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Strategic Technology Adaptation Framework: AI, IoT, and the Shift in Strategic Paradigms

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Abstrak

Evolusi cepat teknologi strategis seperti Kecerdasan Buatan (AI) dan Internet of Things (IoT) telah memicu pergeseran paradigma dalam cara organisasi merumuskan, menerapkan, dan mengadaptasi strategi mereka. Namun, literatur saat ini masih terfragmentasi dalam mengintegrasikan teknologi ini dengan kerangka kapabilitas dinamis. Studi ini mengusulkan Kerangka Adaptasi Teknologi Strategis (STAF) untuk secara konseptual menjembatani adopsi AI/IoT dengan kemampuan penginderaan, perebutan, dan transformasi organisasi. Dengan menggunakan Tinjauan Literatur Sistematis (SLR) dari 30 artikel terpilih yang diterbitkan antara tahun 2012–2024, penelitian ini memetakan hubungan antara teknologi tertentu dan kapabilitas organisasi di seluruh sektor. Studi ini mengungkapkan bahwa AI terutama mendukung kemampuan perebutan dan transformasi melalui otomatisasi dan analisis prediktif, sementara IoT meningkatkan penginderaan melalui integrasi data waktu nyata. Model STAF yang diusulkan berkontribusi pada teori kapabilitas dinamis dengan mengintegrasikan pandangan ke depan teknologi dan penyelarasan strategis. Ini juga memberikan panduan praktis bagi organisasi yang berusaha membangun respons adaptif dan ketangkasan strategis dalam lingkungan yang mengganggu. Studi ini diakhiri dengan mengusulkan validasi empiris masa depan STAF melalui studi kasus dan pendekatan metode campuran.

Kata Kunci: Teknologi Strategis; Kecerdasan Buatan; Internet of Things; Kemampuan Dinamis; Pemetaan Kemampuan; Adaptasi Teknologi; Kelincahan Strategis; Strategi Organisasi.

Abstract

The rapid evolution of strategic technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) has triggered a paradigm shift in how organizations formulate, implement, and adapt their strategies. However, the current literature on integrating these technologies with the dynamic capabilities framework remains fragmented. This study proposes the Strategic Technology Adaptation Framework (STAF) to conceptually bridge AI/IoT adoption with organizational sensing, seizing, and transforming capabilities. Employing a Systematic Literature Review (SLR) of 30 selected articles published between 2012 and 2024, this research maps the relationships between specific technologies and organizational capabilities across sectors. The study reveals that AI predominantly supports seizing and transforming capabilities through automation and predictive analytics, while IoT enhances sensing through real-time data integration. The proposed STAF model contributes to the dynamic capabilities theory by integrating technological foresight and strategic alignment. It also provides practical guidance for organizations seeking to build adaptive responses and strategic agility in disruptive environments. This study concludes by proposing future empirical validation of STAF through case studies and mixed-method approaches.

Keyword: Strategic Technology; Artificial Intelligence; Internet of Things; Dynamic Capabilities; Capability Mapping; Technology Adaptation; Strategic Agility; Organizational Strategy.

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1. Introduction

The advancement of digital technology in the last two decades has had a transformative impact on business strategies and organizational management systems. Innovations such as digitalization, automation, big data, artificial intelligence (AI), the Internet of Things (IoT), and cloud computing have significantly revolutionized the way companies operate and create competitive advantages in an increasingly complex and dynamic environment (Porter & Heppelmann, 2014), (Brynjolfsson & McAfee, 2017). These changes are operational and touch on structural and strategic aspects, thus requiring a comprehensive adjustment in the strategic management framework. In modern management, organizations are required to respond to external dynamics and proactively build internal capabilities that are adaptive to technological developments. One approach that has received widespread attention is mapping capabilities, a systematic process for identifying, evaluating, and aligning organizational resources with the needs of a rapidly changing business environment (Teece *et al*., 1997). With the right capability mapping, companies can utilize technology and knowledge in an integrated manner to create unique strategic value that competitors do not easily imitate. Intelligent technologies such as AI and IoT are key elements in business strategies. AI improves operational efficiency, accelerates data-driven decision-making processes, and enables real-time service personalization (Chui *et al*., 2016). Meanwhile, IoT enables digital integration of operational and logistics systems, increasing connectivity and transparency in business processes (Atzori *et al*., 2010). Integrating these technologies, when carried out through a targeted capability mapping process, can strengthen organizational agility and encourage continuous innovation. In the digital era characterized by high uncertainty and dynamics, organizational strategies must be more adaptive, especially in responding to changes triggered by information technology transformation. IT strategy transformation can no longer rely on traditional static approaches, but must undergo a redefinition that allows for faster and more responsive understanding and adaptation to changes in the digital environment (Teubner & Stockhinger, 2020). The development of digital technologies such as AI, IoT, and data-based platforms presents new opportunities in value creation and efficiency, but on the other hand, also raises complex challenges that require the reinvention of technological concepts within the framework of business strategy (Faraj & Leonardi, 2022).

Along with this condition, there is a fundamental shift in strategic management practices, where the focus shifts from rigid long-term planning to an orientation towards continuous innovation, flexibility, and organizational agility in response to rapid market changes (Choori & Kazemi, 2023). Integrating digital technology developments such as AI, IoT, and data-driven platforms marks the need for a new, more dynamic strategic approach to managing digital uncertainty sustainably. However, many organizations still face challenges bridging the gap between technological potential and the business strategy implemented. Technology investment is often not accompanied by mature capability mapping, so its implementation is not optimal or even aligned with the company's long-term goals (Westerman *et al*., 2014). Therefore, a more systematic and strategic approach to integrating technology into the managerial process is becoming increasingly important. Based on this background, this article proposes developing a conceptual framework called the Strategic Technology Adaptation Framework (STAF), which maps the relationship between strategic technology utilization and the formation of organizational capabilities to achieve long-term strategic results. Although studies in strategic management have shown significant progress in accommodating the influence of technology on organizational strategy formulation, there are still important gaps in the literature that have not been comprehensively explored. Several previous studies have highlighted the role of dynamic capabilities in responding to the dynamics of the business environment (Teece, 2007). However, many of these approaches are still partial and have not fully included the role of digital technology as a key strategic component in the strategy formulation process. In the era of rapid digital transformation, the urgency to design a managerial model that can systematically connect the use of technology and business strategy is increasing. Unfortunately, many existing studies still separate the dimensions of technology and strategy or only discuss technology adoption from a technical perspective, without thoroughly examining the integration of these technologies in developing organizational capabilities (Zahra *et al*., 2006).

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The existence of intelligent technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) has implications that go far beyond operational functions. These technologies have become transformative forces that fundamentally change organizations business structure and add value. The void in a conceptual framework combining internal capability mapping and intelligent technology in building adaptive strategies shows that there is still room for more integrative academic contributions. In addition, empirical research that specifically examines how organizations map their technological capabilities to build sustainable competitiveness is still very limited, especially in the context of developing countries. The lack of an applicable framework that explains the concept theoretically and provides implementation guidance is a challenge in developing technology-based strategies. Based on this gap, this article intends to contribute through an integrative approach that combines mapping capabilities with technology-based adaptive strategies. It is hoped that this approach can enrich the theoretical discourse in the digital strategic management literature while providing practical guidance for organizations in responding to the challenges of ever-evolving technological disruption.

2. Research Methods

This study used a Systematic Literature Review (SLR) as the main technique to find, assess, and synthesize literature relevant to strategic technology integration, especially AI and IoT, in organizational adaptation development. The SLR method was chosen because of its ability to produce comprehensive and evidence-based findings through a transparent, repeatable, and scientifically accountable process (Snyder, 2019). The study aimed to explore the relationship between disruptive technology and dynamic capabilities theory and to identify key themes that formed the basis for developing the Strategic Technology Adaptation Framework (STAF). The literature search strategy was conducted systematically by accessing three major scientific databases: Scopus, Web of Science, and IEEE Xplore, which included reputable journals in management, information technology, and strategic systems. The keywords used included combinations such as “AI and strategy,” “IoT and dynamic capabilities,” and “technology adaptation,” with a publication year limitation between 2012 and 2024 to capture the development of literature in the last decade. The selection procedure followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which included the stages of identification (235 articles), screening (removal of duplicates and irrelevant articles), eligibility (full evaluation of topic suitability), and inclusion (30 primary articles). The selected articles were analyzed using a thematic coding approach and framework-based synthesis based on the dynamic capabilities framework (Teece, 2007), and the results were developed into capability mapping and integrated into STAF.

3. Results and Discussion

3.1 Results

Digital transformation has become a key element in formulating modern organizational strategies. Technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) are no longer treated as operational aids but as key drivers of business model change and the formation of competitive advantages. In this context, organizations must adopt technology technically and align it with their strategic direction and internal structure. The literature shows that AI is widely used to improve decision-making processes, analyze consumer behavior, and automate strategic functions such as risk management, demand forecasting, and product design (Shah *et al*., 2023; Perifanis & Kitsios, 2023). In manufacturing, AI is used in predictive maintenance and data-driven production optimization. Meanwhile, IoT has revolutionized supply chain management, logistics, and real-time monitoring by integrating smart devices. AI plays a role in image-based diagnosis and personalized treatment in the healthcare sector, while IoT is used for real-time patient monitoring. In logistics, the combination of AI and IoT drives the

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creation of a smart supply chain that can respond adaptively to disruptions. The education sector uses AI for personalized learning, while the energy sector adopts IoT for consumption optimization and system failure prediction. In the education sector, AI has been used to design adaptive curricula and recommendation-based learning, strengthening organizational capabilities in sensing and personalizing services (Jiménez, 2024). In the e-commerce sector, AI provides real-time product recommendations, allowing organizations to dynamically understand customer behavior and increase the speed of decision-making (Aulia *et al*., 2024). Banking services integrate AI to automate customer interactions through chatbots and fraud detection, which directly strengthens the transforming dimension and efficiency of service processes (Narayan *et al*., 2025). These trends show that AI and IoT are not only disruptive technologies, but also strategic elements in developing sensing and transforming capabilities. In other words, digital technology serves as a key lever in shaping adaptive capabilities that form the foundation of long-term competitive advantage.

Based on the results of literature synthesis, strategic technologies such as AI and IoT play a role in shaping organizational capabilities through three main stages in the dynamic capabilities framework: sensing, seizing, and transforming (Teece, 2007). AI generally contributes to seizing and transforming through predictive analysis and automated decision-making, while IoT is more dominant in enhancing sensing through real-time data integration and monitoring of the operational environment. Literature findings show that the relationship between technology and organizational capability dimensions is highly dependent on the sectoral context. In the energy sector, IoT is used to form a digital twin, which directly strengthens the transformation capability because it allows for real-time simulation and optimization of production processes (Yu *et al*., 2022). In the logistics sector, IoT-based sensors are utilized to track inventory in real-time, strengthening sensing capabilities in supply chain management (Ding *et al*., 2021). In agriculture, IoT is used to monitor weather and land conditions to support prediction-based decisions, reflecting sensing capabilities (Muthmainnah *et al*., 2024). Meanwhile, AI has been used in automated medical diagnostic systems, demonstrating how technology drives sensing in fast and accurate clinical decision-making processes (Rathi *et al*., 2021).

Figure 1. Technology and Organizational Capabilities Mapping Diagram

In the manufacturing sector, AI is used for process adaptation and optimization (transforming), while IoT drives the ability to sense machine conditions and supply chains. In the logistics sector, IoT supports sensor-based tracking (sensing), and AI is used for route optimization (seizing). Meanwhile, in the healthcare sector, AI is used for clinical diagnosis and recommendations (seizing-transforming), and IoT for patient monitoring (sensing). Figure 1 shows a conceptual mapping between technology and the organization's strategic capabilities, which is the basis for the development of STAF. This mapping provides a visual understanding of how organizations can build adaptive capability-based strategies through the use of AI and IoT.

3.2 Discussion

Analysis of 30 systematically reviewed articles shows that organizations in different sectors face different strategic demands in responding to technological disruption. Initial findings from the literature synthesis identified that the most frequently discussed organizational capability in the context of technology adoption is Transforming, followed by Sensing and Seizing. These findings reinforce the relevance of Dynamic Capabilities theory (Teece, 2007) in the context of disruptive technologies such as AI and IoT. A mapping of the relationship between technologies (AI, IoT, and Blockchain) and organizational capabilities was conducted to deepen the understanding of how specific technologies contribute to the development of certain capabilities. The visualization results in the form of a heatmap show that AI has a strong relationship with Sensing and Transforming capabilities, reflecting its role in data

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analysis and process automation. Meanwhile, IoT is widely associated with Sensing and Transforming, in accordance with its capabilities in real-time condition detection and operational automation. Blockchain, although less frequently mentioned, shows a strong relationship with Seizing and Transforming, indicating its role in process efficiency and trust-based decision making. Next, a cross-sector analysis was conducted to identify the relationship between industry domains and organizational capabilities. The distribution map shows that sectors such as manufacturing, education, and urban planning stand out in implementing transforming capabilities. Retail, agriculture, logistics, and e-commerce sectors focus more on sensing capabilities, especially through IoT and data-based monitoring systems. On the other hand, the global logistics, smart supply chain, and transportation sectors show a strong relationship with Seizing, which is related to real-time technology-based strategic decision making and automation.

Based on the synthesis of capability distribution, technology mapping, and sectoral context, a conceptual framework of the Capability Mapping Framework is developed that summarizes the contribution of each technology in shaping adaptive organizational capabilities and underlies the development of the main model of the Strategic Technology Adaptation Framework (STAF). This visualization emphasizes that AI tends to drive Transformation capabilities, IoT is dominant in sensing, and blockchain supports sizing and transforming. This framework is the foundation for understanding the technology-strategy relationship in organizational adaptation to digital disruption. Although various technologies such as AI, IoT, Big Data, and Blockchain contribute significantly to forming organizational capabilities, their strategic implementation is not free from obstacles. However, this process faces cultural resistance, concerns about data privacy, technical integration, and regulatory limitations. Rapid and dynamic technological changes have required organizations to develop a more adaptive and capability-based strategic approach. Based on the synthesis of capability mapping and mapping technology contributions to the organization's strategic capabilities, a conceptual framework called the Strategic Technology Adaptation Framework (STAF) was developed. This framework explains how organizations can respond to external technology-based pressures by activating relevant internal strategic processes. The STAF framework consists of three main blocks: Drivers of Change, Adaptive Strategy Process, and Strategic Outcomes. Drivers of Change, This block includes external and internal sources of change that trigger the organization's need to transform. Technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, Blockchain, Cloud Computing, and organizational management systems such as Leadership and HRM Systems act as enablers and disruptors. This change is multi-level, covering technology, processes, and organizational culture.

The core of the Strategic Technology Adaptation Framework (STAF) is a series of processes representing the organization's strategic adaptation cycle, consisting of four main stages. First, Strategic Sensing, which is the process of identifying technology-based opportunities and threats relevant to the external environment and the organization's internal needs, requires the ability to scan information, analyze trends, and process strategic data in real time. Second is leadership alignment, which is the stage of aligning the organization's leadership vision, strategic direction, and goals with the needs of technology adaptation. Leadership plays a role as the main driver of organizational change. Third, capability mapping is mapping existing organizational capabilities or those that need to be developed to respond to change, including assessing resources, structures, and digital processes relevant to the transformation. Fourth, Execution and Realignment is the stage of implementing strategic initiatives that have been set and continuous evaluation to ensure the right direction of adaptation, with an iterative and dynamic approach. The STAF process's result is targeted to produce strategic capabilities that support long-term organizational performance. These outcomes include increased organizational agility, innovation in products and processes (innovation), improved customer experience, operational excellence, leadership effectiveness, and digital workforce transformation, collectively strengthening the organization's competitiveness and resilience to disruptive environmental changes.

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4. Conclusion

This study has developed and proposed the Strategic Technology Adaptation Framework (STAF) as a conceptual framework that integrates strategic technologies, especially Artificial Intelligence (AI) and the Internet of Things (IoT), with the development of organizational adaptive capabilities. Through a Systematic Literature Review approach to 30 primary articles, this study successfully identified how AI and IoT support three main dimensions in the dynamic capabilities theory: sensing, seizing, and transforming. The visual mapping compiled in STAF shows that the success of technology adoption cannot be separated from the readiness of the organization in building internal capabilities that are relevant to the sectoral context and the rapidly changing business environment. The STAF model is conceptually validated through a synthesis of cross-sector literature, including manufacturing, healthcare, logistics, and retail. The analysis results show consistency between the role of technology and capability formation, strengthening this framework's relevance in a strategic context. Thus, STAF provides a theoretical contribution in expanding the dynamic capabilities model and adding an implementative dimension to the study of technology and strategy.

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