Chief executives, university presidents, government ministers, hospital administrators, school principals, military leaders, and nonprofit executives increasingly make technologically consequential decisions. Digital competence must therefore become a component of leadership competence.

The second priority is empirical development. Researchers should construct validated digital leadership scales and test relationships with organisational innovation, employee trust, AI adoption, productivity, workforce adaptability, ethical climate, cybersecurity resilience, and organisational performance. Cross-sectional surveys should be supplemented with longitudinal and experimental research. Comparative studies should investigate whether digital leadership operates differently across sectors and countries. Research should also distinguish technological adoption from successful technological transformation.

The third priority concerns developing economies. Leadership research should investigate digital leadership within Caribbean, African, Latin American, Asian, and small-state environments rather than assuming frameworks derived from large technologically advanced corporations generalise universally. Digital infrastructure, institutional capacity, national culture, economic inequality, workforce education, and technological dependency can fundamentally shape leadership outcomes. Developing-country scholarship can consequently make theoretical rather

than merely contextual contributions to digital leadership. The digital divide is itself a leadership phenomenon when leaders determine who receives technological access and capability.

The fourth priority concerns human-AI leadership research. Scholars should examine when leaders should delegate decisions to AI, when human oversight adds value, how employees respond to AI-generated instructions, whether workers trust algorithmic supervisors, and how responsibility should be allocated within hybrid decision systems. Research should investigate whether AI coaching changes employee development and whether machine-generated communication affects perceptions of leader authenticity. The psychology of being “managed by an algorithm” deserves particular attention. These questions will become increasingly central as autonomous agents enter workplaces.

Conclusion

Leadership theory stands at an important intellectual transition. The dominant leadership theories of the twentieth and early twenty-first centuries generated valuable understanding of influence, motivation, relationships, ethics, change, strategy, and organisational behaviour. These insights remain indispensable. However, the organisations to which they are now applied are becoming technologically different from those within which the theories were originally constructed. Artificial intelligence, GenAI, automation, robotics, digital platforms, algorithmic management, and autonomous systems increasingly influence organisational cognition and action. Leadership scholarship must consequently evolve alongside the organisations it seeks to explain.

Digital leadership provides an important foundation for this evolution but requires theoretical expansion. Earlier e-leadership scholarship insightfully recognised reciprocal interaction between advanced information technology and leadership (Avolio et al., 2000). Contemporary digital leadership research has subsequently identified strategic thinking, digital insight, innovation, collaboration, empowerment, and adaptation as important capabilities. The next theoretical stage must explicitly incorporate artificial intelligence, automation, robotics, algorithmic judgement, cyber-resilience, and human-machine orchestration. Digital leadership should therefore evolve from a literature concerned primarily with leading through digital technology towards a literature explaining leadership within intelligent socio-technical systems.

The Digital-Artificial Intelligence Leadership Integration Framework developed in this study proposes eight dimensions for that transition: digital vision, technological intelligence, human-AI orchestration, algorithmic judgement, digital ethics and governance, workforce transformation, cyber-resilience, and continuous technological adaptation. These dimensions extend rather than discard established leadership theories. Transformational leadership supplies vision and mobilisation; ethical leadership supplies moral responsibility; servant leadership foregrounds human welfare; adaptive leadership contributes continuous learning; strategic leadership contributes organisational direction; and digital leadership integrates these capabilities with technological intelligence. The resulting leader is simultaneously human-centred and technologically sophisticated.

Automation will further change leadership by transferring portions of routine supervision, monitoring, scheduling, analysis, reporting, and coordination towards intelligent systems. Human

leadership should consequently migrate towards higher-order judgement, purpose, relationships, ethics, innovation, exception management, and system orchestration. The leader's future competitive advantage will not consist of processing more information than AI because machines increasingly dominate information-processing scale. Human advantage will instead derive from determining which questions matter, which values should govern decisions, which recommendations deserve trust, which consequences are acceptable, and who must remain accountable. AI may increasingly optimise means, while legitimate leadership must continue determining ends.

The transformation has particular significance for developing economies. Digital leadership cannot simply involve importing technologies created elsewhere. Leaders must determine whether technologies correspond with national priorities, institutional capacity, workforce realities, cultural conditions, data protections, and social-development objectives. Jamaica and the wider Caribbean therefore require digital leadership capabilities across government, education, healthcare, business, finance, tourism, public administration, and civil society. Failure to develop such leadership can create technological dependency even where technology adoption itself increases. The capacity to govern digital transformation may consequently become as important as the capacity to finance it.

Beyond 2035, leadership may increasingly become the orchestration of hybrid systems containing humans, AI agents, robots, automated workflows, platforms, and external digital ecosystems. Such organisations will require theories that move beyond the traditional leader-follower dyad. The critical question will increasingly become not merely “How does one person influence another?” but “How should human and artificial capabilities be configured, governed and mobilised towards legitimate collective purposes?” That question represents a substantial new frontier for leadership scholarship. Digital leadership should therefore be positioned not at the margins of leadership discourse but near its theoretical centre.

The future of leadership is consequently neither exclusively digital nor exclusively human. It is human, digital, artificial, relational, ethical, adaptive and increasingly hybrid. Leadership scholarship that recognises this transformation can remain intellectually relevant to the organisations of 2035, 2040 and beyond. Leadership scholarship that does not risks developing increasingly sophisticated explanations of an organisational world that no longer exists.

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