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The Development and Practice of Management of Technology in China under the Context of Digital Economy

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Abstract

Purpose – This paper examines the evolution, current practices, and future directions of Management of Technology (MOT) in China within the digital economy, highlighting the impact of digital transformation on innovation, organizational design, and strategic decision-making.
Design/Methodology/Approach – Using literature review, policy analysis, and case studies of leading enterprises, the study investigates how emerging digital technologies reshape MOT models and operational frameworks.
Findings – China's MOT has shifted from manufacturing-focused approaches to innovation-driven, data-enabled, and ecosystem-oriented models. Significant opportunities arise from artificial intelligence, big data, blockchain, and the industrial internet. However, major challenges persist, including shortages of interdisciplinary talent, complex data governance, and geopolitical technology decoupling.
Research Implications – Effective MOT in the digital era requires integrated strategies that align technological capabilities with managerial innovation and societal needs. The findings offer practical guidance for policymakers, enterprises, and academic institutions on strengthening MOT capacity through coordinated policy support, talent development, and cross-industry collaboration to sustain global competitiveness.

Keywords: Management of Technology, Digital Economy, China, Innovation Management, Industry 4.0
JEL Classifications: O3,O5,L8,P3

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I. Introduction

The 21st century has been marked by the emergence of a global digital economy, characterized by the integration of advanced digital technologies—such as artificial intelligence (AI), big data analytics, blockchain, cloud computing, and the Internet of Things (IoT)—into nearly all sectors of production and services. These technologies are not merely auxiliary tools; they are redefining the logic of competition, the structure of industries, and the way organizations generate value.

In China, the digital economy has grown into a critical driver of national economic development. According to the China Academy of Information and Communications Technology (CAICT, 2024), the digital economy contributed over 40% of China's GDP in 2023, a proportion that is expected to rise steadily in the coming decade. This transformation has not only accelerated industrial upgrading but also reshaped the strategic priorities of both private enterprises and public institutions.

The Management of Technology (MOT)—broadly defined as the discipline and practice of managing technological resources and capabilities to achieve competitive advantage—has consequently undergone a profound evolution. Traditionally focused on R&D management, manufacturing optimization, and technology assimilation, MOT in the digital era encompasses new dimensions such as data-driven innovation, platform governance, digital ecosystem coordination, and cybersecurity management.

The purpose of this paper is threefold:

Historical Analysis – To examine how MOT in China has evolved over the past four decades, especially in response to globalization, industrial policy, and technological change.

Current Practices – To explore how Chinese enterprises manage technology under the influence of digital economy forces.

Future Prospects – To assess challenges, opportunities, and strategic directions for MOT in the next phase of China's economic transformation

II. Theoretical Framework and Literature Review

2.1 Conceptualizing Management of Technology

The concept of Management of Technology (MOT) has undergone substantial theoretical and practical evolution since it first emerged as a formalized discipline in the late 20th century. While technology management practices existed in various forms prior to the 1980s, the term "MOT" was explicitly institutionalized following the publication of the National Research Council's seminal definition in 1987, which framed MOT as "the integration of engineering, science, and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational objectives of an organization" (National Research Council, 1987, p. 3). This definition emphasized technology primarily as a tangible and codifiable resource—machinery, physical infrastructure, patents, and manufacturing processes—reflecting the industrial manufacturing emphasis of that era.

However, by the early 1990s, scholars began to recognize that technological capability extends beyond physical artifacts to encompass organizational routines, human expertise, and knowledge flows. Gregory (1995) advanced a process-oriented conceptualization, framing MOT as an iterative and cyclical process comprising five interdependent stages:

Technology Identification – recognizing emerging technologies with potential strategic value.

Technology Acquisition – obtaining technological assets through internal R&D, licensing, partnerships, or acquisitions.

Technology Development – adapting, improving, and tailoring technologies to fit organizational needs.

Technology Exploitation – deploying and commercializing technologies to create value.

Technology Protection – safeguarding intellectual property and competitive advantage through legal, technical, and strategic measures.

In the pre-digital era, these stages followed relatively predictable timelines, often spanning years or even decades, and were primarily driven by corporate R&D labs and hierarchical decision-making structures. The role of managers was to ensure alignment between technology strategy and corporate goals, while minimizing risks associated with large-scale investments.

The rise of the digital economy, however, has fundamentally altered the conceptual foundation of MOT. Technology is now increasingly seen as an intangible, knowledge-intensive capability embedded in networks of data, algorithms, and human expertise (Teece, 2018). Digitalization has blurred the boundaries between technology development and business operations, as new capabilities—such as real-time data analytics, cloud computing, and artificial intelligence—continuously reshape the way organizations innovate and compete. MOT, therefore, is no longer a static function but a dynamic orchestration process in which technology, business models, and market ecosystems evolve simultaneously.

Modern conceptualizations also emphasize ecosystem thinking. Adner (2017) highlights that in interconnected environments, technological success depends on the alignment of multiple actors—suppliers, complementors, regulators, and end-users—making MOT a systemic coordination challenge. Similarly, Ghezzi and Cavallo (2020) argue that digital transformation requires MOT to be deeply integrated into strategic agility frameworks, enabling firms to reconfigure technological capabilities in response to fast-changing environments.

2.2 Digital Economy's Impact on MOT

The digital economy—defined by the OECD (2020) as "economic activity that relies on digital inputs, including digital technologies, digital infrastructure, services, and data"—has introduced structural changes that directly reshape MOT practices. These changes can be grouped into three interrelated domains:

(1) Acceleration of Innovation Cycles

Traditionally, the innovation cycle followed a linear "stage-gate" model, progressing from idea generation to prototyping, testing, and market launch over extended periods. In the digital economy, however, innovation has become continuous and iterative.

Data-Driven Experimentation: Organizations can now test and refine products in real-time using A/B testing, predictive analytics, and customer feedback loops (Yoo et al., 2010).

Rapid Prototyping: Technologies like 3D printing and low-code development platforms reduce the time and cost of iteration, enabling “fail-fast, learn-fast” approaches.

Shortened Time-to-Market: Digital tools allow companies to compress R&D timelines, as illustrated by the pharmaceutical industry’s use of AI to accelerate drug discovery during the COVID-19 pandemic (Zhavoronkov, 2020).

The implication for MOT is that managers must adopt agile governance structures capable of making quick investment and resource allocation decisions, while maintaining long-term strategic coherence.

(2) Platform-Based Collaboration

Digital platforms—such as Amazon Web Services, Alibaba Cloud, and Microsoft Azure—have transformed the economics of technology access and collaboration. Cusumano et al. (2019) identify two key mechanisms through which platforms reshape MOT:

Lowering Entry Barriers: Small and medium-sized enterprises (SMEs) can leverage shared infrastructure for computing, AI, and big data without massive capital expenditures.

Enabling Open Innovation: Platforms serve as neutral spaces for multi-party co-creation, where knowledge and technology are shared across organizational boundaries.

In the Chinese context, Alibaba’s Taobao and Ant Group ecosystems exemplify how platform-based MOT extends beyond infrastructure provision to actively curate innovation ecosystems, connecting merchants, developers, logistics providers, and financial services.

(3) Data as a Strategic Asset

The shift to data-centric business models has elevated data governance to a core MOT function. Data is now widely recognized as a factor of production on par with capital and labor (Brynjolfsson & McAfee, 2014). The implications for MOT include:

Data-Driven Decision-Making: Integrating data analytics into all stages of technology management—from identification to protection—enables evidence-based strategy formulation.

New Valuation Frameworks: Organizations must develop capabilities to assess the economic value of data assets, incorporating considerations of quality, timeliness, and exclusivity.

Ethics and Regulation: Data usage is increasingly subject to stringent regulations, such as China’s Personal Information Protection Law (2021) and the EU’s GDPR, requiring MOT managers to incorporate compliance into technology strategies.

2.3 China’s Digital Transformation Context

China’s digital transformation has unfolded within a state-guided market economy, where government policy plays a pivotal role in shaping MOT trajectories. Since the mid-2010s, three national strategies have set the direction:

Internet Plus (2015): Integrating internet technologies with traditional industries to enhance productivity, foster innovation, and create new business models.

Made in China 2025 (2015): Upgrading manufacturing capabilities through advanced technologies such as robotics, AI, and the industrial internet.

Digital China (2017): Building nationwide digital infrastructure, promoting e-governance, and accelerating the integration of digital technologies into all sectors.

Scholars such as Liu and Liang (2018) note that these strategies mark a decisive shift from a reliance on technology importation and assimilation—dominant in the 1980s and 1990s—to indigenous innovation and global technology leadership. The transformation is evident in several areas:

Innovation Ecosystems: The rise of hubs such as Shenzhen, Zhongguancun, and Hangzhou has created fertile environments for start-ups, research institutions, and multinational corporations to collaborate.

Digital-First Enterprises: Companies like Alibaba, Tencent, and ByteDance have leveraged data analytics, AI, and platform models to compete on a global scale, influencing not only consumer markets but also MOT best practices.

Industry Upgrading: Manufacturing giants, including Haier and SANY, have deployed IoT-enabled platforms to transition from product-centric to service-oriented business models.

Policy-Driven Open Innovation: Government programs, such as the National Artificial Intelligence Development Plan (2017), provide funding, regulatory support, and talent development to align MOT with strategic national priorities.

Despite these advances, challenges remain. The digital divide between coastal and inland regions persists, limiting the diffusion of advanced MOT practices. Moreover, regulatory tightening on data security and platform governance since 2021 has introduced new compliance complexities for technology managers.

In summary, China's MOT in the digital era operates within a complex interplay of market dynamics, policy directives, and global competitive pressures. The ability to align technological capability development with national strategies, while remaining agile and responsive to digital disruption, will be a defining factor in China's pursuit of technological leadership in the coming decades.

III. The Development and Practice of Technology Management in China in the Context of the Digital Economy

3.1 Early Stage (1980s–1990s): Technology Introduction

The inception of China's Management of Technology (MOT) framework during the early stages of the Reform and Opening policy (initiated in 1978) was fundamentally shaped by the country's urgent need to modernize its industrial base. At this time, China was transitioning from a centrally planned economy to one that embraced market mechanisms, yet its technological infrastructure lagged far behind advanced economies such as Japan, the United States, and major European nations. Consequently, the primary strategy for MOT in the 1980s and 1990s centered on technology introduction through transfer and assimilation.

Technology transfer during this stage took several forms:

Importation of Machinery and Production Lines: Chinese enterprises imported turnkey manufacturing systems, particularly in high-value sectors such as automotive manufacturing, consumer electronics, and petrochemicals. These imports were often facilitated through government-to-government agreements or through foreign direct investment. For example, Shanghai Automotive Industry Corporation's partnership with Volkswagen in 1984 marked a pivotal moment in the automotive sector.

Joint Ventures with Foreign Firms: To accelerate learning, the Chinese government encouraged joint venture (JV) formations with established multinational corporations. Through JVs, domestic firms gained access not only to advanced machinery but also to managerial expertise, quality control systems, and after-sales service models.

Foundation for Technical Standardization: China began adopting international industrial standards, especially in electronics, telecommunications, and machine tools, to ensure compatibility and to prepare domestic firms for future participation in global supply chains.

Despite these efforts, the innovation process in this era was largely passive. Imported technologies were adapted to fit local production environments rather than being fundamentally improved or reengineered. This adaptation often involved minor modifications in equipment settings or localized sourcing of non-critical components. While such assimilation shortened the learning curve for domestic industries, it also entrenched a dependency on foreign technology providers. MOT functions during this period were primarily administrative—focused on project coordination, technical training, and quality assurance—rather than strategic innovation management. As a result, the capacity for indigenous research and development (R&D) remained weak.

3.2 Growth Stage (2000s): Capability Building

China's accession to the World Trade Organization (WTO) in 2001 marked the beginning of a transformative phase for MOT. The integration into global trade networks not only opened vast export markets but also subjected domestic enterprises to heightened competition from foreign firms. In response, MOT practices began to emphasize capability building over mere technology assimilation.

Key developments in this stage included:

National Science and Technology Programs: Government-led initiatives such as the "863 Program" (National High-Tech R&D Program, launched in 1986) and the "973 Program" (National Basic Research Program, launched in 1997) reached maturity in the 2000s. These programs focused on strategically critical technologies in aerospace, advanced materials, information technology, and biotechnology. MOT in this era required project managers and policymakers to coordinate multi-year, multi-institutional research efforts, with clear performance benchmarks.

Innovation Demonstration Zones: The creation of National Innovation Demonstration Zones, such as Zhongguancun Science Park in Beijing, promoted triple-helix collaboration between enterprises, universities, and government agencies. This collaboration model required a more complex form of MOT—balancing intellectual property rights, joint funding arrangements, and cross-sectoral knowledge sharing.

Rise of Domestic R&D Leaders: Firms like Huawei, ZTE, and Lenovo emerged as R&D-intensive corporations, investing significant portions of their revenue into proprietary technology development. MOT expanded to encompass intellectual property (IP) portfolio management, technology commercialization strategies, and process innovation frameworks.

Quality Management and Process Upgrades: In line with global standards such as ISO 9001, many Chinese firms adopted systematic quality management processes. This required MOT professionals to integrate technology management with operational excellence methodologies such as Six Sigma and Lean Production.

During this decade, MOT evolved from a primarily operational task into a strategic capability for competitive differentiation. Domestic firms began to selectively import technology not for direct replication, but as a foundation for iterative innovation. Intellectual property rights became a focal point, prompting both legal reforms and corporate strategy shifts toward patent creation and protection.

3.3 Digital Transformation Stage (2015–Present)

From 2015 onwards, the widespread integration of artificial intelligence (AI), cloud computing, blockchain, big data analytics, and the industrial internet has redefined the boundaries of MOT in China. This period coincides with the implementation of national initiatives such as “Made in China 2025” and the 14th Five-Year Plan’s Digital Economy Development Strategy, which explicitly position technology management as a core driver of sustainable economic growth.

Key characteristics of this stage include:

Rise of Digital-Native Enterprises: Companies like Alibaba, Tencent, and ByteDance have pioneered platform-based MOT models, where technological innovation is intertwined with ecosystem governance. These enterprises leverage AI-driven recommendation engines, scalable cloud architectures, and integrated payment solutions to build digital marketplaces with global reach. MOT in such contexts involves managing not just internal R&D, but also partner integration, developer ecosystems, and platform rule enforcement.

Smart Manufacturing Integration: Manufacturing leaders such as Haier have transitioned to IoT-enabled, user-driven production models. Haier’s COSMOPlat platform exemplifies the fusion of cloud-based design, user co-creation, and mass customization, where consumers can influence product configurations in real time. MOT in this paradigm must coordinate hardware, software, and service innovation simultaneously.

Government-Led Open Innovation Ecosystems: The Chinese government has established “national new-generation AI innovation platforms” in collaboration with industry leaders (e.g., Baidu for autonomous driving, iFlytek for voice recognition). These initiatives foster collaboration between research institutions, startups, and established corporations, requiring MOT to manage multi-stakeholder governance structures and ensure alignment with policy objectives.

Data as a Strategic Asset: Data governance, cybersecurity compliance, and ethical AI deployment have emerged as central MOT challenges. Enterprises are increasingly required to implement frameworks for secure data sharing, cross-border data flow management, and algorithmic transparency.

Overall, the digital transformation stage represents the shift of MOT from a discipline focused on technology deployment to one emphasizing innovation orchestration in complex, data-intensive environments. The speed of technological cycles has accelerated dramatically, requiring MOT frameworks to incorporate agile project management, rapid prototyping, and continuous ecosystem adaptation.

3.4 Digital Innovation Management

In the digital era, innovation management has undergone a fundamental transformation. Traditionally, innovation followed a linear R&D process, often referred to as the "technology push" model, where scientific research generated technological outputs that were subsequently commercialized. However, as digital technologies became ubiquitous, innovation processes have shifted toward data-driven, user-centered, and ecosystem-oriented approaches (Chesbrough, 2003; Yoo et al., 2010).

The data-driven paradigm in innovation management relies heavily on the continuous collection, analysis, and application of large-scale datasets. This approach enables firms to detect subtle shifts in consumer behavior, anticipate market demand, and accelerate iterative product development cycles. Data analytics tools—combined with AI algorithms—allow companies to run rapid A/B testing, optimize product features, and forecast user needs with high precision (Brynjolfsson & McAfee, 2014).

A prominent example of this paradigm is Huawei's "1+8+N" ecosystem strategy. In this model, the "1" represents the smartphone as the central control device; "8" refers to key categories of peripheral devices such as tablets, PCs, wearables, smart TVs, smart audio systems, AR/VR devices, smart speakers, and in-vehicle systems; and "N" stands for a virtually unlimited range of IoT applications and third-party devices. This ecosystem is supported by Huawei's HarmonyOS operating system, Huawei Cloud, and integrated AI capabilities. Through seamless device interconnectivity, the ecosystem ensures that users experience consistent services across devices, while developers gain access to a unified platform for application deployment.

Huawei's innovation management approach is notable for its ecosystem governance model, in which third-party developers, component suppliers, and service providers participate in co-innovation. The firm maintains strategic control over core technologies such as chip design (HiSilicon) and telecommunications infrastructure, while fostering open collaboration on application layers. This dual approach—control over the core and openness at the periphery—allows Huawei to balance proprietary advantages with network effects (Gawer & Cusumano, 2014).

Another example of digital innovation management in China is Baidu Apollo, an open-source autonomous driving platform launched in 2017. Unlike traditional closed R&D models in the automotive industry, Apollo invites automotive OEMs, parts manufacturers, software developers, and regulators into a collaborative innovation environment. Participants can access open APIs, simulation tools, and sensor data frameworks to develop their own autonomous driving solutions. This approach not only accelerates technological development but also builds an industrial alliance that shares both risk and reward. Baidu leverages its strength in AI algorithms, high-definition mapping, and cloud computing to provide the technological backbone of Apollo, while partners contribute expertise in hardware, vehicle integration, and market deployment.

In both Huawei and Baidu's cases, digital innovation management is no longer confined to internal R&D labs. Instead, it thrives within platform ecosystems that blend in-house capabilities with external contributions, driven by continuous data exchange and collective learning.

3.5 Platform-Based Technology Management

The platform economy represents one of the most significant shifts in technology management under the digital economy. Platforms are not merely intermediaries connecting supply and demand; they function as technological and governance infrastructures that facilitate resource allocation, innovation, and market access (Cusumano et al., 2019).

For small and medium-sized enterprises (SMEs), one of the greatest barriers to adopting advanced technologies—such as AI, big data analytics, and IoT—is the upfront investment in infrastructure and the shortage of specialized technical personnel. Platform-based technology management addresses this problem by democratizing access to capabilities that were once exclusive to large corporations.

Alibaba Cloud (Aliyun) is a prime example of this phenomenon. As the largest cloud service provider in China, Alibaba Cloud offers an extensive suite of tools including Elastic Compute Service (ECS), MaxCompute for big data processing, and PaaS solutions for AI model deployment. SMEs can subscribe to these services on a pay-as-you-go basis, avoiding heavy capital expenditures. Moreover, Alibaba Cloud's AI PAI platform allows businesses with no in-house AI expertise to train and deploy models using pre-built templates.

This "technology-as-a-service" model not only reduces barriers to technology adoption but also creates a positive feedback loop: the more SMEs join the platform, the richer the data pool becomes, enhancing the AI models' predictive power, which in turn attracts more participants. From a technology management perspective, Alibaba operates as both a technology provider and a platform orchestrator, setting standards, ensuring interoperability, and fostering trust among participants.

Another illustrative case is Pinduoduo, a social commerce platform that integrates AI-driven recommendation algorithms into its business model. By analyzing consumer interaction data in real-time, Pinduoduo tailors product suggestions to individual preferences, maximizing conversion rates. This approach extends beyond retail into agricultural supply chains: farmers can use Pinduoduo's platform to directly sell produce to consumers, bypassing intermediaries. AI analytics help predict market demand, optimize pricing strategies, and reduce food waste.

Through such platform-based technology management, the value creation process becomes distributed, with participants across the supply chain contributing to and benefiting from shared technological resources.

3.6 Integration of Emerging Technologies

The integration of multiple emerging technologies—AI, IoT, blockchain, robotics—marks the latest frontier in MOT practice. This integration is not merely a matter of technological layering; it involves strategic orchestration so that each technology complements and enhances the others (Porter & Heppelmann, 2014).

Haier's COSMOPlat exemplifies this integration. Initially launched as an industrial internet platform for manufacturing, COSMOPlat allows customers to customize products in real time. By linking IoT-enabled manufacturing equipment with customer interfaces, the platform ensures that production lines can switch configurations rapidly based on incoming orders. AI algorithms optimize scheduling and resource allocation, while blockchain ensures data integrity and traceability across the supply chain. This approach significantly reduces lead time, enhances customer satisfaction, and strengthens Haier's competitive position in global markets.

JD Logistics offers another case study in technology integration. To meet the demands of rapid e-commerce growth, JD has implemented AI-based demand forecasting, autonomous delivery robots, and blockchain-enabled tracking systems. AI models process vast amounts of sales and inventory data to predict regional demand patterns, enabling pre-positioning of goods in strategically located warehouses. Robotics handle high-volume sorting tasks, increasing throughput and reducing labor costs. Blockchain records every transaction and movement of goods, providing end-to-end transparency that is especially valuable in industries like pharmaceuticals and luxury goods, where authenticity is critical.

In both Haier and JD's cases, the integration of emerging technologies requires sophisticated MOT capabilities:

Cross-functional coordination among engineering, IT, operations, and marketing teams.

Vendor and partner management to ensure interoperability of hardware and software components.

Continuous skill upgrading to keep pace with technological advances.

Ultimately, the competitive advantage lies not in any single technology but in the ability to orchestrate multiple technologies into a coherent, value-generating system.

IV. Challenges in China's MOT under the Digital Economy

While China's Management of Technology (MOT) framework has evolved rapidly in response to the opportunities of the digital economy, a range of complex and interrelated challenges constrain its sustainable development and global competitiveness. These challenges are not only technical but also institutional, cultural, and geopolitical, requiring a multi-dimensional approach to policy formulation, organizational strategy, and talent development. The key issues can be grouped into four main categories: shortage of interdisciplinary talent; balancing data governance with innovation; navigating geopolitical tensions and technology decoupling; and addressing uneven digitalization between large enterprises and small and medium-sized enterprises (SMEs).

1. Shortage of Interdisciplinary Talent

One of the most persistent barriers to effective MOT in China's digital economy is the shortage of interdisciplinary talent capable of integrating engineering, business strategy, and digital technologies. The digital economy increasingly demands professionals who possess hybrid skill sets—proficiency in areas such as artificial intelligence (AI), blockchain, data analytics, as well as strategic management, organizational change, and cross-cultural communication (Li & Wang, 2021). However, the traditional education system in China remains largely compartmentalized, with engineering and management disciplines often taught in isolation (Zhang & Liu, 2020).

This structural separation results in a talent pool that is either highly technically skilled but lacking business acumen, or strategically competent but technologically underqualified. For example, while China produces a large number of STEM graduates annually, only a fraction have hands-on experience in applying emerging technologies to business scenarios (Chen, 2022). Furthermore, interdisciplinary programs such as MOT master's degrees, though growing in number, have yet to achieve widespread recognition among employers, limiting their ability to attract top-tier candidates.

Global competition exacerbates the problem, as multinational corporations and technology hubs in the United States, Europe, and Southeast Asia often offer more attractive compensation packages, research freedom, and international exposure. This "brain drain" phenomenon further reduces the availability of qualified personnel within China's MOT ecosystem. In the long term, addressing this challenge will require reforms in higher education, increased industry-academia collaboration, and the creation of career pathways that reward interdisciplinary expertise.

2. Balancing Data Governance with Innovation

In the digital economy, data has emerged as a strategic resource comparable to capital and labor (Brynjolfsson & McAfee, 2014). However, managing data effectively within China's MOT framework presents a difficult balance between ensuring robust governance and enabling innovation. On one hand, the government has introduced comprehensive regulations such as the Cybersecurity Law (2017), the Data Security Law (2021), and the Personal Information Protection Law (2021), which aim to protect national security, prevent data misuse, and safeguard individual privacy. These frameworks have been critical in establishing trust in digital systems and mitigating risks related to cyberattacks, fraud, and unauthorized surveillance (Liu & Huang, 2022).

On the other hand, overly restrictive data controls can hinder the free flow of information necessary for innovation, particularly in fields like AI model training, cross-border research collaboration, and platform-based business models. For instance, start-ups and SMEs often lack the resources to comply fully with complex regulatory requirements, which can delay product launches and reduce competitiveness (Sun, 2022).

Moreover, China's approach to data localization—requiring certain categories of data to be stored and processed domestically—creates additional operational complexity for multinational firms operating in China, potentially discouraging foreign investment and technology transfer (Xie & Zhang, 2021). The tension between security and openness thus represents an ongoing policy challenge: finding a governance model that protects critical interests while fostering an environment conducive to rapid technological experimentation and cross-sector collaboration.

3. Navigating Geopolitical Tensions and Technology Decoupling

Geopolitical dynamics—particularly the escalating competition between China and the United States—pose significant risks to China's MOT under the digital economy. Since 2018, the United States has implemented a series of export controls, investment restrictions, and sanctions targeting Chinese technology companies, most notably in sectors such as semiconductors, telecommunications, and AI (Friedman, 2021). These measures have restricted Chinese firms' access to critical technologies, components, and design software, forcing them to accelerate self-reliance strategies in core technology areas.

For example, the inclusion of Huawei and other firms on the U.S. "Entity List" has disrupted global supply chains and pushed Chinese enterprises to develop indigenous chipsets, operating systems, and enterprise software (Tan, 2022). While this has stimulated domestic R&D investment, it also presents immediate challenges in terms of performance gaps, increased costs, and slower time-to-market compared to competitors with unrestricted global supply chain access.

The broader trend of technology decoupling—fragmenting the global technology ecosystem into competing spheres of influence—threatens the very premise of globalized innovation networks that have historically fueled China's rapid MOT development. Chinese firms may find themselves excluded from certain international standards-setting bodies, joint research initiatives, and overseas markets. As a countermeasure, China has intensified efforts in international cooperation with Belt and Road Initiative (BRI) partner countries, particularly in areas such as 5G infrastructure, e-commerce, and smart manufacturing (Xu, 2023). Nevertheless, the uncertainty created by geopolitical rivalry complicates long-term strategic planning and increases the risk profile for both domestic and foreign stakeholders in China's technology sectors.

4. Uneven Digitalization between Large Enterprises and SMEs

While China's leading technology companies—such as Alibaba, Tencent, and Huawei—are recognized globally for their advanced digital capabilities, the digital transformation of SMEs remains uneven and fragmented. According to a 2022 report by the China Academy of Information and Communications Technology (CAICT), less than 30% of SMEs had adopted advanced digital tools such as cloud computing, industrial IoT, or AI-driven analytics (CAICT, 2022).

The barriers are multifaceted. First, SMEs often face financial constraints that limit their ability to invest in cutting-edge technologies or hire specialized talent. Second, there is a significant knowledge gap, as many SME owners lack awareness of how digital technologies can enhance efficiency, market reach, and customer engagement (Yang, 2022). Third, the return on investment (ROI) for digital transformation projects in SMEs can be uncertain, especially in traditional industries with low margins and long product cycles.

Government initiatives—such as the "SME Digital Empowerment" program launched by the Ministry of Industry and Information Technology (MIIT) in 2021—have sought to close this gap by providing subsidies, training programs, and access to shared digital platforms. However, implementation challenges persist, including low participation rates in rural and underdeveloped regions, as well as a lack of tailored solutions for sector-specific needs (Li, 2023). Without addressing this digital divide, the broader MOT ecosystem risks becoming polarized, with a handful of highly advanced firms driving national metrics while a vast majority of smaller enterprises lag behind, thereby constraining inclusive economic growth.

The challenges facing China's MOT under the digital economy are multi-layered, spanning talent development, regulatory balance, geopolitical strategy, and equitable digital transformation. Addressing these issues requires coordinated action from policymakers, industry leaders, academic institutions, and international partners. Interdisciplinary education reform, nuanced data governance frameworks, diversified technology partnerships, and targeted SME support programs are all critical for ensuring that China's MOT continues to evolve in a way that is both globally competitive and domestically inclusive.

V. Opportunities and Strategic Recommendations

With the rapid development of the digital economy, China's Management of Technology (MOT) is facing unprecedented opportunities. Effectively seizing these opportunities can not only enhance enterprises' competitiveness but also help achieve the national goals of independent scientific and technological innovation and high-quality economic development. This article puts forward specific strategic suggestions from three levels: policy, enterprise, and academia, aiming to promote the comprehensive upgrading and continuous optimization of China's MOT system.

5.1 Policy Level

At the national level, policymakers should focus on popularizing and optimizing digital infrastructure, especially in relatively underdeveloped economic regions, and promoting fiscal incentive measures for cross-industry collaboration to help form a diversified, open, and win-win innovation ecosystem.

Balanced Regional Development of Digital Infrastructure. Currently, the construction of digital infrastructure in China's eastern coastal areas has achieved remarkable results. Technical conditions such as high-speed broadband networks, 5G network coverage, and data center construction are relatively complete, but there is still a large gap in central and western regions and rural areas (China Academy of Information and Communications Technology, 2024). The existence of the digital divide restricts the digital transformation of small and medium-sized enterprises in these regions and the improvement of their technological innovation capabilities. At the policy level, guidance for investment in digital infrastructure should be strengthened, and social capital should be encouraged to participate in network construction in underdeveloped areas.

One of the core characteristics of the digital economy is the blurring of industrial boundaries and cross-border integration. The government should encourage technical cooperation and innovation experiments between traditional manufacturing, internet, big data, artificial intelligence and other industries through policies such as financial subsidies and tax incentives. Establish special funds to support cross-industry innovation projects, with priority given to the in-depth integration of digital technology with key fields such as manufacturing, medical care, and finance.Provide tax reductions and exemptions for enterprises participating in innovation alliances, technology transfer, and the construction of sharing platforms. Establish a multi-level innovation voucher system to lower the threshold for small and medium-sized enterprises to obtain technical services and encourage them to participate in open innovation networks. In addition, policymakers need to improve data governance regulations, promote the open sharing of data resources while ensuring security and compliance, and build a healthy legal environment for the digital economy.

5.2 Enterprise Level

As the main body of technological innovation, enterprises need to improve their own MOT capabilities, actively embrace digital transformation, build an agile and flexible management mechanism, and enhance employees' digital skills through internal training to ensure the effective transformation and commercialization of technical achievements.

(1) Adopting Agile Management Frameworks to Improve the Efficiency of Technology Commercialization

In the digital economy, the speed of technological updating is extremely fast, and traditional waterfall-style R&D management can hardly meet market demands. Enterprises should promote agile MOT frameworks to achieve cross-departmental collaboration and rapid iteration. Establish an innovation process centered on customer needs, adopt short-cycle development and continuous feedback mechanisms to ensure the rapid implementation of technical achievements. Apply data-driven decision-making tools to monitor R&D progress and market dynamics in real-time and optimize resource allocation. Cultivate cross-functional teams to promote close cooperation between technology, market, production, and finance departments and eliminate information silos.

(2) Building an Internal Digital Skills Training System for Enterprises

The ability of technical management talents is the key to the success of enterprise MOT. To fill the talent gap, enterprises should establish digital training academies or learning platforms to systematically improve employees' digital literacy and innovation capabilities. Design training courses covering cutting-edge technologies such as artificial intelligence, big data analysis, and cloud computing. Encourage employees to participate in online open courses, industry certifications, and internal enterprise innovation projects. Promote the combination of "mentorship system" and "project-driven learning" to facilitate the in-depth integration of theory and practice. In addition, enterprises should strengthen cooperation with universities and research institutions to jointly cultivate compound talents and improve the level of technological R&D and management.

5.3 Academic Level

The academic community plays an irreplaceable role in cultivating future MOT talents and promoting theoretical innovation. Universities and research institutions should reform the education system around the development needs of the digital economy and build interdisciplinary comprehensive MOT courses and research platforms.

(1) Building an Interdisciplinary MOT Curriculum System.

Traditional engineering management, information technology, and business management courses have strong disciplinary barriers, which are difficult to meet the needs of compound talents in the digital economy. Universities need to integrate engineering, data science, artificial intelligence, business strategy, and innovation management to form a systematic and modular MOT curriculum system.Offer basic courses on digital technology, such as big data processing, machine learning, and cloud computing principles.Add core management content such as technology strategy, innovation management, and data governance.Promote case teaching, experimental training, and school-enterprise joint projects to enhance practical capabilities.

(2) Promoting In-depth Integration of Industry, Education, and Research

Universities should actively build collaborative innovation platforms with enterprises and the government to promote the two-way transformation of technology management theory and practice.Establish MOT joint laboratories to carry out research on smart manufacturing, digital platforms, and innovation ecosystems.Set up technology transfer offices to support the industrialization of scientific research achievements and promote student entrepreneurship and enterprise innovation.Encourage teachers and students to participate in enterprise projects to realize the connection between theory and market demand.

(3) Conducting Cutting-Edge Research to Lead MOT Theoretical Innovation

The continuous evolution of the digital economy brings new challenges to technology management. Universities and research institutions should deepen theoretical discussions on issues such as platform governance, algorithm ethics, and data property rights, and enhance China's academic influence in MOT. Support interdisciplinary research projects focusing on hot directions such as digital ecosystems and open innovation models.Organize international academic exchanges to absorb and integrate the latest global research results.Promote the application of research results in government policy formulation and enterprise practice.

VI .Conclusion

The evolution of Management of Technology (MOT) in China has been remarkable, tracing a path from the initial phases of passive technology absorption in the late 20th century to its current position as a prominent player in global innovation ecosystems. This transformation has been propelled by a unique confluence of government policy, rapid economic development, and increasing integration into the global digital economy. Today, China is not only a major adopter of advanced technologies but also a leading innovator in areas such as artificial intelligence, industrial internet, and digital platform ecosystems. The trajectory of China's MOT offers important lessons and insights for emerging economies navigating the complexities of digital transformation.

(1) The Historical Transformation of China's MOT

Historically, China's MOT framework was characterized by a focus on technology transfer and assimilation. During the early reform and opening period, the main objective was to bridge the technological gap with developed countries by importing machinery, equipment, and production techniques. The challenge at this stage was predominantly organizational and managerial—how to adapt and integrate foreign technologies within domestic production systems. Despite limitations in indigenous innovation capacity, this period laid the essential groundwork for more advanced technological management capabilities.

With China's accession to the World Trade Organization (WTO) in 2001 and subsequent policy initiatives such as the 863 and 973 Programs, the focus shifted to building domestic capabilities in core scientific and technological domains. Enterprises began investing heavily in research and development, and the MOT discipline expanded to incorporate intellectual property management, process innovation, and collaborative innovation models. This stage witnessed the rise of Chinese multinational enterprises like Huawei, Tencent, and Alibaba, who not only absorbed technology but also started generating proprietary innovations.

The ongoing digital transformation phase, starting around 2015, represents a fundamental redefinition of MOT in China. Emerging digital technologies—AI, cloud computing, blockchain, and IoT—have reconfigured the production and innovation landscape. The concept of MOT has expanded to encompass ecosystem governance, platform strategies, and data-centric innovation. Digital-native companies have become key drivers of this change, pioneering new models of technology management that emphasize openness, agility, and real-time responsiveness. Government-led initiatives further support the creation of innovation clusters and cross-sector partnerships, helping to accelerate technology diffusion and commercialization.

(2) Integrating Technological, Managerial, and Societal Dimensions

The sustained success of China's MOT in the digital economy requires a holistic integration of technological innovation, managerial capacity, and societal considerations. Technologically, the ability to develop and apply frontier technologies remains crucial. This includes not only core technological breakthroughs but also the capability to integrate diverse technologies into coherent solutions tailored to market needs.

From a managerial perspective, MOT demands agility, strategic foresight, and cross-functional coordination. The rapid pace of digital innovation means that traditional hierarchical decision-making processes are often too slow to respond effectively. Agile methodologies, data-driven decision frameworks, and ecosystem collaboration have become essential components of effective MOT. Moreover, enterprises need to foster a culture of continuous learning and adaptability to keep pace with technological disruptions.

Societal dimensions involve the ethical, legal, and social implications of technology deployment. Data governance, privacy protection, cybersecurity, and equitable access to digital resources are areas where MOT strategies must align with societal values and regulatory frameworks. Failure to address these aspects can lead to public distrust, regulatory backlash, and reputational damage, undermining technological progress.

(3) The Role of Policy, Enterprise, and Academia

Policy support remains a fundamental enabler of China's MOT development. National strategies such as "Internet Plus," "Made in China 2025," and "Digital China" have provided clear direction and resources to guide digital transformation efforts. Investment in digital infrastructure, regulatory frameworks for data security, and incentives for innovation collaboration have created a fertile environment for MOT advancement. However, policymakers must continue to balance innovation encouragement with risk mitigation, particularly regarding data governance and international technology cooperation.

Enterprises are the frontline agents of MOT execution. Their ability to embrace agile innovation models, cultivate interdisciplinary talent, and adopt digital tools determines the practical effectiveness of MOT frameworks. Leading Chinese firms have demonstrated that combining entrepreneurial vigor with strategic management can create world-class innovation capabilities. SMEs, however, need targeted support to overcome resource and knowledge constraints, ensuring inclusive technological progress across the economy.

Academic institutions play a dual role of talent development and theoretical advancement. Expanding interdisciplinary MOT education that integrates engineering, data science, and business strategy is essential to supply the skilled professionals required by enterprises and governments. Furthermore, academia must engage in cutting-edge research on digital innovation management, ecosystem governance, and the socio-technical implications of emerging technologies, informing evidence-based policy and corporate strategies.

VII. Future Prospects and Challenges

Looking forward, the trajectory of China's MOT is promising but also faces significant challenges. The ongoing geopolitical tensions and global technology decoupling pose risks to supply chain security and international cooperation. Developing robust indigenous technologies, while maintaining openness to global innovation networks, will be a delicate balancing act.

Talent development remains a priority, especially in cultivating interdisciplinary professionals who can bridge technical and managerial domains. Addressing regional disparities in digital infrastructure and SME digitalization will also be critical to avoid exacerbating economic inequalities.

Finally, as digital technologies become increasingly pervasive, MOT strategies must prioritize responsible innovation that incorporates ethical considerations, data privacy, and social inclusiveness. This will require stronger collaboration between technologists, managers, policymakers, and civil society.

In sum, China's MOT has undergone a profound transformation from technology absorption to innovation leadership under the impetus of the digital economy. This evolution reflects China's ability to integrate policy guidance, enterprise dynamism, and academic support into a coherent framework for managing technological change. The future success of China's MOT depends on continuing this integrative approach, balancing rapid technological advancement with sound management practices and societal responsibility. By doing so, China is well-positioned to sustain its role as a global leader in technology innovation and contribute meaningfully to shaping the digital economy worldwide.

References

Brynjolfsson, E., & McAfee, A. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies. W.W. Norton.

CAICT. (2024). China Digital Economy Development Report 2024. China Academy of Information and Communications Technology.

Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019). The business of platforms: Strategy in the age of digital competition, innovation, and power. Harper Business.

Gregory, M. J. (1995). Technology management: A process approach. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 209(5), 347–356.

Liu, Z., & Liang, Y. (2018). Evolution of China's technology management under globalization. Journal of Technology Management in China, 13(2), 142–159.

National Research Council. (1987). Management of technology: The hidden competitive advantage. National Academies Press.

OECD. (2020). Measuring the digital transformation: A roadmap for the future. OECD Publishing.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—The new organizing logic of digital innovation: An agenda for information systems research. Information Systems Research, 21(4), 724–735.