Research on the Path and Mechanism of Dual Innovation Development in Enterprises Empowered by Digitalization

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Abstract: This paper aims to explore the application of digital technology in the dual innovation development of enterprises, and how to realize the optimization and innovation of digital enterprise management by establishing a path and mechanism for digital empowerment in the dual innovation development of enterprises. The article first introduces the basic concepts and development trends of digital enterprise management, followed by an analysis of the role and mechanisms of digital technology in the dual innovative development of enterprises. It focuses on how digital technology promotes both internal and external dual innovation within enterprises. Finally, the paper proposes paths and mechanisms for digital empowerment in the dual innovation development of enterprises, including establishing a digital enterprise management system, promoting digital technological innovation, strengthening the cultivation and incentive mechanisms for digital talents. Through this research, it is expected to provide valuable insights and directions for optimizing and innovating digital enterprise management.

Keywords: Digital Empowerment, Dual-mode Innovation, Development Path, Mechanism Study, Enterprise Innovation

1. Introduction

As the rapid evolution from an informational society to a digital society unfolds (Bharadwaj et al., 2013) [1], global enterprises are confronted with an unprecedented wave of transformation. In this era fraught with change, the digital empowerment of enterprise innovation development has emerged as an inevitable trend. Dual Innovation Development refers to the synergetic progress in both technological innovation and business model innovation within enterprises. The process of digital empowerment in fostering dual innovation development in enterprises involves leveraging cutting-edge technologies such as cloud computing, big data, and artificial intelligence to comprehensively optimize and upgrade internal management, production processes, and product services (Schwab, 2017; Lacity et al., 2019) [2] [3]. Simultaneously, it necessitates the establishment of flexible organizational structures adapted to the digital environment, nurturing cross-domain innovation capabilities, and building dynamic strategic management mechanisms that support dual innovation (Garud et al., 2018; Zhu et al., 2020) [4] [5]. This paper aims to investigate the pathways and mechanisms of digital empowerment in driving dual innovation development within enterprises, with the hope of providing valuable insights for enterprises undergoing digital transformation and innovative development.

IEDM 2024, February 23-25, Kuala Lumpur, Malaysia

DOI 10.4108/eai.23-2-2024.2345926

2. Research Significance and Theoretical Foundations

2.1Research Significance

The significance of digital empowerment in fostering dual innovation within enterprises lies in the following aspects:

(1)Enhancing Corporate Innovation Capability:

Digital technology can enable enterprises to digitize, intelligentize, and optimize their innovation processes, **thereby significantly boosting their overall innovative capacity.**

(2)Accelerating Enterprise Transformation and Upgrading:

The integration of digital empowerment into an enterprise's dual innovation strategy expedites its transformation and upgrading process. This not only elevates the company's competitiveness in the market but also improves its production efficiency.

(3)Driving Industrial Upgrading:

Dual innovation powered by digital technologies plays a pivotal role in driving the upgrading and transformation of entire industries. It facilitates sustainable development across sectors by promoting industrial modernization and adaptability to new technological paradigms.

In essence, digital empowerment serves as a catalyst for corporate and industrial growth through innovation, strategic evolution, and sustainable practices.

2.2 Theoretical basis:

(1) Enterprise Dual Innovation Theory

The enterprise dual innovation theory emphasizes that enterprises should not only uncover their internal potential through independent innovation but also keep up with the cutting-edge global technological trends by introducing, assimilating, and re-innovating technologies. In the context of digitalization, enterprises can leverage advanced technologies such as big data and artificial intelligence to deeply integrate and innovate further on introduced advanced technologies. They can also stimulate original technological innovation based on their internal R&D systems, thereby achieving efficient collaborative development of dual innovation (Tushman & O'Reilly, 1996) [6]..

(2) Innovation Management Theory

Innovation management theory provides a systematic management framework for enterprise dual innovation. In the digital era, enterprises need to establish an innovation management system adapted to this context, including setting up flexible R&D processes, constructing innovation incentive mechanisms, and nurturing a corporate culture that encourages innovation, thereby activating employees' innovative potential and further enhancing the overall innovative capacity of the enterprise (West & Bogers, 2014) [7].

(3) Enterprise Informationization

Theory Under the backdrop of the digital age, the enterprise informationization theory further propels the development of dual innovation. By building advanced information infrastructure

and leveraging information technologies such as big data analysis and cloud computing, enterprises can effectively enhance management efficiency and operational productivity. On this foundation, they can construct a comprehensive and multi-level information ecosystem that powerfully drives digital transformation and dual innovation in enterprises (Porter & Millar, 1985) [8].

(4) Dual Innovation Drive Theory

The dual innovation drive theory posits that in the course of innovation development, enterprises rely on the driving forces from both internal and external innovation aspects. This theory highlights the synergistic effect of internal and external innovation resources. In the digital era, enterprises should fully utilize both internal and external innovation resources, cultivating internal innovation teams and reinforcing fundamental R&D capabilities while actively seeking strategic alliances with external innovation partners to form mutually complementary, resource-sharing innovation networks that jointly propel the in-depth development of dual innovation (Chesbrough, 2003) [9].

In summary, the digital empowerment of enterprise dual innovation and development necessitates grounding on theoretical foundations such as dual innovation theory in enterprises, innovation management theory, enterprise informationization theory, and dual innovation drive theory. It involves establishing a comprehensive digital management system and mechanisms to realize digital transformation and innovative development.

2.3 The connotation of digital empowerment for enterprise dual innovation mainly includes the following aspects(See Figure 1.):

(1)Technology Innovation :

Digital technology such as artificial intelligence, the Internet of Things and big data provides enterprises with new innovation tools and means. For instance, AI can optimize production processes, IoT technology enables real-time monitoring and predictive maintenance of equipment status to enhance production efficiency, and big data assists enterprises in deeply mining customer needs and accurately targeting product design and upgrade directions (Teece, D. J. 2018) [10]. The application of these technologies not only enhances the hard power of enterprises but also positions them advantageously in market competition.

(2)Business Model Innovation:

Enterprise dual innovation under digitalization involves the disruption and reshaping of traditional business models, such as the sharing economy and platform economy models formed based on cloud computing and mobile internet. These model innovations can break through spatial and temporal limitations, expand the scope of services, and give rise to entirely new business and profit models (Parker, G. et al., 2016) [11].

(3)Organizational Innovation :

The digital environment requires enterprises to transform traditional organizational forms and establish more flexible, open, and collaborative organizational structures. This transformation should be supported by incentive mechanisms adapted to innovation, in order to stimulate employees' innovative potential and enthusiasm (Zhu, J., & Liu, Z. 2019) [12].

(4)Conceptual Innovation :

The innovation of corporate culture is a significant driving force for enterprise dual innovation, especially for enterprises in the digital age. They should establish a value system centered on innovation, customer-centricity, continuous improvement, and sustainable development (Sahaym, A., & Bharadwaj, A., 2016) [13].

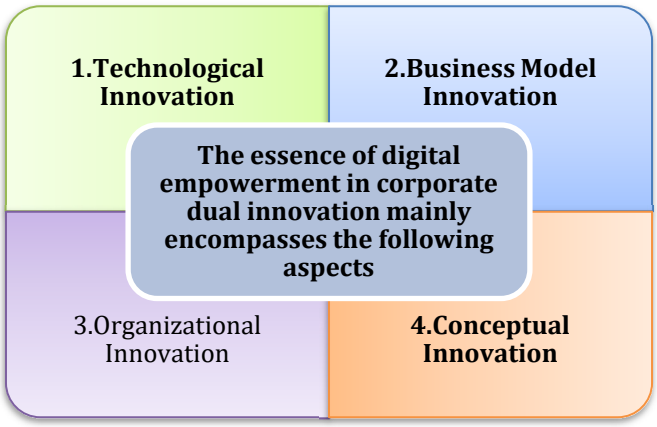

Figure 1. The connotation of digital empowerment for enterprise dual innovation mainly includes the following aspects

In summary, digital enterprise dual innovation is a complex process that requires enterprises to reform and innovate from multiple aspects. Enterprises need to strengthen technology R&D and talent cultivation, value market research and customer needs, focus on the integration of digital technology and business models, and build innovative organizational mechanisms and corporate cultures, thereby achieving dual innovation and sustainable development for the enterprise.

2.4 Characteristics of Dual Innovation Development in Enterprises:

(1) Innovation Driven:

In the context of the digital economy era, digital technologies such as AI, blockchain, and cloud computing have provided a strong driving force for corporate innovation activities (Westerman et al., 2014) [14]. These technologies not only increase the speed of innovation but also enhance its flexibility, enabling enterprises to quickly adapt to market demands and continuously iterate products and services (Teece, 2018) [15]. For example, digital technologies based on 3D printing and intelligent manufacturing allow companies to achieve rapid prototyping and customized production.

(2) Cross-Boundary Integration:

Digital technologies have broken down industry barriers, promoting deep integration across industries and domains (Bughin et al., 2018) [16]. For instance, Alibaba has leveraged big data and cloud computing to integrate multiple business sectors such as e-commerce, finance, and logistics, creating entirely new business models.

(3) Intelligent Transformation:

The intelligent transformation led by digital technologies in enterprises is reflected not only in the automation and intelligence of production processes (Schwab, 2017) [17] but also in its impact on corporate decision-making processes. By utilizing real-time data analysis and artificial intelligence algorithms to optimize resource allocation, efficiency and productivity are enhanced (Lacity & Willcocks, 2016) [18].

(4) Networked Collaboration:

With the help of cloud computing and big data technologies, enterprises can achieve seamless information sharing and collaborative innovation on a global scale. This networked collaboration model has driven the optimization and integration of the global supply chain and has fostered the development of open innovation platforms.

(5) Customer-Centricity:

Digital technologies assist enterprises in gaining a deep understanding of and precisely meeting the personalized needs of their customers. Through big data mining and analysis, companies can construct user profiles, predict consumption trends, and thus provide highly customized products and services, effectively enhancing customer satisfaction and loyalty.

3. The Main Contents and Advantages of Digital Empowerment in Enterprise Dual Innovation

Digital empowerment in dual innovation for enterprises refers to the process where businesses leverage digital technologies to drive profound reforms and development in two dimensions: optimizing and upgrading existing business processes (termed as "preserving the essence") and fostering innovation in emerging business models, products, and services (termed as "breaking new ground"). The following outlines the main contents and advantages of research on digital empowerment in dual innovation for enterprises:

3.1 Main Contents:

(1) Application of Digital Technologies in Business Process Optimization :

Enterprises introduce technologies such as big data analytics, cloud computing, and artificial intelligence to achieve intelligent and precise operations. As Vial (2019) points out, during the digital transformation process, organizations need to alter their value creation paths, managing structural changes and organizational barriers that impact both positive and negative outcomes [19]. This not only optimizes production, management, and sales processes but also enhances efficiency and reduces costs.

(2) Innovation-Driven Development :

Digital technology drives product innovation, service innovation, and model innovation. Alstyne et al. (2016) emphasize that traditional enterprises must develop new core competencies and ways of thinking to design, govern, and expand platforms based on their existing businesses [20]. Enterprises can launch personalized customized products based on

user data and utilize blockchain technology to construct novel supply chain management models.

(3) Transformation of Organizational Structure and Culture :

Digital empowerment also involves adjustments to an enterprise's organizational structure and cultural transformation. Huang et al. (2017) argue that digital platforms create unique socio-technical products that interweave with systems, markets, and technologies, making them challenging research subjects [21]. Enterprises should encourage an internal entrepreneurial spirit and establish flexible mechanisms to respond swiftly to market changes.

(4) Formulation and Implementation of Dual Innovation Strategies :

While stably maintaining their core businesses, enterprises use digital tools to explore and nurture new growth points. Bharadwaj et al. (2013) propose that enterprises should build a process model for digital transformation dynamic capabilities to adapt to the highly volatile digital environment [22]. Developing a comprehensive dual innovation strategy system is crucial for enterprises to achieve sustained growth.

3.2 Main Advantages

(1) Enhanced Operational Efficiency

Digital transformation enables enterprises to monitor operational status in real-time, predict and address issues proactively. Furr & Shipilov (2019) point out that digital transformation involves the gradual transmission of core value propositions through incremental steps, focusing on user needs, organizational flexibility, and respect for progressive change [19].

(2) Stimulating Innovation Capability

Digital technologies provide powerful tool support for innovative activities within enterprises. Li et al. (2018) argue that under the backing of digital platform service providers, SME entrepreneurs drive digital transformation by updating management cognition, developing social capital, building business teams, and cultivating organizational capabilities [23].

(3) Strengthening Competitiveness

Dual innovation allows enterprises to maintain their competitive edge in traditional businesses while continually expanding into new domains. Mithas et al. (2013) found that digital strategies are closely related to the corporate competitive environment and digital strategy posture, significantly influencing an enterprise's digital business strategy [24].

(4) Supporting Scientific Decision-making

Big data analysis offers accurate data support for corporate decision-making, making the process more scientific and precise. Hess et al. (2016) emphasize that enterprises must carefully design changes to their organizational structure to better leverage digital technologies [25].

(5) Facilitating Sustainable Development

Digital capabilities help enterprises efficiently allocate resources and reduce waste, aligning with the concept of sustainable development. Loebbecke & Picot (2015) assert that the

combination of digitalization and big data analysis presents new opportunities and challenges, greatly impacting the scope of functions in digital products and services [26].

4.Analysis of Dual Innovation Empowerment in Enterprises through Digitalization: Domestic and International Cases

4.1 Domestic Case: Alibaba Group

Alibaba Group is one of the most influential digital enterprises in China, driving the development of dual innovation through the application and innovation of digital technologies. The path of Alibaba Group's digital dual innovation mainly encompasses the following aspects:

(1)Application of Digital Technologies:

As a representative of Chinese digital enterprises, Alibaba extensively applies advanced technologies such as cloud computing, big data, and artificial intelligence. For instance, its constructed AliCloud platform provides comprehensive cloud services to businesses, utilizing big data analysis to offer precise marketing solutions to merchants. It also optimizes the product recommendation system on its e-commerce platforms using AI technology, thereby enhancing user experience[27].

(2)Talent Team Building:

Alibaba places significant emphasis on talent cultivation, with institutions like DAMO Academy and Alibaba Academy dedicated to continuously attracting and nurturing high-end research and technical talents. Through initiatives like the "Centennial Alibaba" talent development program, it has assembled a team with a global perspective and strong innovative capabilities[27].

(3)Strategic Planning:

In strategic planning, Alibaba adheres to the principle of "customers first, employees second, shareholders third," with a core focus on the digital economy. It has proposed the 'Five New' strategies including 'New Retail', 'New Finance', 'New Technology', and 'New Energy', which propel the company towards deeper digital transformation[27].

(4)Marketing Innovation:

Leveraging its robust digital technologies, Alibaba innovates its marketing models. This includes using big data for user profiling to achieve personalized recommendations and precision marketing. It has also created the Singles' Day Shopping Festival, establishing a novel e-commerce consumption scenario that sets the trend for online retail industry growth[27].

4.2 International Case: Amazon Inc.

In the study of the pathways and mechanisms for digital empowerment of dual innovation in enterprises, the practice of Amazon provides a valuable international case. As a global e-commerce giant, Amazon fully leverages digital technology to promote dual innovation,

achieve the reconstruction and optimization of its business model, and establish a strong competitive advantage on a global scale (Taneja, 2018) [28]. Its digital dual innovation path mainly includes the following aspects:

(1) Application of Digital Technology:

In terms of the application of digital technology, Amazon is a paragon. It deeply integrates advanced technologies such as cloud computing (AWS), artificial intelligence (AI, such as Alexa), and big data, forming a unique digital innovation capability. Specifically, by improving the precision of the product recommendation system through machine learning and big data analysis techniques, it effectively increases sales (Smith & Anderson, 2017) [29]. At the same time, as a leading global cloud service platform, AWS provides stable and flexible cloud infrastructure for Amazon itself and numerous external enterprises, strongly supporting the continuous expansion and innovation of its business (Jain et al., 2019) [30].

(2) Talent Team Building:

Amazon's construction of its talent team also reflects its concept of dual innovation. By establishing programs such as the Amazon Technical Academy, Amazon not only cultivates the digital skills and innovation capabilities of its internal employees but also actively attracts top global tech talents, building a team with a high level of digital literacy and innovation capability (Chen & Hamori, 2020) [31].

(3) Strategic Planning:

Amazon's strategic planning fully embodies its forward-looking grasp of future trends and comprehensive layout of dual innovation thinking (Taneja, 2018) [32]. It breaks through the boundaries of traditional e-commerce, strategically entering fields such as smart hardware (like Kindle, Echo series), cloud computing, and streaming media, and is committed to becoming the world's most customer-centric enterprise around the core concept of the "everything store" (Laudon & Traver, 2017) [33].

(4) Marketing Innovation:

Amazon's innovation in marketing also demonstrates its digital dual innovation path. By deeply mining and analyzing massive user data, Amazon achieves refined operations, such as personalized email promotions and exclusive discount strategies for members. In particular, the pioneering Prime membership system has revolutionized the membership marketing model of the e-commerce industry (Frasquet et al., 2020) [34]. In addition, by planning events like Prime Day, Amazon successfully creates new shopping festivals, effectively enhancing its brand influence and market share (Johnson et al., 2017) [35].

4.3 Practical Cases and Implications of Digital Empowerment for Dual Innovation in Enterprises

Digital empowerment for dual innovation in enterprises refers to a scenario where, based on a stable core business foundation, companies concurrently engage in both disruptive and continuous innovations to adapt to the rapidly changing market environment. Alibaba Group and Amazon, as leading global digital enterprises, boast rich practical experience and remarkable success stories in dual innovation.

4.3.1 Insights from Alibaba Group's Practice Cases of Dual Innovation:

(1) Continuous Innovation:

Alibaba consistently engages in minor innovations within its e-commerce business, exemplified by the launch of diverse platforms such as Taobao and Tmall, which diversify its e-commerce offerings, optimize transaction processes, and enhance user experience. Furthermore, through the establishment of Alipay, it has developed a secure and convenient online payment system that strengthens user loyalty. Additionally, the development of Aliyun (Alibaba Cloud) reflects its commitment to continuous innovation; by constantly improving its capabilities in cloud computing and big data technology, it provides businesses with efficient and stable IT infrastructure services.

(2) Disruptive Innovation:

Alibaba's introduction of the "New Retail" strategy represents a disruptive innovation, deeply integrating online and offline commerce and reshaping traditional retailing. Hema Fresh, for instance, leverages big data and artificial intelligence technologies to achieve precision marketing and service upgrades, fundamentally redefining the consumer shopping experience. Moreover, the establishment of DAMO Academy symbolizes Alibaba's cutting-edge technological exploration, venturing into areas like quantum computing, chip design, and blockchain, thus preparing for potential industry transformations in the future through advanced research and development.

4.3.2 Insights from Amazon Company Practice Cases of Dual Innovation:

(1)Continuous Innovation:

Amazon consistently innovates in the e-commerce field, evolving from a single online bookstore to its present status as a one-stop shopping platform offering a wide array of products. It enhances the consumer experience through features such as the Prime membership program and one-click purchasing. Notably, Amazon Web Services (AWS), Amazon's cloud service, stands out as a testament to its continuous innovation, providing global enterprises with robust support for data storage and computing resources.

(2)Disruptive Innovation:

Amazon Echo, equipped with the AI assistant Alexa, has spearheaded a revolution in the smart home industry, introducing a new mode of voice interaction. Furthermore, Amazon Go, the cashier-less convenience store, disrupts traditional retail models by enabling a shopping experience without checkout lines, leveraging advanced technologies like machine vision and deep learning. Additionally, Amazon's drone delivery plans and the Kiva robot system significantly enhance warehouse logistics efficiency, demonstrating the company's commitment and prowess in disruptive innovation.

4.3.3 Summary :

(1)Dual-track innovation requires companies to pursue both disruptive and breakthrough innovations while not neglecting the improvement and refinement of existing businesses. These two aspects should complement each other, jointly driving the development of the enterprise.

(2)Enterprises should establish a flexible and open organizational structure and an innovative culture that encourages employees to proactively propose innovative ideas and supports cross-departmental and interdisciplinary collaborative innovation.

(3)In the process of innovation, it is essential to closely monitor changes in market demands and technological trends, centering on the customer to ensure that innovative outcomes genuinely address user pain points and create value.

(4)In terms of resource allocation, enterprises must guarantee the stable operation of core businesses while also being bold enough to invest in exploring uncharted territories, balancing risks and potential returns.

5. The Pathways and Mechanisms for Dual Innovation Development Empowered by Digitalization in Enterprises

The pathways and mechanisms through which digital empowerment drives dual innovation development in enterprises can be elaborated from the following aspects:

5.1 Strategic Planning Stage:

(1)Clearly define digital transformation objectives:

Enterprises must first establish a dual innovation development strategy, aiming to maintain steady growth in existing business while actively exploring and developing new business models, products, or services. Digitalization plays a pivotal role here, such as using big data analysis to predict market trends and providing a basis for innovation directions.

(2)Formulating Digital Empowerment Strategies:

Establish an application system of next-generation information technologies including cloud computing, artificial intelligence, the Internet of Things, and blockchain, aiming to enhance R&D efficiency, decision-making precision, and service quality within the enterprise.

5.2 Technological Innovation Stage:

(1)Internal Innovation-Driven:

Utilize digital tools (like R&D management systems and collaborative design platforms) to accelerate product development speed and boost innovation capabilities, driving continuous improvement and optimization of existing businesses.

(2)External cooperative innovation:

Leverage open innovation platforms to share data resources with other enterprises, universities, and research institutions, collaboratively undertaking innovative projects, thus achieving cross-disciplinary and cross-organizational collaborative innovation.

5.3 Organizational Transformation Stage:

(1)Build a flexible and agile organizational structure:

Implement flat management and project-based operations to increase the organization's responsiveness to market changes, supporting rapid iteration in product innovation and business model innovation.

(2)Digital talent cultivation and introduction:

Intensify the cultivation and recruitment of digital talents, building a talent pool that aligns with digital innovation, ensuring the company remains competitive during technological updates.

5.4 Ecosystem Construction Stage:

(1)Establish a digital ecosystem:

Centered around core business, build an open, collaborative, and symbiotic digital ecosystem involving suppliers, partners, and customers, driving dual innovation development through resource sharing and value co-creation.

(2)Data-driven operations:

Thoroughly mine and utilize the value of big data, guiding operational decisions through data analysis, to achieve precise marketing, personalized services, and thereby propel the transition of the enterprise from traditional models to digital economic models.

5.5 Mechanism Guarantee Stage:

(1)Improve incentive mechanisms:

Establish special reward systems for dual innovation projects to stimulate employee innovation enthusiasm, and use equity incentives to attract and retain high-**end digital innovation talents.**

(2)Establish a tolerance for failure mechanism:

For exploratory and innovative projects, provide a certain margin for trial and error and time allowance, encouraging innovation attempts, and mitigating the negative impacts of innovation failures.

In summary, digital empowerment for dual innovation development in enterprises is a systematic project encompassing multiple levels such as strategic formulation, technological innovation,

6. Challenges and Countermeasures for Dual Innovation in Digital Enterprises

Dual innovation in digital enterprises refers to the simultaneous pursuit of disruptive and incremental innovations on the foundation of stable core businesses to adapt to rapidly changing market environments and technological trends. However, in implementing dual innovation, enterprises face a series of challenges, with the following being specific challenges and corresponding strategies (see Table 1):

Table 1. Challenge and countermeasures of dual innovation of digital enterprises

Challenge		Countermeasure	
Challenge One	Difficulties in Technology Integration and Upgrade	**Countermeasure One**	1.Technology Roadmap Planning
			2.Establish Partnerships
			3.Continuous Technology Training
Challenge Two	Adaptability of Organizational Culture and Structure	**Countermeasure Two**	1. Cultural Change
			2.Organizational Structure Adjustment
Challenge Three	Data Security and Privacy Protection	**Countermeasure Three**	1.Strengthen Data Management
			2. Invest in Security Technology
			3.Raise Employee Awareness
Challenge Four	Allocation and Optimization of Innovation Resources	**Countermeasure Four**	1. Prioritize Resources
			2.Performance Evaluation Mechanism
			3.Flexible Resource Allocation
Challenge Five	Rapid Response to Market Changes	**Countermeasure Five**	1.MarketMonitoring System
			2.Agile Innovation Process
			3.Customer Engagement

Data Source: Author's Own Creation

Challenge 1: Difficulties in Technology Integration and Upgrading

With the constant emergence of new technologies, enterprises need to effectively integrate these into their existing business processes and carry out necessary upgrades. This not only requires substantial financial investment but also overcoming issues of technology compatibility and integration.

Countermeasures 1:

(1) Technology Roadmap Planning: Develop a clear technology development roadmap, specifying short-term and long-term objectives, ensuring that technology upgrades align with corporate strategy.

(2) Partnership Building: Establish close partnerships with technology suppliers to jointly develop and implement technology integration solutions.

(3) Continuous Technical Training: Provide ongoing technical training and support for employees to enhance their understanding and application capabilities of new technologies.

Challenge 2: Adaptability of Organizational Culture and Structure

Digital transformation often necessitates changes in an enterprise's organizational culture and structure to better accommodate innovative activities. Traditional hierarchical structures and conservative cultures may impede the implementation of innovation.

Countermeasures2:

(1) Cultural Transformation: Drive change in corporate culture, encouraging employees to actively embrace new things, tolerate failure, and learn from it.

(2) Organizational Structure Adjustment: Optimize the organizational structure, reduce layers, increase decision-making efficiency, establish cross-departmental collaboration platforms, and promote knowledge sharing and innovation.

Challenge 3: Data Security and Privacy Protection

During the digitalization process, enterprises handle large amounts of sensitive data. Ensuring data security and user privacy, and avoiding potential legal risks, is a problem enterprises must confront.

Countermeasures 3:

(1) Strengthened Data Management: Establish strict data management and protection policies to ensure all data processing activities comply with legal and regulatory requirements.

(2) Investment in Security Technologies: Invest in advanced security technologies, such as encryption and firewalls, to protect enterprise data from external threats.

(3) Employee Awareness Enhancement: Conduct regular training for employees on data security and privacy protection to heighten their awareness.

Challenge 4: Allocation and Optimization of Innovation Resources

In driving dual innovation, enterprises need to rationally allocate and optimize innovation resources, including human resources, financial resources, and time, to ensure efficient innovation activities.

Countermeasures 4:

(1) Resource Priority Division: Categorize resource priorities according to the strategic importance and urgency of innovation projects.

(2) Performance Evaluation Mechanism: Establish a performance evaluation mechanism for innovation projects to ensure resource inputs yield expected innovative outcomes.

(3) Flexible Resource Allocation: Adjust resource allocation flexibly based on market changes and project progress to meet evolving innovation demands.

Challenge 5: Rapid Response to Market Changes

In the digital age, market changes occur swiftly, necessitating rapid responses from enterprises to adjust their innovation strategies promptly.

Countermeasures 5:

(1) Market Monitoring System: Establish an effective market monitoring system to track real-time market trends and consumer needs.

(2) Agile Innovation Process: Adopt an agile innovation process to shorten the time from product concept to market launch.

(3) Customer Involvement: Encourage customer participation in the innovation process, guiding product development and service improvements through feedback and suggestions.

In summary, when facing the challenges of dual innovation in digital enterprises, businesses need to comprehensively assess their conditions and adopt targeted countermeasures to proactively respond to change, thereby achieving sustainable and innovative development.

7. Conclusion and Prospects

7.1 Conclusion

In conclusion and outlook, this study, through an in-depth exploration of dual innovation in digital enterprises, has reached the following main conclusions:

(1) Dual innovation in digital enterprises encompasses both continuous improvement and optimization of existing business processes (incremental innovation), as well as exploration and breakthroughs in cutting-edge areas such as emerging technologies and new business models (disruptive innovation). These two modes of innovation complement each other, jointly driving the enterprise towards sustained development and competitive advantage construction.

(2) The digital environment provides fertile ground for dual innovation. Technologies like cloud computing, big data, and artificial intelligence offer technical support for enterprises to carry out dual innovation activities. Simultaneously, the open innovation ecosystem encourages enterprises to continuously expand their collaborative boundaries, thereby enhancing innovation efficiency.

(3) Effective management and balancing organizational conflicts and resource allocation are critical in implementing dual innovation within digital enterprises. This necessitates adaptive reforms in institutional design, cultural shaping, and human resource management within the company to ensure that both innovative models can coexist harmoniously and maximize their value within the organization.

(4) Digital strategy is closely linked with dual innovation capabilities. A comprehensive and profound digital strategy implementation contributes to building a flexible and open organizational structure, fostering a culture conducive to innovation, inspiring employees' innovative potential, and ultimately enhancing the dual innovation capability of the enterprise.

7.2 Prospects

Looking ahead, several suggestions are proposed for future research directions on dual innovation in digital enterprises:

(1) Future studies should consider how the further maturation and popularization of frontier digital technologies like 5G, IoT, and blockchain will present more possibilities for the development of dual innovation in enterprises. For instance, high-speed, low-latency data transmission enabled by 5G technology can drive service innovations like remote control and predictive maintenance of products, while blockchain technology can promote model

innovation in areas such as supply chain finance and data sharing under the premise of ensuring information security.

(2) With the acceleration of global digitalization, cross-regional and cross-industry collaborative innovation will become the norm. Therefore, researching how to construct an open innovation network supportive of dual innovation and how to efficiently allocate and integrate innovation resources on a global scale holds significant theoretical and practical implications.

(3) From a policy-making perspective, governments should increase their support for dual innovation in digital enterprises by formulating suitable science and technology innovation policies and improving intellectual property protection systems, thus providing a favorable external environment and institutional safeguards for the enterprises' dual innovation.

(4) For enterprises themselves, they should continue to deepen their understanding and application of digital technology, and continuously improve their data-driven decision-making and innovation capabilities to achieve their continued growth and leading position in a complex and ever-changing market competition environment.

In summary, dual innovation in digital enterprises is a complex and dynamic process that requires concerted efforts from academia, industry practitioners, and policymakers to continually explore and refine, ultimately better propelling the rapid development of the digital economy in China and globally.

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