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How Digital Transformation Affects the Innovative Development of Tobacco Enterprises

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MSc in Business Administration

Supervisor:

PhD, Alexandra Azevedo Fernandes O'Neill, Invited Lecturer

Iscte – Instituto Universitário de Lisboa

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Department of Marketing, Strategy and Operations

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Resumo

Este estudo explora o efeito da transformação digital no desenvolvimento inovador das empresas de tabaco. Através de uma revisão abrangente da literatura, quadro teórico e análise empírica, investiga-se como o nível de aplicação tecnológica, a literacia digital dos colaboradores e o investimento digital influenciam a capacidade de inovação e a vantagem competitiva destas empresas. Os resultados da investigação sugerem que a melhoria da literacia digital dos colaboradores e o aumento do investimento digital têm um impacto positivo na capacidade de inovação, enquanto um nível inferior de aplicação tecnológica tem um efeito negativo. O estudo enfatiza a importância de formular estratégias de transformação digital adaptadas às necessidades específicas das empresas de tabaco para melhorar a inovação e a competitividade. As recomendações incluem o foco na formação digital e no investimento, a alocação eficaz de recursos e a promoção da inovação para alcançar um crescimento sustentável. Adicionalmente, a investigação destaca a importância da privacidade dos dados, da fiabilidade e da validade na recolha e análise de dados. As limitações incluem o uso de dados transversais e a necessidade de futuros estudos considerarem fatores adicionais de influência e expandirem o âmbito a diferentes indústrias para análise comparativa. O estudo fornece insights valiosos para as empresas de tabaco que procuram aproveitar a transformação digital para o sucesso a longo prazo num mercado em evolução.

Palavras-chave: Transformação digital, Empresas de tabaco, Capacidade de inovação, Vantagem competitiva, Literacia digital dos funcionários

Classificação JEL: M10 – General, O32 - Management of Technological Innovation and R&D

Abstract

This study explores the effect of digital transformation on the innovative development of tobacco enterprises. Through a comprehensive literature review, theoretical framework, and empirical analysis, it investigates how technology application levels, employee digital literacy, and digital investment influence the innovation ability and competitive advantage of these enterprises. The research findings suggest that improving employee digital literacy and increasing digital investment positively impact innovation ability, while a lower level of technology application has a negative effect. The study emphasizes the significance of formulating digital transformation strategies tailored to the specific needs of tobacco enterprises to enhance innovation and competitiveness. Recommendations include focusing on digital training and investment, effectively allocating resources, and promoting innovation to achieve sustainable growth. Additionally, the research highlights the importance of data privacy, reliability, and validity in data collection and analysis. Limitations include the use of cross-sectional data and the need for future studies to consider additional influencing factors and expand the scope to different industries for comparative analysis. The study provides valuable insights for tobacco enterprises seeking to leverage digital transformation for long-term success in the evolving market landscape.

Keywords: Digital transformation, Tobacco enterprises, Innovation ability, Competitive Advantage, Employee digital literacy

JEL Classifications: M10 – General, O32 - Management of Technological Innovation and R&D

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Chapter 1 - Introduction

This study explores the impact of digital transformation on innovation in the tobacco industry. Specifically, the research will concentrate on analyzing the effects of digital transformation on the innovation capabilities, product development, and marketing of tobacco enterprises to reveal the impact of digital transformation on the strategy and operations of the tobacco industry.

With the rapid growth and application of digital technologies, tobacco enterprises face pressure and opportunities for digital transformation. Understanding the influence of digital transformation on tobacco enterprises can help companies formulate effective strategies and development paths to enhance innovation capabilities and competitiveness. Furthermore, the research results can provide valuable references for the tobacco industry's managers, decision-makers, and stakeholders, promoting sustainable development and transformation upgrades.

1.1. Contextualization

Enterprises' business, operations, and customer relationships are transformed by integrating and innovating digital technology. This process is called digital transformation. Digital transformation has become a significant trend that must be addressed worldwide and cannot be ignored, especially in tobacco enterprises that have been in traditional industries for a long time and gradually face market competition pressure. As one of the industries with a considerable market value worldwide, the conventional production and sales model has yet to meet modern consumers diversified and personalized needs (Zhang, 2022).

Based on the analysis of tobacco enterprises' internal and external environment, combined with the existing relevant theories and empirical research, we will explore the impact of digital transformation on the innovation and development of tobacco enterprises. The development and current situation of the tobacco industry show that this industry is facing multiple challenges, such as industrial restructuring, intensified market competition, and changing consumer demand. Digital transformation may be a key for tobacco enterprises to cope with these challenges and achieve sustainable development (Li et al., 2022).

Digital transformation's significance is integrating digital technology to innovate business models, improve operational efficiency, optimize customer experience, and realize enterprise value improvement (Fang et al., 2022). According to the research of Yang et al. (2022), digital transformation can promote internal innovation and produce a customer contagion effect. From

the perspective of supplier innovation, this plays a positive role in promoting the whole industrial chain. In this process, tobacco enterprises can better understand market demand and consumer behavior through data analysis and artificial intelligence technology for more accurate market positioning and product development (Jin et al., 2022).

Promoting digital transformation will help tobacco enterprises realize the allocation and utilization of resources better and improve productivity. Tao et al. (2023) show that digital transformation can enhance the resilience of industrial and supply chains, thus further improving the productivity of enterprises. By promoting their innovation activities, digital transformation may also positively affect enterprises' ESG performance and help improve their social responsibility and environmental friendliness (Hu et al., 2023).

Digital transformation impacts all aspects of an enterprise, including its production, operations, internal relationships, and structure. Xiao et al. (2022) pointed out that the digital transformation of enterprises will lead to the adjustment of human capital structure, which may impact the labor income share. This transformation may lead to the disappearance of some traditional functions, but it will also lead to new functions and positions. Therefore, tobacco enterprises need to consider the training and development of employees when carrying out digital transformation to adapt to the latest business models and working methods.

Therefore, according to recent published literature, digital transformation has offered new opportunities and a series of challenges to the innovation and development of tobacco enterprises. To fully use the opportunities brought by digital transformation, tobacco enterprises should formulate and implement their digital transformation strategies according to their actual situation and constantly improve their innovation ability and market competitiveness. At the same time, enterprises also should consider the changes brought by the digital transformation on the internal structure and external environment of the enterprise, as well as the long-term impact of these changes on the development of the enterprise and make corresponding adjustments and responses.

1.2. Research Questions

Considering the previously explained relevance of understanding the changes brought by the digital transformation, in the present study, we investigate how digital transformation impacts the innovative development of tobacco companies. As a crucial part of the global economy, the sustainable development and innovation of the tobacco industry are significant. Digital

transformation is a critical factor in promoting the innovative development of tobacco enterprises.

This study explores the application and practice of digital transformation in tobacco enterprises. Previous studies have shown that digital transformation has a critical influence on enterprises' productivity, innovation performance, and financial performance (Xue, 2022; Li et al., 2022; Bai et al., 2022). However, more empirical research is needed on how digital transformation affects tobacco enterprises' innovative developments.

This study investigates how digital transformation affects tobacco enterprises' internal operation and organizational structure, as according to Li et al. (2022), the digital transformation of enterprises is closely related to the development of China's real economy. Therefore, this study explores how tobacco enterprises' operation modes and organizational structures are adjusted to adapt to new development trends and achieve more efficient innovative development. The conducted research also aims to analyze the impact of digital transformation on the relationship between tobacco companies and their supply chain partners. In this sense, Yang et al. (2022), have discussed the customer contagion effect of digital transformation from the perspective of supplier innovation. Based on this perspective, this study will further aim to understand how digital transformation can promote tobacco enterprises to establish closer and more collaborative cooperative relations with their supply chain partners to promote the innovative development of the entire industrial chain.

The study also aims to examine the role of digital transformation in the strategic decision-making of tobacco enterprises, considering that Fang et al. (2022), had also raised a fundamental question of whether digital transformation has promoted shared prosperity within the enterprise.

By exploring the previously mentioned questions, this study aims to fill the gap in the existing literature on how digital transformation explicitly affects tobacco enterprises' innovative development and provides theoretical and practical guidance for tobacco enterprises to realize digital transformation and creative development. The study results aim to enable tobacco enterprises to meet the challenges and opportunities of digitalization more effectively and lay a solid foundation for their long-term development. At the same time, it also aims to provide support and reference for the government to formulate policies and promote the sustainable development of the tobacco industry in the digital transformation era.

1.3. Study Purpose and Significance

This study investigates how digital transformation affects the innovation and development of tobacco enterprises. It specifically looks at the impact of the following independent variables: *technology application level, employee digital literacy, and digital investment on tobacco enterprises' innovation ability and competitive advantage*. The aim is to provide insights into how these factors can be leveraged to improve innovation and competitiveness in the tobacco industry. The primary purposes of this study are to improve the understanding and cognition of tobacco enterprises on digital transformation and to provide theoretical support and practical guidance for the digital transformation of tobacco enterprises, thus promoting the sustainable innovation and development of the tobacco industry.

Digital transformation significantly impacts an enterprise's innovation ability and competitive advantage, making it an essential driving force for enterprise development and innovation (Li et al., 2022). Specifically, the application level of technology, the digital literacy of employees, and the digital investment are the key factors that promote the digital transformation of tobacco enterprises, which build the basic framework of the digital transformation of enterprises and further affect the innovation ability and competitive advantage of tobacco enterprises. Through research on the relationship between these independent and dependent variables, this study aims to provide scientific and systematic digital transformation strategies for tobacco enterprises and help them improve their innovation ability and competitive advantage more effectively.

For tobacco enterprises, digital investment may improve the resilience of the industrial and supply chains (Tao et al., 2023) and thus optimize enterprise productivity. At the same time, improving the employees' digital literacy and technology application level can further promote the integration of enterprises into the global innovation network and improve innovation performance (Li et al., 2022). The comprehensive application of cutting-edge technologies can help tobacco enterprises realize their digital transformation better and improve their innovation ability and competitive advantages.

This study is intended to propose responses to and extend the existing academic discussion on the digital transformation of enterprises, filling the research gap on the application of digital transformation in tobacco enterprises. Through in-depth analysis and empirical research, this study can provide more comprehensive and in-depth theoretical insights for the academic circle and practical strategic suggestions for the practical operation of tobacco enterprises to promote the sustainable development and innovation of the industry.

Meanwhile, this study also aims to highlight social significance. As an essential trend of the development of enterprises in the new era, the influence of digital transformation far exceeds the enterprise level. It involves the social and economic structure and development model. Therefore, a study of the impact of digital transformation on tobacco enterprises can promote the healthy development of the tobacco industry and help realize the sustainable development of the social economy.

In conclusion, this study conducts comprehensive research on digital transformation and its impact on tobacco enterprises through theoretical discussion and empirical analysis. It aims to provide insights and references for enterprises and academia and promote the more lasting and sustainable development of tobacco enterprises and society.

1.4. An Overview of The Study Methods

The study uses secondary and primary data collected from a series of information related to tobacco enterprises to quantify the three independent variables of technology application level, employee digital literacy, and digital investment. This research will capture data from publicly available corporate financial reports, industry reports, government publications, and related academic articles. This data aims to evaluate the performance of tobacco companies in the digital transformation more accurately and understand how the transformation affects the innovation ability and competitive advantage (Li et al., 2022). The study also employs multiple linear regression analysis to examine the extensive impact of digital transformation on the innovative development of tobacco companies.

Digital transformation is comprehensive and complex (Zhang, 2022), involving adjustment and change at multiple levels. Therefore, when evaluating the independent variables, this research will use various indicators to measure each variable's performance to obtain a more comprehensive and in-depth analysis. For example, this research will measure the application level of technology application from the aspects of technology input, number of technology research and development personnel, breadth and depth of digital application, from the aspects of employees' digital training, digital skills, and digital application ability, and measure digital investment from the elements of digital investment amount, investment efficiency and return on investment. We will analyze the links between the application level of technology, the digital literacy of employees, the digital investment and the innovation ability of tobacco enterprises, and the competitive advantage of tobacco enterprises (Yang et al., 2022).

Digital transformation has become the core strategy pursued by today's enterprises, and it plays a crucial role in promoting the innovation and development of enterprises (Bai et al., 2022). Based on the analysis findings, we will discuss the practical significance and far-reaching impact of digital transformation on the innovation and development of tobacco enterprises. The results aim to assist the academic community in gaining a more comprehensive understanding of the impact of digital transformation on enterprise innovation and competitive advantage. Additionally, the results provide valuable references for practical enterprises to help them develop more effective strategies and policies in digital transformation (He et al., 2023).

The conducted research aims to enhance our understanding of digital transformation's practical application and advantages in the tobacco industry. It also seeks to deepen our theoretical knowledge of how digital transformation can foster enterprise innovation and development. Ultimately, this study will provide scientific and practical theoretical support to tobacco companies seeking to undergo digital transformation.

1.5. Dissertation Structure

To fully understand how digital transformation affects the innovation ability and competitive advantage of tobacco enterprises, the conducted research contemplates a systematically designed structure to enable discussion and present a clear and complete research portrayal.

The introduction chapter contextualizes and defines the research question, clarifies its relevance and importance, states the research objectives and questions, and presents the dissertation structure.

The following chapter, regarding literature review and theoretical basis, reviews the research in related fields and builds the theoretical framework of this study based on existing academic theories. This will enable us to explore the possible correlation between the independent variables of technology application level, employee digital literacy, digital investment, innovation ability, and competitive advantage of tobacco enterprises to lay a solid theoretical foundation for the subsequent empirical research.

The next chapter, Methodology, presents an overview of the study methods and details the study design, data collection, and analysis methods used in this study. This study analysis the connection between innovation ability and competitive advantage of tobacco enterprises from three dimensions: technology application, employee digital literacy, and digital investment.

The results, findings, and discussion chapter present the analysis of the collected data and the research findings, contributions to existing theory, and implications for practice. In this

chapter, we will examine the relationship between the respective variables interpret the data, and compare with the existing theories to obtain the main findings of this study.

The last chapter includes conclusions, recommendations, limitations, and implications for academic and practical fields based on the primary research findings. In this chapter, the study also discusses the research limitations and future research directions and proposes more comprehensive and in-depth research recommendations.

In conclusion, this study conducts systematic research through strict structural design, aiming to explore how digital transformation can shape tobacco enterprises' innovative development and competitive advantage. Through the discussion of relevant theories, the analysis of empirical data, and the interpretation of the results, this study expects to provide academic support for digital transformation and enterprise competitiveness and provide guiding suggestions for the practical operation of tobacco enterprises.

Chapter 2 - Literature Review

This chapter comprises the literature review and theoretical basis of the conducted research. It reviews published research on how digital transformation impacts the innovative development of tobacco companies, mainly through artificial intelligence. The chapter builds the theoretical framework of the presented study based on secondary research data.

When discussing the digital transformation of tobacco enterprises and its impact on the innovation and development of organizations, we consider the core factors of digital transformation: *technology application level, digital literacy of employees, and digital investment*. We propose that these variables impact tobacco enterprises' innovation ability and competitive advantage.

The level of technology application is essential for promoting further innovation and development in tobacco enterprises, this was confirmed in the research by Li et al. (2022), who proposed that the digital transformation of enterprises has supported the development of China's real economy and further promoted innovation and competitiveness. Thus, a high degree of technology application can encourage tobacco enterprises to innovate in production, management, and marketing, thereby gaining more competitive advantages.

According to literature, the digital literacy of employees has a decisive impact on the digital transformation of tobacco enterprises. The digital literacy of employees determines whether enterprises can make full use of digital tools and technologies, give full play to their potential, and achieve innovation goals. In this sense, the research conducted by Zhang (2022) proposes that digital transformation can drive the all-round development of an enterprise by improving corporate culture, staff literacy, and management efficiency.

Moreover, literature proposes that digital investment is the key to achieving digital transformation. Sufficient investment in both hardware facilities and software development may ensure the success of tobacco companies in the digital transformation. Regarding this perspective, the research by Yu et al. (2022) reveals the significant impact of the digital transformation of commercial banks on labor demand and underlines the importance of investment in promoting digital transformation.

However, the impact of digital transformation on the innovation and development of tobacco enterprises is multifaceted. The research results of Fang et al. (2022) on whether digital transformation promotes shared prosperity in enterprises show that digital transformation has indeed created more development opportunities for enterprises. For tobacco enterprises, by improving the application level of technology, strengthening the digital literacy training of

employees, and increasing the digital investment, their innovation ability and competitive advantage may be further improved.

At the same time, Xiao et al. (2022) proposed that the digital transformation of enterprises may also promote the corresponding adjustment of the human capital structure and then affect the share of labor income. In the digital transformation, tobacco enterprises can form a virtuous development cycle by introducing and applying technology, improving digital investment, increasing employee literacy, and improving enterprises' innovation ability and competitive advantage.

From a global perspective, the digital transformation has also enabled tobacco companies to become more integrated into the global innovation network. The research of Li et al. (2022) shows that integrating digital transformation and international innovation networks can enable to improve the innovation performance of enterprises. In today's deepening globalization and digitalization, tobacco enterprises should actively embrace digital transformation and better integrate into the global innovation network to enhance their innovation and development ability and competitive advantages.

Considering the described scenario, we propose that the three independent variables of *technology application level, employee digital literacy, and digital investment are the core factors affecting the digital transformation of tobacco enterprises*. The improvement of these factors may directly affect the innovation ability and competitive advantage of tobacco enterprises, thus promoting the innovation and development of tobacco enterprises in the global market. Besides this, we propose that tobacco enterprises should also have a deep understanding of the role of digital transformation in reshaping the development mode and organizational structure of enterprises to develop a more scientific and reasonable development strategy.

Literature indicates that digital transformation has become one of the core strategies of modern enterprises, which profoundly impacts their production efficiency and competitive advantage. Understanding this concept and its type is explicitly the critical problem discussed in the conducted research. In this sense, Yang et al. (2022) proposed that digital transformation involves using digital technologies, such as big data and artificial intelligence, to realize fundamental changes in business, operation, and organizational models. The authors propose that the goal of digital transformation is to improve the efficiency, innovation ability, and competitiveness of enterprises.

Digital transformation may also enable companies to understand the market and customer needs better, according to literature. By analyzing and utilizing big data, enterprises may find market trends and consumer behavior patterns to develop more accurate market strategies. In

this perspective, Zhang (2022) suggests digital transformation is of great significance for formulating market positioning and competitive strategy of enterprises.

As suggested by literature, digital transformation is also a vital aspect in enhancing the effectiveness of a business's internal operations. Authors suggest that through digital technology, enterprises can automate and optimize their business processes, reduce operating costs, and improve their employees' work efficiency. Li and Pan (2022) pointed out that digital transformation helps enterprises realize the optimal allocation of resources and improve productivity.

To understand digital transformation and its impacts, we must also take into consideration that literature indicates that it may be divided into technology-driven, business-driven, and organization-driven digital transformation. According to literature, technology-driven digital transformation focuses on adopting advanced technology to improve products or services. For example, artificial intelligence can be used for product design and service optimization. Meanwhile, business-driven digital transformation focuses on changing enterprises' business models and market strategies through digital means, such as applying e-commerce platforms. On the other hand, the organization-driven digital transformation mainly optimizes the enterprise's organizational structure and management mode through digital means to adapt to the rapidly changing market environment. In this perspective, Fang and Lin (2022) proposed a similar classification and emphasized the interaction and integration of these types in practical applications.

The present research proposes that digital transformation is a technological innovation and a comprehensive change involving all enterprise levels. We propose enterprises should develop appropriate digital transformation strategies according to their situation and market environment to achieve sustainable development. In general, considering literature's perspective, the essence of digital transformation lies in enterprises' adaptation and application of emerging technologies to achieve the transformation and improvement of their business goals.

Research points out that while pursuing economic benefits, tobacco enterprises face many challenges and pressures. Digital transformation provides a new development path for these enterprises. The application of digital transformation in tobacco enterprises is mainly reflected in production, marketing, and enterprise management. Bai (2022) found that through digital transformation, tobacco companies can manage their supply chains more effectively, optimize production processes, and improve production efficiency.

Through automation and digital technologies such as the Internet of Things and artificial intelligence, tobacco companies have achieved precise control and optimization of the production process. This digital transformation improves production efficiency and helps reduce production costs, achieve sustainability goals, and promote environmental friendliness (He et al., 2023).

Tobacco companies use extensive data analysis and social media marketing to gain more accurate insight into consumer needs and trends, develop personalized market strategies, and increase their market share. Ding (2023) also mentioned that the development of the digital economy provides new marketing opportunities for tobacco enterprises and helps to enhance their competitiveness.

For enterprise management, tobacco enterprises are realizing the integrated management of enterprise resources and improving the decision-making efficiency through digital means, such as the enterprise resource planning system. In this sense, Li et al. (2022), found that digital transformation promotes tobacco enterprises to better integrate into the global innovation network and improve innovation performance.

The present research proposes that tobacco enterprises must have clear goals and strategies in the digital transformation to ensure that the digital transformation can bring real value to the enterprises. We propose tobacco enterprises must also continue exploring and practicing to better respond to the changing market environment.

2.1. Needs And Prospects of Digital Transformation

In studying digital technology applications in tobacco enterprises, cloud computing, big data, and artificial intelligence show potential and practicality. By analyzing the research of Tao (2022) and Zhang (2022), the authors propose that digital transformation can optimize the productivity and operational efficiency of enterprises. In the tobacco industry, these technologies can enhance product quality management, market research, and customer service and further enhance the competitive advantage of enterprises. These technologies are not limited to optimizing existing business processes but can also create new business models and revenue streams, such as developing personalized marketing strategies based on big data.

Cloud computing can provide scalable computing resources that allow tobacco companies to adapt their IT infrastructure flexibly to meet business needs without investing heavily in hardware facilities. Big data technology can help tobacco companies better understand market trends and consumer needs and develop more precise market strategies to gain market share. In

addition, artificial intelligence can play an essential role in product design, production, and marketing, as well as in achieving more efficient and accurate operation management through intelligent analysis and decision-making.

Digital transformation has brought significant advantages to tobacco enterprises, but there are also certain risks and challenges. According to research by Li and Dang (2022), digital transformation can help enterprises integrate into global innovation networks and improve their innovation performance. However, Fang and Lin (2022) pointed out that digital transformation may also lead to inequalities within enterprises, especially regarding labor demand and income distribution.

In terms of advantages, digital technology can optimize the production process of tobacco enterprises and improve efficiency and output. For example, applying artificial intelligence to make market predictions may enable enterprises to more accurately grasp the market demand and reduce inventory costs. Through extensive data analysis of consumer behavior and preferences, tobacco companies may more accurately conduct product design and marketing activities to increase their market share.

However, digital transformation also carries potential risks. The risk of data security and privacy leakage is increasingly prominent, affecting the reputation of enterprises and leading to legal liability. On the one hand, with the introduction of new technologies, tobacco companies need to constantly update their business models and organizational structure, which may lead to conflict and cultural conflicts among employees. More importantly, tobacco companies face the challenge of the digital divide, namely, how to balance the investment and benefits of technology and how to solve the moral and ethical issues arising from the application of technology.

2.2. Innovative Development

Ferreira et al. (2019) found that enterprises often adopt new digital processes to maintain and increase their market share and improve product quality. Moreover, Reddy and Reinartz (2017) pointed out through research that digital transformation can effectively reduce the interaction cost of market participants in information exchange, coordination, protection and implementation, reduce the degree of information asymmetry among market participants, release enterprise value and improve potential benefits.

Meanwhile, the research conducted by Wiesbdck and Hess (2020) proposed the use digital technology to explore new business processes or improve existing processes from the

perspective of processes, to reduce the cost of operation and management processes and improve service quality. Regarding this perspective, Bouncken et al. (2021) pointed out that enterprises can apply digital technology to improve or innovate internal and external processes and integrate them into new business models. With the deepening of enterprise digitalization, the creation, assertion and acquisition of enterprise value will be carried out through digital processes and technologies.

Considering the research conducted by Shamsud (1996), these authors proposed that enterprises should reposition themselves, find a suitable development path and allocate resources reasonably, to maximize the overall competitiveness of enterprises and cope with the current new economic environment. This approach is underlined by Loebbecke and Picot (2015) that believe that in this process, the biggest impact on enterprises is that the application and development of digital technology make big data and the Internet transform enterprises and create new management models. However, Hess (2016) pointed out that the top managers of an enterprise can also be an important driving force for the transformation of the enterprise. Marion and Meyer (2015) on the other hand, analyzed the effect of digital design on product structure from the perspective of information infrastructure, and reached a conclusion that information technology infrastructure can play a role in the design of modular products, and then play a role in the innovation performance of products. Complementarily, Eisenhardt et al. (2000) believe that dynamic capability refers to a process in which an enterprise acquires, integrates and reconstructs resources, which can indirectly improve the performance of an enterprise by influencing its operational capability. In this sense, Teece (2007) believes that dynamic ability mainly includes three aspects: environmental perception, learning and absorption, and integration and reconstruction ability.

Currently, the literature on enterprise digital transformation is divided into two main categories: *factors affecting digital transformation and the economic consequences of digital transformation*. In terms of the research on the factors affecting digital transformation, Chen (2019) proposes that a dual business model, open organization, cooperative and United corporate culture, firm leadership, technological penetration, and the right people are essential abilities to accelerate the digital transformation of enterprises. In this context, Li (2018) suggests that management and cognitive change, improvement of organization and coordination, formation of business teams, and development of management social capital are the essential abilities that affect the digital transformation of small and medium-sized enterprises. On the macro level, and aiming to understand the impact of innovative development, Svbetov (2018) also discussed and underlined the role of the digital economy in promoting women's

employment by studying the frequency of credit card transactions and the popularity of the Internet. We may from this refer that Chinese and foreign scholars show interest, discuss and analyze the economic consequences of digital transformation from macro and micro perspectives.

Literature indicates that digitalization has improved the quality of the economy in different aspects, and the promotion effect of the digital economy on the quality of economic development can be better brought into play through institutional innovation (Song Yang, 2019). The research findings of Liu (2020) suggest that an innovative digital management framework Ubay, from support to process to output and found that the digital economy based on IT infrastructure and the Internet has occupied a certain amount in the world economy, but it will also increase some new ways of tax evasion. Researchers also propose that the development of the digital economy will constantly promote the upgrading of industrial structure, and the specific effect is an accelerated upward curve (Chen, X. H, 2020). Authors compared the production system and distribution structure between the new era of the digital economy and the era of the industrial revolution, and the results showed that the digital economy not only promoted production innovation but also damaged the remuneration of working people at the micro level, these studies propose that digital transformation has changed small and medium-sized companies' organizational structure and marketing methods by applying new technologies and improving their value and efficiency (Canhoto, 2018). Qiu and Guo (2019) summarized the effects of digital transformation, which played a role in connecting networks, reducing costs, and generating new value and value governance. Authors propose that digital transformation can improve economic benefits by saving costs and improve efficiency (He et al., H. X, 2019).

Liu (2020) research shows that digital transformation promotes the decentralization of enterprises by improving the cost of organizational information resources and reducing the cost of organizational agency. Authors also believe digitalization can improve corporate governance by rationalizing managers' decision-making and reducing information asymmetry (Qi, J., 2020). These authors proposed that the management costs derived from digital transformation will reduce the benefits, and ultimately, digitalization has no significant impact on the overall performance of enterprises (Qi et al., C. W, 2020).

Still regarding innovative development, literature proposes that under the background of the booming digital economy, promoting the company's management innovation by replacing competition and user value can not only help enterprises accurately locate their goals and optimize their management structure but also promote the reform of internal management methods (Xiao, X, 2020). Research shows that digital transformation can promote the

productivity of enterprises through four significant effects, namely scope economy, scale economy, management efficiency, and technological innovation (Du, C. Z. and Zhang, Y, 2021). In this sense, literature proposes that digitalization can improve enterprise value, especially for enterprises whose life cycle is mature (Li, X. Z, 2021). Published research also proposes that enterprise digitalization positively affects investment efficiency, but it hurts over-investment, and the performance fluctuation between them plays an intermediary role (Chen, Y. F, 2022). Research results also indicate that digitalization can restrain the risk of the stock price crash, and this result is more evident for enterprises with high social responsibility, non-state-owned enterprises, non-stock price crash enterprises, and enterprises in a high institutional environment (Lin, C.'s, 2022). Authors believe that digital transformation can reduce the risk of corporate debt default by reducing business risks, saving agency costs, and relaxing financing constraints (Wang, S. H, 2022).

Many factors affect innovation, and external environment and internal heterogeneity will affect innovation behavior differently. Therefore, the factors influencing enterprise innovation can be divided into external and internal aspects. From the external factors that affect innovation, literature proposes that the demand of users in the market is the critical factor for the innovation of high-tech enterprises in China (Zhang et al., Y, 2014). Research shows that the financial subsidy policy has different incentive effects on enterprises with varying property rights, and it has the best impact on private enterprises in promoting innovation performance (Shao et al., S. J, 2015). Literature proposes that the government can improve the innovation level of both sides by enhancing the protection of intellectual property rights to promote the collaborative research and development of different enterprises and give full play to their respective advantages (Kafouros et al., 2015). In this sense, tax incentives have played a positive role in promoting innovation investment, and this influence is different in areas, property rights, and company size (Yuan et al. et al., 2016). Research also shows that government tax incentives can improve the company's output expectations and benefits in innovation investment and reduce risks (Rao's, 2016). Sheng (2017) studied the impact of intellectual property protection on innovation from the perspective of the life cycle and found that the relationship between the two was inverted U-shaped for enterprises in growth and maturity, while for enterprises in recession, the intensity of intellectual property protection inhibited enterprise innovation. Research shows that the business environment positively impacts innovation investment (He et al., D. J, 2018), as it also proves that financial subsidies can significantly increase the R&D investment of enterprises (Yao et al., Y. Y, 2019). In this perspective, research found that the imperfect system will lead to the unscientific allocation of market factors, hindering enterprises from

implementing innovative behavior, improving their creative ability, and restricting innovation level (Chen et al., N. P, 2020), and that tax incentives can significantly improve innovation performance (Yang et al., X, 2021).

From the internal factors that affect innovation, literature suggests that the diversity of financing channels and methods positively impacts improving the company's innovation ability (Ayyagari et al., 2011). Research shows that through technology spillover, foreign ownership can stimulate technological progress and encourage enterprises to implement innovative behavior (Luong et al., 2017). Lu et al. (2018) proposed that in different organizational structures, the positive effects of equity incentives on innovation levels are different. Meanwhile, Wang Yanan and Dai W. T. (2019) found that internal control can control risks and increase the input of innovative resources by reducing agency conflicts and information gaps, thus promoting enterprises to carry out creative activities. Literature studied the relationship between financing constraints and innovation and found that financing constraints hindered investment decision-making and reduced output (Cheng, Y. et al., 2021). An appropriate two-tier ownership structure can positively impact innovation input and output. However, if the proportion of ownership is unbalanced, it will have a restraining effect (Yang et al., J. Q, 2021).

The referenced literature mentioned above provides a relatively rich discussion on digital transformation and the ability of enterprises to innovate. However, more research is needed on the influence of digital transformation on the innovation ability of enterprises. The effect of digital transformation on enterprise innovation has only been a concern for Chinese and foreign researchers in recent years, so there are few related documents. Most authors believe that the digital transformation of enterprises can promote innovation, and that the digital transformation of companies, as an innovation in operation mode, will impact innovation ability (Eha et al. 2018). For those companies that integrate digital technology into their operations, digital transformation will promote innovation through two channels: one is to save costs, and the second is to improve the efficiency of the operation, which will eventually improve the company's innovation level, in this sense it is proposed that digitalization may effectively enhance the innovation level of companies (He, F. and Liu, H. X, 2019).

Further research found that since digital technology can collect information, digital transformation can positively impact innovation performance and help companies explore and innovate business models (Li, 2017). In this sense, with digital transformation, enterprises can promote innovation in specific ways, such as information interconnection, dynamic use of data, and building digital platforms (Yang, Y. J, 2020), as digital transformation has a particular influence on the innovation of manufacturing companies in terms of products, processes,

business models, and organizational innovation (Yang, D, 2021). In this sense, the conducted research by Wang (2021), contemplated small and medium-sized companies in traditional industries in China as research samples and found that the digital transformation of small and medium-sized companies can significantly promote innovation. Some scholars believe that digital transformation may hinder enterprise innovation, believing that the digital transformation of enterprises has a positive impact but also brings certain risks (Chen C. H, 2019). Moreover, authors consider that blind digital transformation will not only positively affect innovation performance but may also inhibit the company's innovation performance due to increased costs. Authors like Wang (2021) also found that the company's original innovation model, knowledge scope, and facilities investment may not apply to digital transformation, so there may be some obstacles in the process of digital transformation, which is not conducive to company innovation.

Lin (2023) believes that digital transformation has become a new trend in many industries due to the rapid development of the economy, science, and technology. After surveying over 400 Chinese companies on their digital maturity, only a few significantly impact digital transformation. Lin (2023) suggests that the digital transformation of Chinese enterprises could accelerate, and tobacco companies' digital transformation elements need to increase their market share. Therefore, the study indicates that tobacco companies should analyze and comprehend the impact of digital transformation on corporate performance.

The secondary research data obtained by the literature review aimed to enable the understanding of the drivers and influencing factors behind the digital transformation of tobacco enterprises and provide theoretical support and analytical framework for research. At the same time, combined with actual cases and data, the application and influence of digital transformation in the tobacco industry can be discussed in more depth and breadth.

In the present section, we presented the literature review and theoretical basis, reviewing the literature research on innovative development and tobacco digital transformation, building the theoretical framework of this study based on existing academic theories. In the following chapter, we will present the conceptual model and research hypothesis aiming to, combined with the above literature review, understand how the level of technology application, employee digital literacy, and digital investment affect the innovation ability and competitive advantage of tobacco enterprises.

Chapter 3 - Methodology

This chapter details the rationale and strategy of the research approach used to explore how digital transformation affects the innovative development of tobacco enterprises. The conducted study examines the impact of three independent variables, technology application level, employee digital literacy, and digital investment, on the innovation ability and competitive advantage of tobacco enterprises. Resource-based theory posits that the resources and capabilities of enterprises are key factors in achieving competitive advantage. Digital transformation, technology application level, and digital investment are considered vital resources that enhance competitiveness and promote innovation. According to human capital theory, the knowledge, skills, and experience of employees significantly influence enterprise performance. Employees' digital literacy, as a component of human capital, according to literature is crucial for the innovation and competitiveness of enterprises.

Based on the theoretical framework, the following hypotheses were formulated: H1: The technology application level will affect enterprises' innovation performance; H2: Employees' digital literacy will affect enterprises' innovation performance; H3: Digital investment will affect the innovation performance of enterprises. According to resource-based theory, the level of technology application is regarded as an essential resource for enterprises, providing them with competitive advantages. Practical technology applications can improve production efficiency, enhance product quality, and bolster enterprises' innovation ability. By adopting advanced technologies and tools, enterprises can better respond to changes in market demand, elevate their product research and development, and innovate to stand out in a highly competitive market. This process of technology-driven innovation helps businesses continuously refine their products and services, thereby improving their market competitiveness and innovation performance. Barney's (1991) research underscores the significance of technology application levels in driving innovation performance, offering a theoretical foundation for businesses to sustain their competitive advantage in an ever-changing market environment. Therefore, Hypothesis H1 is proposed: H1: The technology application level will affect enterprises' innovation performance.

Considering the theory of human capital, employees' digital literacy is considered essential human capital that significantly impacts the innovation performance of enterprises. Employees with high digital literacy can better understand and utilize digital technology, thus fostering innovation activities and enhancing the innovation performance of enterprises (Becker, 1964). Improving digital literacy helps employees adapt to the digital environment, increase work

efficiency, and boost their innovation ability, providing robust support for enterprise innovation. By cultivating employees' digital literacy, enterprises can enable their workforce to respond more flexibly to technological and market changes, improve work quality and efficiency, and quickly master new technologies, effectively solve problems, and innovate. This brings competitive advantages to enterprises. Therefore, enterprises should focus on enhancing employees' digital literacy to promote innovation activities, improve innovation performance, and achieve sustainable development and competitive advantage. Accordingly, Hypothesis H2 is proposed: H2: Employees' digital literacy will affect enterprises' innovation performance.

According to the technology-organization-environment (TOE) framework, the impact of digital investment on enterprise innovation performance can be explained through three aspects: technology, organization, and environment. First, digital investment can enhance the technical capabilities of enterprises by introducing advanced digital technologies and tools, thereby accelerating innovation and improving product quality. Second, digital investment helps optimize organizational structures, promote information sharing and cooperation, and improve work efficiency and innovation capability. Most importantly, digital investment enables enterprises to adapt to changes in the external environment, such as market demand and competitive pressure, to maintain their competitive advantage and continue innovating. Through the comprehensive effects of technology, organization, and environment, digital investment can effectively enhance the innovation performance of enterprises. Therefore, Hypothesis H3 is proposed: H3: Digital investment will affect the innovation performance of enterprises.

Thus, the present study on how digital transformation affects the innovative development of tobacco enterprises highlights the crucial roles of technology application, employee digital literacy, and digital investment. These hypotheses underscore the multifaceted impact of digital transformation on innovation performance, providing a comprehensive framework for understanding and enhancing the competitive advantage of tobacco enterprises. By validating these hypotheses, this research aims to offer actionable insights and strategic recommendations for tobacco enterprises to leverage digital transformation effectively, driving sustainable growth and innovation in a rapidly evolving market landscape.

The study employs both primary and secondary data. Primary data were collected using an online survey designed specifically for this research. The survey was distributed to practitioners, consumers, and partners in the tobacco industry from August 10th, 2023, to November 10th, 2023. Out of 500 distributed questionnaires, 457 valid responses were recovered, yielding a recovery rate of 91.40%. The survey was divided into two sections, the first regarding the

characterization of respondents. This section collected demographic and professional details, including gender, age, income range, and industry affiliation, to ensure a comprehensive understanding of the sample. The second part of the survey, regarding core research hypotheses, this section comprised closed-ended questions answered on a five-point Likert scale to address the research hypotheses. Questions were grouped into four items: Technology Application Level, Digital Literacy of Employees, Digital Investment, and Enterprise Performance.

Regarding sample characterization, analyzing the data obtained in the survey, according to the gender distribution shown in the survey sample data, men account for 56.56%, slightly higher than women's 43.44%. In terms of age distribution, the survey data shows a relatively balanced result, among which people aged 31-40 account for the highest proportion, reaching 33.12%. Regarding the income range, the survey data showed that most of the respondents' income ranged from 10,000 yuan to 30,000-yuan, accounting for 30.15%. As far as the industry where the respondents are located is concerned, the proportion of consumers participating in the survey is the highest, accounting for 41.80%.

Secondary data included scientific articles and published data from major Chinese tobacco companies, encompassing financial and operational metrics such as Total Revenue, Net Profit, and Technology Application Level. Metrics on Digital Literacy of Employees and Digital Investment were also analyzed.

The collected data were analyzed using statistical methods to uncover potential connections between the independent variables (technology application level, employee digital literacy, and digital investment) and the dependent variables (innovation ability and competitive advantage). Regarding Reliability Analysis, internal consistency analysis (Cronbach's α coefficient) was conducted to evaluate the stability and consistency of the measurement tools. As for Validity Analysis, the validity of the measurement items was evaluated using KMO and Bartlett's test for factor analysis.

To ensure data privacy and confidentiality, encryption technology and access control strategies were employed. All data were de-identified to protect personal privacy, and the collection of sensitive information, such as employee digital literacy data, adhered to strict security measures. The data in the table regarding the List of enterprise data, sheds light on the relationship between various independent and dependent variables. In this study, we aim to analyze the primary and secondary research data to uncover potential connection between the technology application level, employee digital literacy, and digital investment - and the ability of tobacco enterprises to innovate and gain a competitive edge. By doing so, we hope to assist

management in making informed decisions and positively impact the future development of the tobacco industry.

Table 3.1 - List of Enterprise Data

Corporate name	Total revenue (RMB 100 million)	Net profit (RMB 100 million)	Technology application level (proportion of R & D expenses to total revenue)	Digital literacy of employees (proportion of employees receiving digital training)	Digital investment (the average value of digital equipment investment in the past three years (ten thousand yuan))	Innovation ability score	Competitive advantage score
Guangdong Tobacco Industry	10152.5	1507.4	1.50%	80%	4000	85.7	90
China Tobacco Jiangxi Industrial Co., LTD	396.2	57.6	1.30%	75%	3200	78.3	84.5
China Tobacco Hebei Industrial Co., LTD	474.5	71.8	1.60%	82%	3800	80.6	86
Hunan China Tobacco Industrial Co., LTD	574.8	86.8	1.40%	79%	3500	79.2	85.1
Hongta Tobacco (Group) Co., Ltd. Grass (Group) Co., Ltd	477.5	73.5	1.50%	81%	3900	80.4	85.3

Source: Self-elaborated

The indicated enterprise data framework includes the significant tobacco enterprise revenue, net profit, technology application level (research and development cost of total revenue), staff digital literacy (digital training staff proportion), and digital investment (over the past three years, digital equipment into average). These data were obtained not only from the official public data and enterprise annual reports but also from the non-public internal data of enterprises, such as internal financial data and internal survey data.

The data sources and acquisition methods displayed in the following table 3.2 aim to cover every variable, ensuring the comprehensiveness and authenticity of the data and providing a foundation for the subsequent data analysis and research conclusions. In particular, the

collection of employee digital literacy data is carried out through the internal investigation of the enterprise and the data provided by the human resources department, which aims to ensure the reliability and scientificity of the data of this variable.

Table 3.2 - Technology of Data Collection

data name	Data source (actual website domain name)	Access to the way
The innovation ability score data of tobacco enterprises	China Tobacco Guangdong Industry (http://www.tobacco.com), China Tobacco Jiangxi Industrial Co., Ltd. (www.jxtobacco.com), China Tobacco Hebei Industrial Co., Ltd. (www.hebeitobacco.com), Hongta Tobacco (Group) Co., Ltd. (www.redtowergroup.com) class	Through the company's official website, enterprise annual report, public information, industry reports, and other ways to obtain
Competitive advantage score data of tobacco enterprises	China Tobacco Guangdong Industry (http://www.tobacco.com), China Tobacco Jiangxi Industrial Co., Ltd. (www.jxtobacco.com), China Tobacco Hebei Industrial Co., Ltd. (www.hebeitobacco.com), Hongta Tobacco (Group) Co., Ltd. (www.redtowergroup.com) class	Through the company's official website, enterprise annual report, public information, industry reports, and other ways to obtain
Total revenue (100 million yuan), net profit (100 million yuan), technology application level data, etc	China Tobacco Guangdong Industry (http://www.tobacco.com), China Tobacco Jiangxi Industrial Co., Ltd. (www.jxtobacco.com), China Tobacco Hebei Industrial Co., Ltd. (www.hebeitobacco.com), Hongta Tobacco (Group) Co., Ltd. (www.redtowergroup.com) class	Through the company's annual report, internal financial data, official websites and other channels
Employee digital literacy data	China Tobacco Guangdong Industry (http://www.tobacco.com), China Tobacco Jiangxi Industrial Co., Ltd. (www.jxtobacco.com), China Tobacco Hebei Industrial Co., Ltd. (www.hebeitobacco.com), Hongta Tobacco (Group) Co., Ltd. (www.redtowergroup.com) class	It is obtained through the internal investigation and the data provided by the human resources department.
Digital investment data	China Tobacco Guangdong Industry (http://www.tobacco.com), China Tobacco Jiangxi Industrial Co., Ltd. (www.jxtobacco.com), China Tobacco Hebei Industrial Co., Ltd. (www.hebeitobacco.com), Hongta Tobacco (Group) Co., Ltd. (www.redtowergroup.com) class	Through the company's annual report, internal investment records, official websites and other channels

Source: Self-elaborated

As recommended by the literature, the research data collection followed ethical principles to ensure the information's accuracy, completeness, and reliability. The right to privacy was respected, and relevant personal data was collected and used with explicit consent. Data collection, especially data from tobacco company employees, fully complied with relevant Chinese laws and regulations and considering personal privacy and rights. All data collection and analysis were kept objective, fair, and transparent, and prejudice and injustice should be avoided to maintain the scientific and impartial nature of the research. Finally, any conflict of interest that may affect the results will be clearly stated and adequately addressed to ensure the purity and objectivity of the findings.

Protecting data privacy and confidentiality is an essential aspect of this study. All the collected data shall be kept appropriately and not disclosed to irrelevant personnel. Strict security measures were taken to prevent data leakage for sensitive information, such as employee digital literacy data. This research adopts encryption technology and a rigorous access control strategy to protect data security in the concrete implementation. Any unauthorized access and use are subject to strict restrictions. At the same time, to protect personal privacy, all data will be deidentified to ensure that it cannot be traced back to specific individuals.

In addition to sample characterization, a reliability analysis was conducted to evaluate the stability and consistency of the measuring tools. This step is essential to determine the tools' reliability and accuracy. In psychological and social science research, reliability analysis is crucial for assessing whether the measurement tools consistently reflect the actual state or characteristics of the subjects. The standard for judging reliability depends on the specific method used. Internal consistency analysis, using Cronbach's α coefficient, is commonly applied. A Cronbach's α coefficient greater than 0.7 indicates good internal consistency. Although the reliability threshold can be adjusted according to the specific research field and purpose, a higher reliability coefficient generally signifies that the measurement tool has strong stability and consistency. In the following chapter, the results table shows that each question item's corrected total correlation values. Also, validity analysis was used, as it evaluates whether each measurement item can accurately measure the degree of the concept or variable to be measured. The validity analysis is based on the results of KMO and Bartlett's sphericity test using SPSS 26 software for factor analysis. When the KMO value is more significant than 0.9, it is very suitable for factor analysis, between 0.8 and 0.9, it indicates that it is very suitable, between 0.7 and 0.8, indicating suitability, between 0.6 and 0.7, indicating that it is still acceptable, between 0.5 and 0.6, indicating poor performance, when it is below 0.5, it should

be abandoned. In the next chapter the KMO values for each variable and the overall KMO range are presented. The Pearson coefficients output by the software are used to evaluate the correlation between various variables. Specifically, we investigated the correlation between technology application level and employee digital literacy, digital investment, and enterprise-level performance.

To ensure the study's replicability, a series of measures were taken in the present study. This research details each step of data collection and analysis, ensuring all steps are clear, transparent, and traceable. All the available codes and algorithms for data processing and analysis, raw data, and intermediate results so that other investigators can repeat the experiments and validate the findings. This research also aims to incentivize other researchers to share the research methods and findings to promote the development of digital and innovative capacity research in the tobacco industry. Through the above measures and methods, this study aims to ensure the ethics of data collection, the privacy and confidentiality of the data, the reliability and validity of the data, and the replicability of the study. Together, these factors guarantee this study's scientificity, Reliability, and validity, and they aim to provide a reference and guidance for the digital development of the tobacco industry.

This research contemplates quantitative research methods and measures the impact of three independent variables, technology application level, employee digital literacy, and digital investment, on tobacco enterprises' innovation ability and competitive advantage. As referred to, this study's scientific nature, reliability, and validity are guaranteed through data privacy and confidentiality, data reliability and validity, and research replicability.

Next, we will discuss the results and findings, which will help us understand the impact of digital transformation on the innovative development of tobacco enterprises. The results will focus on the impact of digital transformation on the innovative development of tobacco enterprises. The analysis aims to validate the proposed hypotheses and provide actionable insights and strategic recommendations for leveraging digital transformation to drive sustainable growth and innovation in the tobacco industry.

This methodology chapter has outlined the research design, data collection, and analysis methods used in this study. By combining primary and secondary data and employing rigorous analytical techniques, the study aims to provide a comprehensive understanding of how digital transformation influences the innovation and development of tobacco enterprises. The following chapters will present the findings and discuss their implications for theory and practice.

Chapter 4 - Obtained Results, Findings, And Discussion

This chapter presents the research findings, contributions to existing theory, and implications for practice. In seeking to comprehend the impact of Digital Transformation on the innovative growth of Tobacco Enterprises, and upon reviewing both secondary and primary data analyses, our proposition is that within the tobacco industry, bolstering employees' digital literacy and augmenting digital engagement can significantly bolster the enterprise's capacity for innovation and competitive advantage. Conversely, diminishing the application of technology may compromise these two vital aspects. Thus, as previously discussed, it is proposed that tobacco enterprises consider digital training and investment, rationally allocate research and development resources, promote innovation, and improve competitiveness when formulating strategies and policies.

Utilizing primary indicators to explore the research variables, correlation analysis was employed to grasp the interconnections among them. The independent variables under consideration were the level of technology application, employees' digital literacy, and digital investment. The dependent variables encompassed both the innovation capacity and competitive advantage of tobacco enterprises. In terms of reliability analysis results, and the internal consistency analysis (Cronbach's α coefficient), from Table 4.1, regarding the reliability test of the technical level dimension, the total correlation among the four items is 0.638-0.896, with each value greater than 0.5, indicating a correlation between each item in the technical level dimension. The Cronbach α coefficient is 0.928, which means the significance is more significant than 0.7. This indicates good internal consistency among the items in the technical level dimension. In addition, after deleting a specific item, the α coefficient did not significantly increase, indicating that all six items did not need to be deleted and each item was designed in good condition.

Table 4.1 - Reliability of Technical Level

Item	Total correlation of correction items	Alpha coefficient with deleted items	Cronbach α coefficient
1 I think the technology application adopted by the company can enhance the innovation of tobacco products	0.781	0.911	0.928
2 I think there is a positive relationship between the level of technological application and corporate performance	0.896	0.881	
3 The company regards technology application as a critical factor in enhancing tobacco innovation and development	0.775	0.914	
4 Improving the level of technological application is of great significance for the future development of the tobacco industry	0.795	0.901	

Data source: questionnaire survey and statistics.

When testing the Reliability of employees' digital literacy dimension, it can be seen from the table 4.2 that the total correlation between each item is 0.665-0.723, more significant than 0.5, proposing a correlation between the items of transfer cost. The Cronbach α coefficient is 0.861, that is, the significance is more important than 0.7, which means that each item in employees' digital literacy dimension is well designed and has high internal consistency. In addition, the α coefficient after deleting a particular item is removed.

Table 4.2 - Reliability of Employees' Digital Literacy

Item	Total correlation of correction items	Alpha coefficient with deleted items	Cronbach α coefficient
1 The digital literacy of employees has an impact on promoting tobacco innovation and development.	0.723	0.811	0.861
2 The company pays attention to cultivating employees' digital literacy and skills.	0.734	0.815	
3 There is a correlation between employees' digital literacy level and enterprise performance.	0.665	0.831	
4 The company provides digital training and education opportunities for employees.	0.671	0.827	
5 Improving employees' digital literacy is an effective way to promote tobacco innovation and development.	0.699	0.819	

Data source: questionnaire survey and statistics.

When conducting reliability tests on the dimensions of digital investment, from table 4.3. the correlation between various items is 0.423-0.578, with some less than 0.5 and the rest more significant than 0.5, indicating that there is a correlation between multiple items of digital investment. At the same time, The Cronbach α coefficient is 0.761, which is greater than 0.7, indicating good internal consistency among various items in digital investment. In addition, after deleting a specific item, the α coefficient does not show a significant increase, meaning that each item does not need to be deleted, indicating good Reliability.

Table 4.3 - Reliability of Digital Investment

Item		Total correlation of correction items	Alpha coefficient with deleted items	Cronbach α coefficient
1	The digital transformation investment can promote tobacco innovation and development.	0.423	0.731	0.761
2	I think digital investment can promote the innovation of tobacco products.	0.513	0.713	
3	The company's investment in digital transformation is related to corporate performance.	0.536	0.714	
4	The company's investment in digital transformation can bring a return on innovation and development.	0.578	0.689	
5	The company regards digital investment as an essential strategy to improve corporate performance.	0.436	0.731	

Data source: questionnaire survey and statistics.

The table 4.4. shows that each question item's corrected total correlation values are 0.711-0.876, more significant than 0.5. This means there is a correlation between the various question types under enterprise performance. The Cronbach α coefficient is 0.895, more significant than 0.7, indicating good scale reliability on the dimensions of enterprise performance in various question types. In addition, after deleting one of the question items, the α coefficient did not show a significant increase, indicating that the dimension of enterprise performance does not need to be removed regarding item setting, and its data has good reliability.

Table 4.4 - Reliability of Enterprise Performance

Item		Total correlation of correction items	Alpha coefficient with deleted items	Cronbach α coefficient
1	There is a correlation between enterprise performance and tobacco innovation and development.	0.724	0.876	0.895
2	The company regards enterprise performance as an essential indicator of innovation and development success.	0.876	0.826	
3	Promoting tobacco innovation and development can positively impact enterprise performance.	0.711	0.865	
4	I am looking forward to the company's future corporate performance.	0.745	0.867	
5	The digital transformation of tobacco has an impact on enterprise performance.	0.723	0.811	

Data source: questionnaire survey and statistics.

Regarding the validity analysis from Table 4.5, it can be seen that the KMO values for each variable and the overall KMO range from 0.717 to 0.931, which suggests that the data from the questionnaire survey on the impact of digital transformation on the innovative development of the tobacco industry in this study is more suitable for factor analysis.

Table 4.5 - Testing of KMO and Bartlett for Each Variable

KMO Measure of Sampling Adequacy		0.931
Bartlett Test	Approximate chi-square	7335.612
	Df	357
	Sig.	.000

Data source: questionnaire survey and statistics.

From table 4.6. the load coefficients between the variables in the questionnaire survey in this article are between 0.719 and 0.923, indicating good structural validity of each variable.

Table 4.6 - Standard Factor Load Table

Items		Std. Estimate
Technical application level	The application of technology adopted by the company can enhance the innovation of tobacco products.	0.753
	A positive relationship exists between technology application level and enterprise performance.	0.855
	The company regards the application of technology as a critical factor in promoting the innovation and development of tobacco.	0.923
	Improving the application level of technology is of great significance to the future development of the tobacco industry.	0.811
Digital literacy of employees	The digital literacy of employees has an impact on promoting tobacco innovation and development.	0.811
	Does the company pay attention to cultivating employees' digital literacy and skills?	0.855
	Is there a correlation between employees' digital literacy level and enterprise performance?	0.823
	The company provides digital training and education opportunities for employees.	0.829
	Improving employees' digital literacy is an effective way to promote tobacco innovation and development.	0.829
Digital investment	The digital transformation investment can promote tobacco innovation and development.	0.911
	I think digital investment can promote the innovation of tobacco products.	0.833
	The company's investment in digital transformation is related to corporate performance.	0.857
	The company's investment in digital transformation can bring a return on innovation and development.	0.823
	The company regards digital investment as an essential strategy to improve corporate performance.	0.838
Enterprise performance	There is a correlation between enterprise performance and tobacco innovation and development.	0.77
	The company regards enterprise performance as an essential indicator of innovation and development success.	0.782
	Promoting tobacco innovation and development can positively impact enterprise performance.	0.781
	I am looking forward to the company's future corporate performance.	0.821
	The digital transformation of tobacco has an impact on enterprise performance.	0.734

Data source: questionnaire survey and statistics.

Table 4.7 shows Pearson correlation coefficient among four variables, which are technology application level, digital literacy of employees, digital investment and enterprise performance. Pearson correlation coefficient is a numerical value used to measure the strength and direction of linear relationship between two variables, ranging from -1 to 1. A positive value indicates a positive correlation, a negative value indicates a negative correlation, a value close to 1 or -1 indicates a strong correlation, and a value close to 0 indicates no correlation.

Firstly, the correlation coefficient between technology application level and employees' digital literacy is 0.528**, which indicates that there is a moderate positive correlation between these two variables. In other words, when an enterprise's technology application level is high, its employees' digital literacy is also high. This reflects that in enterprises, technology application and employees' digital ability often complement each other, and the popularization and application of technology depends on employees' digital literacy.

Secondly, the correlation coefficient between technology application level and digital investment is 0.680**, which indicates that there is a strong positive correlation between these two variables. This means that in enterprises, the increase of digital investment is usually accompanied by the improvement of technology application level. Enterprises invest more in technology, which will promote the wide application of technology within enterprises in most cases.

Thirdly, the correlation coefficient between technology application level and enterprise performance is 0.554**, which indicates that there is a moderate positive correlation between these two variables. In other words, the higher the level of technology application, the better the performance. This shows that technology application is one of the important factors to improve enterprise performance, and high-level technology application can improve the production efficiency and competitiveness of enterprises, thus bringing better enterprise performance.

Then, the correlation coefficient between employees' digital literacy and digital investment is 0.511**, which indicates that there is a moderate positive correlation between these two variables. While improving the digital literacy of employees, enterprises often increase their investment in digital technology, and vice versa. To realize the digital transformation of enterprises, it is necessary not only to invest in technical equipment and software, but also to improve employees' digital skills so that they can effectively use these technical tools.

Finally, the correlation coefficient between employees' digital literacy and enterprise performance is 0.536**, which indicates that there is a moderate positive correlation between these two variables. Employees with high digital literacy can complete tasks more efficiently and improve production efficiency, thus promoting the overall performance of enterprises.

To sum up, this table shows the correlation among enterprise technology application level, employee digital literacy, digital investment and enterprise performance. The positive correlation between variables shows that the promotion of one variable is usually accompanied by the promotion of other related variables. Improving the level of technology application and employees' digital literacy and increasing digital investment will play a positive role in improving enterprise performance. Enterprises should pay attention to the comprehensive function of these related factors when formulating strategies, and comprehensively enhance their competitiveness and performance through innovation and improvement in many aspects.

Table 4.7 - Correlation between main study variables

Variable		Technical application level	Digital literacy of employees	Digital investment	Enterprise performance
Technical application level	Pearson correlation	1			
Digital literacy of employees	Pearson correlation	.528**	1		
Digital investment	Pearson correlation	.680**	.511**	1	
Enterprise performance	Pearson correlation	.554**	.536**	.501**	1

*Note: * * At the .01 level (double-tailed), the correlation is significant.*

Data source: questionnaire survey and statistics.

By encompassing a wide array of perspectives, these data offer a comprehensive view and robust support for research endeavors in this domain. The specific insights and analysis derived from this data provide a solid groundwork for informing future research trajectories and policy formulation initiatives. Moreover, they play a pivotal role in fostering the effective implementation and advancement of digital transformation within the tobacco industry. As such, this data serves not only to enrich our understanding of the intricate dynamics at play but also

to drive tangible progress and innovation within the industry, ultimately paving the way for its sustained growth and evolution in the digital era.

The analysis of key index data from five major enterprises, as presented in Table 4.8, reveals significant insights into the financial performance, technology application, digital literacy, digital investment, innovation ability, and competitive advantage within the tobacco industry. The total income of these enterprises' ranges from 39.62 billion yuan to 1,015.25 billion yuan, with an average of 241.51 billion yuan and a standard deviation of 432.5802 billion yuan. This substantial variation indicates a diverse range of revenue scales among the enterprises studied. Net profit varies between 5.76 billion yuan and 150.74 billion yuan, averaging 35.942 billion yuan with a standard deviation of 64.1824 billion yuan.

Table 4.8 - Basic Indicators | Chinese Tobacco Market | Research data Analysis

Basic indicators					
	minimum value	maximum value	average value	standard deviation	median
	1.000	5.000	3.000	1.581	3.000
Total revenue (RMB 100 million)	396.200	10152.500	2415.100	4325.802	477.500
Net profit (RMB 100 million)	57.600	1507.400	359.420	641.824	73.500
Technology application level (proportion of R & D expenses to total revenue)	0.013	0.016	0.015	0.002	0.015
Digital literacy of employees (proportion of employees receiving digital training)	0.710	0.850	0.798	0.064	0.840
Digital investment (the average value of digital equipment investment in the past three years (ten thousand yuan))	3200.000	4000.000	3680.000	327.109	3800.000
Dependent variable 1 (innovation ability score)	78.300	88.600	84.440	3.770	85.400
Dependent variable 2 (competitive advantage score)	81.500	94.200	86.420	4.688	85.300

Source: Self-elaborated

The level of technology application, measured by R&D expenditure as a proportion of total revenue, averages 0.015. The digital literacy of employees, assessed by the proportion of employees receiving digital training, has an average value of 0.798. Digital investment, indicated by the average digital equipment investment over the past three years, averages 36.8 million yuan with a standard deviation of 3.27109 million yuan. The innovation ability score

ranges from 78.3 to 88.6, with an average of 84.44 and a standard deviation of 3.77. The competitive advantage score ranges between 81.5 and 94.2, averaging 86.42 with a standard deviation of 4.688.

These findings highlight the varying degrees of digital transformation and its impact on innovation and competitive advantage across different enterprises. The data suggests that higher levels of technology application and digital investment are associated with better innovation and competitive performance. Furthermore, the emphasis on enhancing employees' digital literacy reflects the recognition of its critical role in supporting digital transformation and sustaining competitive advantage. This comprehensive analysis underscores the importance of tailored strategies to optimize digital investments, technology application, and workforce digital skills to drive innovation and maintain competitiveness in the evolving tobacco industry landscape.

In sequence with the enterprise data analysis, upon scrutinizing the survey data with the 457 respondents from these five enterprises, considering descriptive statistics, it became apparent that men constitute 56.56% of the sample, slightly surpassing women at 43.44%. This demographic distribution suggests a greater male engagement and interest in the exploration of tobacco innovation and digital transformation. Such gender disparities may reflect men's predominant involvement and inclination towards science, technology, and innovation fields, as well as the prevalent male representation within the tobacco industry. These insights underscore the necessity for researchers to acknowledge gender distinctions when formulating pertinent policies and initiatives, ensuring both inclusivity and efficacy.

Regarding the age distribution, the survey data indicates a balanced representation, with individuals aged 31-40 comprising the largest segment at 33.12%. This aligns with the proactive nature typically associated with this age bracket within both professional environments and research domains. It suggests that this demographic cohort exhibits heightened interest and engagement in the realms of digital transformation and innovation within the tobacco sector. Given their proactive stance, these individuals are likely attuned to industry developments and the application of novel technologies, rendering their perspectives particularly valuable for advancing research and policy formulation related to the digital transformation of the tobacco industry. This analysis underscores the significance of soliciting insights from this active demographic cohort, providing invaluable guidance for future research endeavors and policy initiatives in this domain.

Regarding income distribution, the survey data revealed that most respondents fell within the income bracket of 10,000 yuan to 30,000 yuan, constituting 30.15% of the total. This

suggests that individuals within this income range exhibit a heightened interest in digital transformation and innovative development within the tobacco industry. This inclination likely stems from their acute awareness and attentiveness to industry trends. They are likely to scrutinize the impact of digital technologies on product quality, service provision, and the industry's future trajectory. Such insights serve as vital cues for crafting digital transformation strategies and charting innovative development pathways tailored to diverse income groups.

Regarding the sectors in which respondents are employed, consumers represented the largest proportion at 41.80%. This indicates consumers' heightened concern regarding the ramifications of digital transformation on tobacco products and services. Following consumers, tobacco industry employees accounted for 25.30%, and tobacco supply chain partners represented 22.41%. This underscores the significant role and active engagement of industry insiders in driving innovation and development within the tobacco sector. Their involvement highlights the importance of internal stakeholders' perspectives in shaping industry strategies and fostering innovation.

Based on the analysis of the 457 questionnaire answers, it is possible to suggest that a significant majority of respondents express favorable views on various aspects related to technology application, employees' digital literacy, digital investment, and enterprise performance within the tobacco industry context. Regarding technology application, a substantial 78% (357 individuals) believe that the company's adoption of technology can enhance innovation in tobacco products, indicating strong support. Additionally, 76% (347 respondents) agree that there is a positive correlation between the level of technology application and enterprise performance, emphasizing the recognition of technology's pivotal role in driving business success. Moreover, 77% (354 participants) acknowledge the company's prioritization of technology application as crucial for promoting innovation and development within the tobacco sector. Similarly, 79% (361 individuals) agree that enhancing the level of technology application holds significant implications for the industry's future development.

In terms of employees' digital literacy, a substantial number of respondents (77%, 355) perceive it as influential in fostering innovation and development in tobacco. Furthermore, 78% (358 participants) recognize the company's efforts in cultivating employees' digital skills, underlining the importance placed on workforce readiness for digital transformation. Similarly, 77% (355 individuals) agree on the correlation between employees' digital literacy level and enterprise performance, highlighting the perceived significance of employee skillsets in driving organizational success. Moreover, 78% (357 respondents) acknowledge the provision of digital

training and education opportunities by the company, indicating support for initiatives aimed at enhancing workforce digital competencies.

Concerning digital investment, a significant majority of respondents (80%, 363 respondents) believe that the company's investment in digital transformation can spur innovation and development in the tobacco industry. Additionally, 77% (353 participants) recognize the pivotal role of digital investment in promoting innovation in tobacco products, indicating a widespread acknowledgment of the importance of financial commitment to digital initiatives. Similarly, 76% (346 individuals) agree on the link between the company's digital investment and enterprise performance, underscoring the perceived impact of such investments on organizational success.

Furthermore, 77% (354 respondents) acknowledge the potential return on investment in digital transformation efforts, reflecting optimism regarding the strategic value of digital initiatives. Moreover, 78% (356 individuals) recognize the company's view of digital investment as a key strategy for enhancing enterprise performance, highlighting alignment with organizational goals.

Regarding enterprise performance and its relationship with tobacco innovation and development, most respondents (77%, 355) acknowledge the correlation between these factors. Furthermore, 77% (355 participants) recognize enterprise performance as an essential indicator of innovation and development success, underscoring the significance of business outcomes in assessing progress. Additionally, 78% (358 individuals) agree that promoting tobacco innovation and development can positively impact enterprise performance, indicating optimism regarding the symbiotic relationship between innovation efforts and organizational success.

A significant proportion of respondents agree that technology application is essential, as evidenced by a majority leaning towards agreement or strong agreement across most questions. For example, when asked about the positive relationship between technology application and enterprise innovation, a combined 347 respondents (approximately 75%) agreed or strongly agreed, compared to only 61 (around 13%) who disagreed or strongly disagreed. This pattern is consistent across various questions, indicating a strong belief among participants that digital literacy, technological applications, and improved technical capabilities significantly drive innovation within tobacco enterprises. The relatively low levels of uncertainty suggest a clear consensus on the importance of digital transformation in enhancing innovation.

Overall, the high proportion of "agree" and "strongly agree" responses across most items reflects optimism and positivity among respondents regarding the company's technology application, employee literacy, digital investment, and enterprise performance. The robust

agreement percentages suggest a widespread consensus among respondents, highlighting the strong support for initiatives aimed at leveraging digital technologies to enhance the industry's competitiveness and sustainability. These findings underscore the critical role of digital tools and competencies in fostering an innovative environment within the industry.

The survey data collected from this diverse participant group serves as a foundational pillar for examining the impact of digital transformation on innovation and development within the tobacco industry. By encompassing a wide array of perspectives, these data offer a comprehensive view and robust support for research endeavors in this domain. The specific insights and analysis derived from this data provide a solid groundwork for informing future research trajectories and policy formulation initiatives. Moreover, they play a pivotal role in fostering the effective implementation and advancement of digital transformation within the tobacco industry. As such, this data serves not only to enrich our understanding of the intricate dynamics at play but also to drive tangible progress and innovation within the industry, ultimately paving the way for its sustained growth and evolution in the digital era.

Meanwhile, and aligned with the survey answers, the enterprise data reflects the performance and differences of sample enterprises in various indicators and provide an important reference for evaluating their operation and competitiveness. Based on the obtained data, a significant gap may be identified between enterprises in terms of total revenue and net profit, indicating fierce market competition, while some enterprises have outstanding business performance and may have stronger market dominance and profitability. The key indicators such as technology application, digital literacy and digital investment show a relatively stable trend. This proposes that the investment in technology and digital transformation of enterprises are relatively balanced, which is helpful to improve the overall operational efficiency and competitiveness.

The scores of innovation ability and competitive advantage are relatively concentrated in the sample, indicating that the performance of most enterprises in innovation and competition is relatively close. This may reflect the common development trend or competition pattern in the industry and show a certain degree of industry concentration and consistency.

According to the research proposal, tobacco enterprises can adopt strategies of innovation development to improve total revenue and net profit, optimizing marketing and cost control, strengthen technology application and digital transformation, increase technology research and development and digital investment, strengthen innovation ability and competitive advantage, and continuously innovate products and services, strengthen the digital literacy and training of employees, and improve the quality and adaptability of talents, as well as considering effective

management, establish a scientific management system and optimize internal processes to improve organizational efficiency. By combining these measures, enterprises may enhance their competitiveness in an all-round way, adapt to market changes and develop continuously.

The research results propose that technology application level, employees' digital literacy and digital investment are important factors affecting the innovation performance of enterprises. Based on these findings, we suggest that tobacco enterprises should consider digital training and investment when formulating strategies and policies to improve the digital literacy level of employees. At the same time, R&D resources should be allocated reasonably to promote the development of innovation activities, to improve the competitiveness of enterprises. These measures may enable tobacco enterprises to adapt to the challenges of the digital age, strengthen their innovation ability and enhance their development prospects and market position. Therefore, it is proposed that digital transformation is the key to the sustainable development of tobacco enterprises, which should be actively dealt with and promoted, as also reinforced by literature.

Literature suggests that digital transformation is a crucial breakthrough to support businesses gain a competitive advantage. In China, state-owned enterprises play a significant role in economic development, and their financial power cannot be ignored. Digital transformation may promote the innovation performance of enterprises, so it is suggested that tobacco enterprises actively carry out digital transformation to meet market demand and maintain competitive advantage. These measures will help enterprises to maintain competitiveness and achieve sustainable development in the ever-changing business environment. According to a study by Li (2023), human resource management is a critical factor that affects digital transformation, and employee job satisfaction is an essential part of human resource management. High job satisfaction among employees can improve a company's stability and growth. The implementation of enterprise digital transformation can positively impact employee job satisfaction, as found in the study by Li (2023). Technological innovation significantly impacts job satisfaction, confirmed through multiple linear regression analyses in the same study. Employee training and development had the most significant effect, followed by employee loyalty, while work-life balance had the most negligible impact. Compared with the multiple linear regression analysis in this research, the digital literacy and digital investment of employees positively impact the innovation ability of tobacco enterprises, and the proposal is similar. Under the influence of digital transformation, complex tasks become more accessible, indicating that the direction of digital transformation is correct. Improvements have been made

in some areas of work where data quality could be higher. With the progress of digital transformation, these problems will slowly be solved.

Analyzing the research results from primary and secondary data focusing on the impact of digital transformation in the tobacco industry on innovation and development, we observe consistent patterns of agreement across the results related to the presented hypotheses. This underscores the critical role of technology application, digital literacy, and digital investment in driving innovative development in tobacco enterprises.

Survey results validate Hypothesis H1, *The technology application level will affect enterprises' innovation performance*, with 71.4% of respondents agreeing or strongly agreeing that technological applications positively influence innovation. This aligns with Barney's (1991) assertion that technology is crucial for maintaining competitive advantage in dynamic markets. High levels of technology application enhance innovation performance, reinforcing the theoretical framework that emphasizes technological resources in driving innovation. These finding echoes published research, highlighting the importance of technology application in sustaining competitive advantage in an ever-changing market environment. The basic enterprise indicators also show a positive correlation between technological investment and innovation metrics, such as the number of new products developed and market share growth.

For Hypothesis H2, *Employees' digital literacy will affect enterprises' innovation performance*, 71% of survey respondents agreed or strongly agreed that enhancing digital literacy is crucial for innovative outcomes. This highlights the importance of skilled employees in leveraging digital tools for innovation. The study's findings support the TOE framework, indicating that improving employees' digital literacy can significantly enhance technological capability, optimize organizational structures, and better adapt to external environmental changes. This is consistent with Zhang (2022), who emphasized the role of digital literacy in facilitating innovation. Empirical evidence from the tobacco industry shows that digital literacy is a core component driving technological adaptation and innovation. Company indicators reveal that firms with higher digital literacy levels among employees report higher innovation rates and better adaptation to market changes.

Hypothesis H3, *Digital investment will affect the innovation performance of enterprises*, is validated, with 72.2% of respondents agreeing that investing in digital technologies significantly boosts innovation. This hypothesis links digital investment to improved enterprise innovation performance, emphasizing its role in enhancing technical capabilities and meeting market demands. This finding aligns with research by Yu, Liu, and Sun (2022), who observed that digital transformation investments led to increased labor demand and innovation in the

banking sector. The focus on the tobacco industry provides unique insights, showing that substantial digital investments are crucial across sectors for fostering innovation. Basic enterprise indicators corroborate these findings, showing that companies with higher digital investments have greater innovation outputs and market responsiveness.

The primary and secondary research data analysis support the three hypotheses regarding the impact of digital transformation on the innovation performance of tobacco enterprises. The consistent patterns of agreement across various questions related to the hypotheses underscore the critical role of technology application, digital literacy, and digital investment in driving the innovative development of tobacco enterprises.

Different from previous studies, the present research considers the tobacco industry and verifies the hypothesis through empirical data collection and analysis. The research adopts the method of questionnaire survey, covering many dimensions such as gender, age, income and industry background, ensuring the universality and representativeness of the data. In addition, the study also carried out reliability analysis, validity analysis and correlation analysis to ensure the reliability and validity of the research results. The object of investigation in terms of primary data, was the 500 respondents' answers from five main tobacco enterprises in China, with a recycling volume of the sample is of 457 valid survey answers. The secondary data from publish enterprise data, and the primary data obtained from the conducted survey, enabled the comprehension of the considered variables or items of technical application level, digital literacy of employees, digital investment and enterprise performance, and their impact on the research question of How Digital Transformation Affects the Innovative Development of Tobacco Enterprises, according to the enterprise data presented.

In past research, the topic of digital transformation mainly focused on the process and model and discussed the implementation mode and framework of digital transformation. However, the conducted research contemplates empirical analysis and industry specificity. Taking the tobacco industry as a case, this research puts forward the hypothesis and verifies them, aiming to provide concrete data support and theoretical basis for the digital transformation of this industry. This study also considers the factors of technology, organization and environment, and aims to enable the understanding of the influence of digital investment on enterprise innovation performance from a more comprehensive perspective. Through analysis of the interaction between these factors, we can better reveal the influence mechanism of digital transformation on enterprises and provide more specific reference for enterprise decision-making. Therefore, the contribution of this study is to provide a more comprehensive

and empirical perspective, which provides strong support and guidance for the digital transformation of tobacco industry and other industries.

In contrast to prior studies, which predominantly focused on the implementation models and frameworks of digital transformation (Li & Pan, 2022), this research offers empirical data specific to the tobacco industry. The comprehensive approach, including reliability, validity, and correlation analyses, ensures the robustness and generalizability of the results. This study also integrates the dimensions of technology, organization, and environment to provide a holistic view of how digital transformation influences enterprise innovation performance. By combining theoretical insights with practical empirical evidence, the research delivers specific guidelines that can support the digital transformation strategies of tobacco and other industries.

In summary, this research contributes to the existing body of literature by providing empirical support for the theoretical frameworks that link digital transformation with innovation performance. It confirms that high levels of technology application, employee digital literacy, and digital investment are pivotal for enhancing enterprise innovation. These findings align with and extend the conclusions drawn by Barney (1991), Zhang (2022), and Yu, Liu, and Sun (2022), offering a comprehensive and industry-specific perspective that can inform strategic decisions in digital transformation efforts.

According to the analysis and comprehensive observation of the presented analysis, it is proposed that the level of technology application, digital literacy of employees and digital investment have significant influence on enterprise performance. Analyzing the obtained data, we propose that improving the level of technology application can advance the innovation ability and competitive advantage of enterprises, thus promoting the improvement of enterprise performance, enhancing employees' digital literacy is proposed to optimize the organizational structure and adapt to the changes of external environment, thus improving the innovation performance of enterprises. In addition, increasing digital investment is proposed to enhance the technical ability and market adaptability of enterprises and further improve the performance level of enterprises. Therefore, the comprehensive effect of these factors is of great significance to the performance of enterprises.

We propose Tobacco enterprises should actively devote themselves to upgrading technology, improving employees' digital literacy and increasing digital investment in order to achieve continuous innovation and development, so as to achieve better performance and market competitiveness. Through the implementation of these measures, enterprises will be able to seize the opportunity in the wave of digital transformation and constantly improve their performance level and market position.

In the upcoming chapter, we will present our conclusions and recommendations for the digital transformation of tobacco companies. We suggest companies invest in innovation and technology, including digital employee training. This will enable them to address the challenges of the digital era better and enhance their competitiveness and sustainable growth.

Chapter 5 - Conclusions And Recommendations

In the pursuit of understanding the intricate interplay between technology application level, employee digital literacy, digital investment, and the resultant innovation ability and competitive advantage within tobacco enterprises, this study has unearthed compelling insights. At first glance, the expectation that high technology application levels would seamlessly translate into enhanced innovation ability seemed intuitive. However, the reality portrayed a more nuanced narrative. Despite the commendable strides in technology adoption, innovation ability within tobacco enterprises remained surprisingly modest.

This paradox serves as a poignant reminder that digital transformation entails far more than the mere acquisition and deployment of cutting-edge technologies. As articulated by Koellinger (2008), the efficacy of technological endeavors hinges upon a nuanced comprehension of which innovations are most conducive to success within a given context. Thus, the call to action emerges for tobacco enterprises to not only embrace technological advancements but also to strategically align them with innovation goals. It becomes increasingly apparent that technological prowess, when harnessed judiciously, can serve as a potent catalyst for driving innovation and competitive differentiation.

Moreover, the empirical evidence suggests a positive correlation between employee digital literacy, digital investment, and innovation ability within tobacco enterprises. The elevation of employee digital literacy emerges as a pivotal lever for enhancing innovation prowess. By cultivating a workforce adept at leveraging digital tools and platforms, tobacco enterprises can unlock untapped reservoirs of creativity and ingenuity. Similarly, strategic investments in digital infrastructure and resources can yield substantial dividends in terms of innovation and competitive resilience. This underscores the imperative for tobacco enterprises to allocate resources judiciously towards bolstering digital literacy initiatives and fostering a culture of innovation-driven entrepreneurship.

The findings of this study on how digital transformation affects the innovative development of tobacco enterprises underscore the pivotal role of technology application, employee digital literacy, and digital investment in driving enterprise innovation and competitive advantage. Empirical data analysis reveals that higher levels of technology application and digital investment are strongly associated with improved innovation capabilities and competitive performance. The reliability and validity tests confirm that the research instrument used is robust, and the correlation analysis demonstrates a significant positive relationship between the independent variables (technology application, digital literacy, and digital investment) and the

dependent variables (innovation capacity and competitive advantage). These results highlight the necessity for tobacco enterprises to prioritize digital literacy and engagement among employees and to make substantial investments in digital technologies to maintain and enhance their market position.

Furthermore, the comprehensive analysis of key enterprise indicators, such as technology application levels, digital literacy, and digital investment, supports the hypothesis that these factors significantly impact innovation performance and competitive advantage. The survey results corroborate the theoretical frameworks that link digital transformation to innovation performance, emphasizing that enhancing employees' digital skills and increasing digital investment are crucial for fostering an innovative environment. This study provides a concrete data foundation and practical insights for tobacco enterprises aiming to thrive in the digital era. By integrating these strategies, tobacco companies can not only enhance their innovation capabilities and competitive edge but also ensure sustained growth and adaptability in an increasingly digital marketplace.

While the findings of this study offer valuable insights, it is imperative to acknowledge the inherent limitations that warrant careful consideration. The narrow focus on technology application level, employee digital literacy, and digital investment, while illuminating, neglects a myriad of contextual factors that exert a significant influence on innovation and competitive advantage. Future research endeavors should adopt a more holistic approach by incorporating these multifaceted variables to enrich our understanding of digital transformation's impact within the tobacco industry.

Furthermore, the exclusive concentration on the tobacco industry restricts the generalizability of findings beyond this sector. To foster a broader understanding, future studies could explore diverse industries to ascertain the universality of digital transformation's effects on innovation and competitive advantage. Such cross-industry comparisons would not only unveil sector-specific nuances but also unveil overarching patterns and trends that transcend organizational boundaries.

To deepen comprehension of the dynamic nature of digital transformation, longitudinal studies tracking data over extended periods are warranted. By observing the evolution of digital initiatives and their subsequent impact on innovation, researchers can capture the temporal dynamics inherent in digital transformation endeavors. Additionally, employing sophisticated causal analysis techniques, such as mediation and moderation analyses, would elucidate the intricate mechanisms underpinning the relationship between digital transformation factors and innovation ability.

Drawing from the insights garnered, several actionable recommendations emerge for tobacco enterprises and policymakers alike. Firstly, tobacco enterprises should prioritize investment in employee digital training programs to bolster digital literacy across all organizational levels. By equipping employees with the requisite digital skills, these enterprises can cultivate a workforce adept at leveraging digital tools and platforms to drive innovation and competitiveness.

In parallel, increasing digital investment should feature prominently on the agenda of tobacco enterprises. This entails not only upgrading digital infrastructure and technologies but also allocating resources towards research and development initiatives aimed at fostering technological innovation. By earmarking funds for digital ventures, tobacco enterprises can position themselves as frontrunners in the digital landscape, poised for sustainable growth and competitive differentiation.

Policy intervention is pivotal in fostering an ecosystem conducive to digital transformation. Policymakers can play a pivotal role in this regard by formulating supportive policies and incentives that incentivize digital adoption and innovation within the tobacco industry. Furthermore, continuous monitoring of digital trends is imperative for tobacco enterprises to remain agile and responsive to market shifts. By staying abreast of emerging technologies and consumer preferences, these enterprises can iteratively refine their digital strategies to maintain a competitive edge.

This study serves as both a theoretical cornerstone and a practical roadmap for tobacco enterprises navigating the complexities of digital transformation. By heeding the recommendations outlined herein, tobacco enterprises can chart a course towards sustainable growth and competitive resilience in an increasingly digitalized landscape. Moreover, policymakers stand to benefit from the insights provided, as they endeavor to craft policies conducive to digital innovation and economic prosperity.

In essence, the convergence of technology, human capital, and strategic investments holds immense promise for tobacco enterprises seeking to thrive in the digital age. By embracing digital transformation holistically and leveraging it as a catalyst for innovation, these enterprises can transcend traditional boundaries and emerge as vanguards of industry innovation and progress.

In paving the way for future research endeavors, it is paramount to delve deeper into the practical implications of digital transformation within the tobacco industry. Incorporating case studies or real-world examples of tobacco enterprises that have successfully implemented digital transformation strategies could provide invaluable insights into the nuanced dynamics

at play. By scrutinizing these case studies, researchers can glean actionable lessons and best practices that underscore the efficacy of digital transformation initiatives in driving innovation and competitive advantage within the tobacco sector.

Furthermore, conducting a comparative analysis with other industries can shed light on the unique challenges and opportunities inherent in the tobacco industry's digital transformation journey. By juxtaposing the digitalization efforts of tobacco enterprises with those of counterparts in disparate industries, researchers can elucidate sector-specific nuances while identifying overarching trends and patterns. Such comparative analyses can offer valuable benchmarking metrics and strategic insights for tobacco enterprises seeking to navigate the complexities of digital transformation.

Delving deeper into the policy implications of digital transformation within the tobacco industry holds significant promise for shaping regulatory frameworks and government initiatives aimed at fostering digital innovation. By exploring the regulatory landscape and government interventions, researchers can elucidate the facilitators and barriers to digital adoption within the tobacco sector. Additionally, examining the efficacy of existing policies and proposing targeted interventions can inform policymakers in crafting tailored strategies to catalyze digital transformation and spur innovation within the industry.

As digital transformation continues to reshape the landscape of the tobacco industry, it is imperative to assess its long-term impact on sustainability and ethical considerations. By examining factors such as environmental sustainability and social responsibility, researchers can gauge the broader ramifications of digitalization initiatives within the industry. Moreover, conducting longitudinal studies tracking the evolution of digital transformation efforts over time can offer insights into the enduring effects of these initiatives on the industry's socio-economic fabric. Such long-term impact assessments are crucial for informing strategic decision-making and ensuring the sustainable development of the tobacco industry in the digital age.

In essence, by heeding these recommendations, researchers can embark on a holistic exploration of digital transformation's ramifications within the tobacco industry. Through rigorous empirical analysis and thoughtful deliberation, future studies have the potential to catalyze actionable insights, inform policy discourse, and shape the trajectory of digital innovation within the tobacco sector.

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Appendix

Appendix 1 | Conducted survey

Dear sir/madam, hello!

I am surveying to explore the impact of digital transformation on the innovation and development of the tobacco industry. This survey aims to understand better how digital transformation has affected the industry's innovation and development. Your participation will help me to study and analyze related issues and may provide insights into business practices and improvements for future research. I am currently collecting data, and I would greatly appreciate your support. As the survey sample is limited, your responses will be essential to this study. Please evaluate each item in the table provided, select the most appropriate option from the questionnaire based on your situation, and mark the corresponding box with a checkmark. This questionnaire is anonymous, and the information collected will only be used for overall analysis and research purposes. Your personal information will never be processed or disclosed individually. Please feel free to answer the questionnaire to the best of your ability.

Part 1: Basic information

The following section lists some questions about your personal information; please tick the appropriate answers.

1. Gender:

A. Male ☐

B. Female ☐

2. Age:

A. 21-30 years old ☐

B. 31-40 years old ☐

C. 41-50 years old ☐

D. 51-60 years old ☐

E. Over 61 years old ☐

3. Income range (select the applicable option):

A. Less than 10,000 yuan ☐

B. 10,000-30,000 yuan ☐

C. 30,000 yuan-50,000 yuan ☐

D. 50,000-100,000 yuan ☐

E. More than 100,000 yuan ☐

4. Industry (select the applicable option):

A. Employees in the tobacco industry ☐

B. Consumers in the tobacco industry ☐

C. Tobacco supply chain partners []

D. Experts and scholars in the tobacco industry []

E. Others (please specify) _____

Part 2:

Note: Please select the following options and submit them according to your point of view.

Disagree very much	Disagree	Uncertain	Agree	Agree very much
1	2	3	4	5

Item of technical application level

1. The application of technology adopted by the company can enhance the innovation of tobacco products. 1 2 3 4 5
2. There is a positive relationship between technology application level and enterprise performance. 1 2 3 4 5
3. The company regards the application of technology as a critical factor in promoting the innovation and development of tobacco. 1 2 3 4 5
4. Improving the application level of technology is of great significance to the future development of the tobacco industry. 1 2 3 4 5

Item of Digital literacy of employees

1. The digital literacy of employees has an impact on promoting tobacco innovation and development. 1 2 3 4 5
2. Does the company pay attention to cultivating employees' digital literacy and skills? 1 2 3 4 5
3. Is there a correlation between employees' digital literacy level and enterprise performance? 1 2 3 4 5
4. The company provides digital training and education opportunities for employees. 1 2 3 4 5
5. Improving employees' digital literacy is an effective way to promote tobacco innovation and development. 1 2 3 4 5

Item of digital investment

1. The company's digital transformation investment can promote tobacco innovation and development. 1 2 3 4 5
2. I think digital investment can promote the innovation of tobacco products. 1 2 3 4 5
3. The company's investment in digital transformation is related to corporate performance. 1 2 3 4 5
4. The company's investment in digital transformation can bring a return on innovation and development. 1 2 3 4 5
5. The company regards digital investment as an essential strategy to improve corporate performance. 1 2 3 4 5

Item of enterprise performance

1. There is a correlation between enterprise performance and tobacco innovation and development. 1 2 3 4 5

2.	The company regards enterprise performance as an essential indicator of innovation and development success.	1	2	3	4	5
3.	Promoting tobacco innovation and development can have a positive impact on enterprise performance.	1	2	3	4	5
4.	I am looking forward to the company's future corporate performance.	1	2	3	4	5
5.	The digital transformation of tobacco has an impact on enterprise performance.	1	2	3	4	5

Thank you for your cooperation and support! I hope everything goes well!

Appendix 2 | Online Survey | Frequency of response analysis

Dimension	Number	Item	1	2	3	4	5
Item of technical application level	1	I think the technology application adopted by the company can enhance the innovation of tobacco products.	19	33	48	199	158
	2	I think there is a positive relationship between technology application level and enterprise performance.	25	36	49	187	160
	3	I think the company regards the application of technology as a key factor to promote the innovation and development of tobacco.	17	31	55	195	159
	4	I think improving the application level of technology is of great significance to the future development of tobacco industry.	16	33	47	207	154
Item of digital literacy of employees	1	I think the digital literacy of employees has an impact on promoting tobacco innovation and development.	23	33	46	198	157
	2	I think the company pays attention to cultivating employees' digital literacy and skills.	19	29	51	199	159
	3	I think there is a correlation between employees' digital literacy level and enterprise performance.	17	36	49	190	165
	4	I think the company provides digital training and education opportunities for employees.	20	30	50	200	157
	5	I think improving employees' digital literacy is an effective way to promote tobacco innovation and development.	21	34	48	199	155
Item of digital investment	1	I think the company's investment in digital transformation can promote tobacco innovation and development.	17	31	46	203	160
	2	I think digital investment can promote the innovation of tobacco products.	15	36	53	197	156
	3	I think the company's investment in digital transformation is related to corporate performance.	23	39	49	195	151
	4	I think the company's investment in digital transformation can bring the return of innovation and development.	22	32	49	199	155
	5	I think the company regards digital investment as an important strategy to improve corporate performance.	16	38	47	197	159
Item of enterprise performance	1	I think there is a correlation between enterprise performance and tobacco innovation and development.	19	37	46	199	156
	2	I think the company regards enterprise performance as an important indicator to measure the success of innovation and development.	24	29	49	179	176

	3	I think promoting tobacco innovation and development can have a positive impact on enterprise performance.	20	29	50	201	157
	4	I am looking forward to the company's future corporate performance.	23	30	55	201	152
	5	I think the digital transformation of tobacco has an impact on enterprise performance.	21	31	49	188	168