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The Relationship between Organizational Culture and Employee Innovative Behavior in Chinese State-owned Technology Enterprises – Different Paths across Hierarchy Culture and Clan Culture

ZHAI Runfeng

Doctor of Management

Supervisor:
PhD MA Shaozhuang, Associate Professor with Habilitation,
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Marketing, Operations and General Management Department

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Jury:

PhD Patricia Andreia da Silva Filipe, Associate Professor,
Iscte - Instituto Universitário de Lisboa
PhD João Pedro Pina Cordeiro, Coordenator Professor,
Instituto Politécnico de Setúbal
PhD Renato Telo de Freitas Barbosa Pereira, Assistant Professor with Habilitation,
Iscte – Instituto Universitário de Lisboa
PhD Feng Yi, Full Professor,
University of Electronic Science and Technology of China
PhD Shaozhuang Ma, Associate Professor with Habilitation,
Iscte – Instituto Universitário de Lisboa

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Signed: *[signature]*　　　　　　　　　Date: 2023.12.28

Name: ZHAI Runfeng

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姓名(拼音)：ZHAI Runfeng

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Abstract

Innovation has become a crucial avenue for companies to gain competitive advantages. Due to China's unique national circumstances, China's state-owned technology enterprises bear the national mission and responsibility in technological competition and innovation. However, the relationship between the organizational culture of state-owned technology enterprises and employee innovative behavior remains unclear. Therefore, this study aims to understand the relationship between the organizational culture and employee innovative behavior in Chinese state-owned technology enterprises, as well as the moderation effects of transformational leadership and employees' traditionality.

Through regression analysis on 595 valid questionnaires collected from state-owned technology enterprises, this study found the following: 1) The predominant organizational culture types in state-owned technology enterprises are hierarchy culture type and clan culture type. 2) Both hierarchy culture and clan culture are positively related to employee innovative behavior. 3) Organizational identification partially mediates the relationship between organizational culture and employee innovative behavior in both hierarchy and clan cultures. 4) In hierarchy culture, transformational leadership enhances the positive impact of organizational culture on employee innovative behavior, and employees' traditionality strengthens the positive impact of organizational culture on organizational identification. However, these moderation effects are not observed in clan culture.

This research contributes to a better understanding of the relationship between organizational culture, transformational leadership, and employee innovative behavior in state-owned technology organizations. It enriches the literature in the field of organizational culture and innovation and provides theoretical guidance and practical suggestions for enhancing technological innovation in state-owned technology enterprises.

Keywords: Organizational culture; Organizational identification; Employee innovative behavior; Transformational leadership; Traditionality; State-owned enterprises.
JEL: M12; O31

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Resumo

A inovação tornou-se uma via crucial para as empresas obterem vantagens competitivas. Devido às circunstâncias nacionais únicas da China, as empresas estatais de tecnologia da China assumem a missão e a responsabilidade nacionais pela competição e inovação tecnológicas. No entanto, a relação entre a cultura organizacional dessas empresas e o comportamento inovador dos seus funcionários permanece incerta. Portanto, este estudo tem como objetivo compreender a relação entre a cultura organizacional e o comportamento inovador dos funcionários em empresas estatais de tecnologia chinesas, bem como os efeitos moderadores da liderança transformacional e da tradicionalidade dos funcionários.

Metodologicamente, foi aplicado um inquérito a empresas estatais de tecnologia, tendo sido recolhidos 596 inquéritos válidos. Através da análise de regressão, os resultados deste estudo indicam: 1) Os tipos de cultura organizacional predominantes em empresas estatais de tecnologia são a cultura de hierarquia (*hierarchy culture*) e a cultura de clã (*clan culture*). 2) A cultura de hierarquia e a cultura de clã estão positivamente relacionadas com o comportamento inovador dos funcionários. 3) A identificação organizacional medeia parcialmente a relação entre a cultura organizacional e o comportamento inovador dos funcionários na cultura de hierarquia e de clã. 4) Na cultura de hierarquia, a liderança transformacional aumenta o impacto positivo da cultura organizacional no comportamento inovador dos funcionários, e a tradicionalidade dos funcionários fortalece o impacto positivo da cultura organizacional na identificação organizacional. Contudo, estes efeitos moderadores não são observados na cultura de clã.

Esta investigação contribui para uma melhor compreensão da relação entre cultura organizacional, liderança transformacional e comportamento inovador dos funcionários em organizações estatais de tecnologia. Enriquece a literatura na área da cultura organizacional e da inovação e fornece orientações teóricas e sugestões práticas para melhorar a inovação tecnológica em empresas estatais de tecnologia.

Palavras-chave: Cultura organizacional; Identificação organizacional; Comportamento inovador dos funcionários; Liderança transformacional; Tradicionalidade; Empresas estatais.

JEL: M12; O31

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摘 要

创新已成为企业获得竞争优势的重要途径。中国国情决定了国有科研企业承担着在科技竞争中的国家使命和创新重任。但是，国有科研企业组织文化和员工创新行为之间的关系并未得到清晰阐明。因此，本研究旨在了解中国国有科研企业的组织文化和员工创新行为之间的关系。

本研究通过对国有科研企业采集的595份有效问卷进行回归分析得到以下研究结果: 1)国有科研企业的主导组织文化类型为层级型组织文化(Hierarchy culture type)和宗族型组织文化(Clan culture type); 2)层级型组织文化和宗族型文化均与员工创新行为有正相关关系；3)组织认同在层级型和宗族型组织文化中均对组织文化和员工创新行为之间起到了部分中介作用；4)在层级型组织文化中，变革型领导能够增强组织文化对员工创新行为的正向影响，而且员工传统性能够增强组织文化对组织认同的正向影响。而在宗族型组织文化中，则不具有上述调节作用。

本研究有助于国有科研组织更好地理解组织文化，变革型领导和员工创新行为的关系，不但丰富了组织文化与创新领域的国际文献，而且为提升国有科研企业的科技创新提供理论指导和实践建议。

关键词：组织文化；组织认同；员工创新行为；变革型领导；传统性；国有企业。
JEL: M12; O31

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Studying and learning is a long process. It is a process of absorbing ideas from different perspectives, constantly breaking through oneself by self-reflection and self-criticism, and rebuilding one's ideological system. My five-year doctoral study is coming to an end, and I would like to express my sincere gratitude to all my supervisors, family, and friends who have cared, supported, and helped me.

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Finally, I would like to express my deepest gratitude to my family. It was their selfless support and care that enabled me to successfully complete this doctoral thesis. This process is long and arduous. Without their support and care, my doctoral journey would not have been so smooth.

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List of Abbreviations

CASIC = China Aerospace Science and Industry Corporation

CETC = China Electronics Technology Group Corporation

CTS = Chinese Traditionality Scale

CVF = Competing Values Framework

EIB = Employee innovative behavior

GII = Global Innovation Index

OC = Organizational culture

OCAI = Organizational Cultural Assessment Instrument

OI = Organizational identification

TL = Transformational leadership

TLQ = Transformational Leadership Questionnaire

TRA = Traditionality

WIPO = World Intellectual Property Organization

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Chapter 1 : Introduction

1.1 Research background

With the increasingly fierce competition in the international market, innovation has become an important avenue for enterprises to obtain competitive advantages. There are many factors that affect organizations' innovation capability. Among them, employee innovative behavior (EIB) is the common cornerstone and micro foundation of organizations' innovation at all levels (Felin et al., 2015; Janssen et al., 2004). Therefore, to improve the innovation capability of the organization, an important task of the managers is to mobilize the innovation desire of technology talents and create an atmosphere and culture that can stimulate employee innovative behavior. That is because organizational culture can greatly impact employees' behavior, surpassing the formal management system, procedures, and authority (O'Reilly III et al., 1991). It is an effective means to achieve organizational goals and realize organizational development and thus is one of the essential vias to develop organizational innovation capability (Quinn & McGrath, 1985).

Regarding the relationship between organizational culture and innovation, typically, organizations with outstanding innovation capability also have a strongly relevant organizational culture. For example, the National Aeronautics and Space Administration (NASA) of the United States has an engineering culture of mutual trust, open communication, encouraging information flow, and reducing information asymmetry (Williams & Howell, 2021). Such a culture has attracted top talents from all sectors and effectively motivated the innovative behavior of its employees, leading to many scientific and technological breakthroughs. However, compared with organizations such as NASA, the relationship between technological breakthroughs and organizational culture is more ambiguous in China's state-owned technological enterprises, for example, Chengdu Aircraft Industry Group (hereinafter referred to as "Chengdu Aircraft"), which has self-developed the fifth generation fighter "Chengdu J-20", China Aerospace Science and Industry Corporation (CASIC), whose missile models have reached the internationally advanced level in the same period, and China Electronics Technology Group Corporation (CETC), which has achieved a number of major innovation achievements in the development and construction of Beidou Navigation System.

The organizational culture of these Chinese state-owned technology enterprises is not as prominent as that of other advanced R&D institutions such as NASA, and differences are clearly observed in the overall orientation of their organizational culture.

The management systems and regulations in Chinese state-owned enterprises are usually rather complex, creating barriers to the formation and development of a healthy organizational culture for innovation. For example, the traditional culture of state-owned enterprises may value stability, standardization, and collectivism. The relatively conservative and hierarchical management system may also limit employees' autonomy and innovation ability. However, with China's reform and opening up, some state-owned enterprises began to explore reform measures to keep pace with the times, including initiatives to encourage innovation and advocate an open culture (Cheng et al., 2005; J. Yu, 2014). Therefore, the organizational culture of state-owned enterprises may evolve with time.

China's national conditions determine that state-owned technology enterprises have the mission of driving the country's technological innovation and bear the task of winning in scientific and technological competition. At the same time, due to China's unique social culture and operating system, Chinese state-owned technology enterprises have formed an organizational culture with Chinese characteristics. However, as mentioned above, for China's state-owned technology enterprises, the relationship between organizational culture and employee innovative behavior has not been clearly clarified. Hence, revealing such a relationship is one of the relevant topics for state-owned technology enterprises to improve their innovation capability and to identify the path for innovation system reform and innovation capability enhancement.

1.1.1 Practical background

In recent years, China's innovation capability has been gradually improved. As shown in Figure 1.1, according to the *Global Innovation Index (GII) 2022* released by the World Intellectual Property Organization (WIPO), China ranked 11th, up one place from last year. China's innovation steadily improved for ten consecutive years, ranking first among the 36 upper middle-income economies (Dutta et al., 2022). The report pointed out that China showed a positive relationship between innovation and development, and innovation investments were transformed into more and higher quality innovation output.
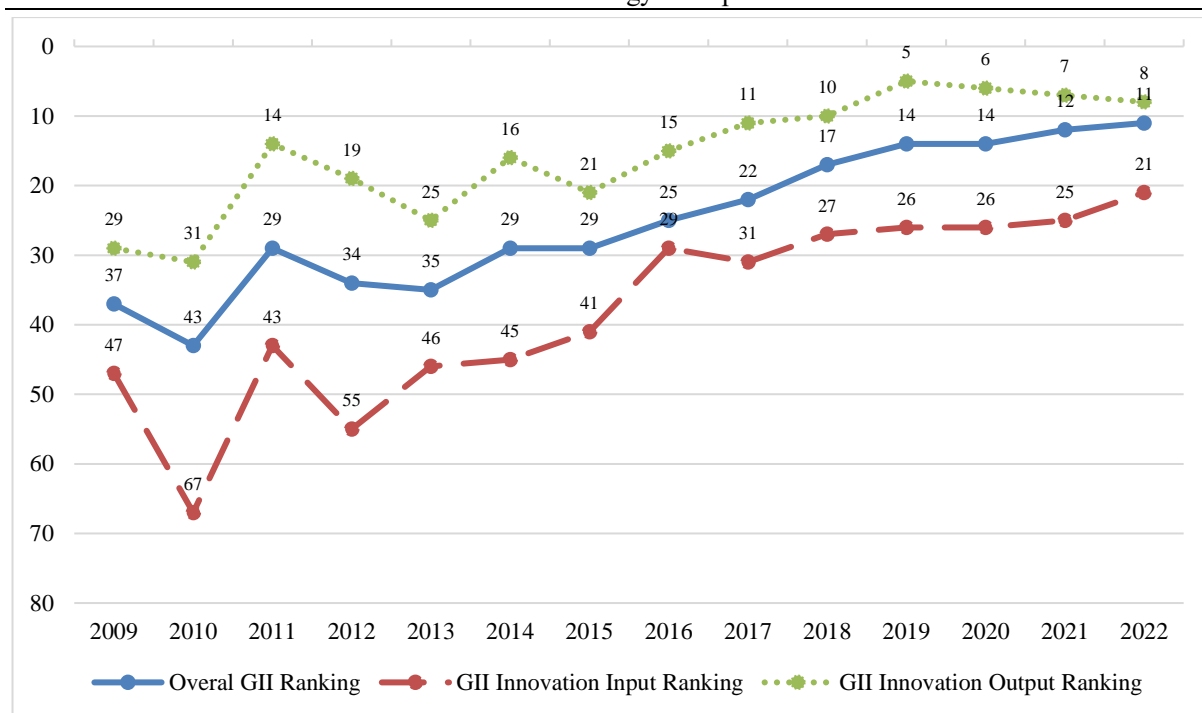
Figure 1.1 China's rankings in the Global Innovation Index (GII)

Source: Global Innovation Index (GII) 2022 by WIPO

Although China's overall innovation capability is gradually improving, due to the increasingly complex international environment and the emerging internal and external social contradictions, the competitive environment faced by China has also become significantly tougher, imposing requirements on enhancing the innovation capability of Chinese state-owned technology enterprises:

First, a new round of scientific and technological reform is about to begin, and the competition for the dominant power of the future industrial chain among countries is becoming more intense. State-owned technology enterprises, as an important component of the national strategic force of technology, need to play a leading role in strategic support and driving major innovation efficiency in key areas (Fan & Li, 2022; Yin et al., 2021). At present, the technological competition among major countries in emerging technologies such as 5G, chips, and artificial intelligence is becoming increasingly intense (Lee, 2018; Sun, 2022). Nowadays, the technological competition between China and the United States has escalated to a global scale, and both sides are pursuing a leading position in technology. In this case, both sides need to maintain cooperation in some areas while avoiding crisis escalation in other sensitive areas. Precise decoupling and de-risking are the core of the current U.S. technology policy against China. The United States has taken a series of measures to reduce the interdependence between the two countries in key technologies while attempting to curb China's development in high technology (Laskai & Sacks, 2018). However, as the development of technology is inevitably

global, and technology innovation and dissemination take place in an international scope, the comprehensive "technology decoupling" may be difficult to realize in practice, and restricting technological exchanges and cooperation will hinder the progress of innovation to a certain extent. At present, China is in a critical period of industrial structure transformation, demanding a gradual shift from the low-end to the high-end of the industrial chain. A number of enterprises have already emerged in some segment areas. In the future, countries will face even more fierce competition for dominance in the emerging technology industry chain, especially industries that are about to enter the critical stage of technology application. Given the increasing strategic significance of these industries, all countries are increasing their investment in emerging strategic technologies to foster development, so as to improve their technological competitiveness in the future.

Second, under the impact of COVID-19 and the intensifying technology competition, the global industrial chain has entered the stage of restructuring (Q. Wang, 2022). Given this new trend, taking state-owned technology enterprises as the core of technology development can enhance the stability and controllability of China's industrial chain. In the field of key technologies, state-owned technology enterprises can better coordinate and manage the supply chain, so as to cope with market fluctuations and external risks. Therefore, it is imperative for China to take state-owned technology enterprises as the core to enhance the robustness and competitiveness of the industrial chain in order to obtain technological competitive advantages in the current global environment. On the positive side, the rapid development of emerging technology industries will trigger a new round of industrial chain transfer and division adjustment internationally. However, since the outbreak of COVID-19, a new trend has emerged; that is, while pursuing business benefits, international companies are now paying more attention to the supply chain stability and risk management than ever before, as COVID-19 exposed the vulnerability of the global supply chain. That reflects the changing trend of the global industrial chain and supply chain under uncertainty and external risks (Q. Huang, 2020). In general, the global industrial chain will show the following features in the future: a) On the one hand, the global supply chain will show a trend of shortening and agglomeration. With the increase of protectionist sentiment and the exposure of the global supply chain vulnerability, enterprises have an increasing demand for shortening the supply chain to reduce the dependence on a single country or region, which will gradually lead to a shift from globalization to regional agglomeration. That means, the industrial spatial agglomeration in some specific regions will become more and more prominent, thus forming a relatively independent industrial ecosystem.

b) On the other hand, as an important component of the global manufacturing and supply chain, China is also exposed to the challenges and opportunities of this new trend. After COVID-19, some countries may prefer to improve their domestic industrial chains rather than rely on other countries, which will undoubtedly put some pressure on China's industrial structure transformation. Therefore, China needs to improve the stability and competitiveness of its industrial chain and supply chain through a "double cycle" development paradigm (Hu, 2020). Under the new developmental trend of the global industrial chain, China's new development paradigm highlights the balance of domestic and international development and sustainable and self-controllable economic growth, which needs to be achieved by means of technological innovation, technological upgrading, and the cultivation of emerging industries.

Third, China's economy has witnessed a shift from high-speed growth to high-quality development, in which innovation plays a leading role in driving economic development and building the strategic pillar of the next stage of economic development. Therefore, state-owned techology enterprises and institutions should, through continuous and comprehensive reform, explore and build the path of improving their innovation capability to become the main force of independent innovation and the stabilizer of economic growth (Guangming Daily, 2015). On the one hand, as the backbone of China's economic and social development, state-owned technology enterprises should take the lead in innovation-driven development, undertake the task of leading and driving industrial upgrading in key areas, and explore corresponding reform and incentive mechanisms to motivate innovation and enhance market vitality, so as to better align with and serve the major national strategies (S. Huang, 2006). On the other hand, innovation is the core strategy for state-owned technology enterprises to cope with the new round of technological revolution and industrial reform, which requires them to solve the contradictions and problems in their development and realize the structural transformation from investment-driven to innovation-driven. That means, enterprises should shift from pursuing scale expansion to quality, efficiency, and value creation in order to effectively support the transformation of China's economy to high-quality development in the future. Innovation is not only about technological innovation; it also includes innovation in other aspects, such as organization, management, and business model. Innovation is not just a means, but also a strategy and a culture. It can help state-owned technology enterprises adapt to changes, seize opportunities, and inject new impetus into the Chinese economy's sustainable development, which are currently the essential tasks of state-owned technology enterprises in their development.

In summary, at present, China's state-owned technology enterprises are facing great

opportunities and challenges in improving their innovation capability and urgently need effective paths to gain corresponding support. According to the book *The Silicon Valley Edge: Silicon Valley Innovation and Entrepreneurship Habitat* by C. Lee et al. (2002), Silicon Valley was not created by the 757 plan; funds are important for the development of high technology, but the system and culture that can give full play to human creativity is more important. In other words, culture is an important factor in shaping silicon valley into an innovation "habitat". All innovative economies are rooted in their specific culture, and cultural factors are an important source of organizational and institutional capability differentiation between countries, leading to differentiated competitiveness (Academy of Sciences & Technology in Berlin, 2006). In 2021, the National Academy of Innovation Strategy of China proposed in its "further thinking on the construction of innovation culture by 2035" that China's innovation policy should gradually shift its focus from technology management to innovation governance, in which cultural governance is one of the important means (Ren et al., 2021). It shows that improving organizations and employees' innovation capability through organizational culture has become the focus of the government, academia, and even the whole society.

1.1.2 Theoretical background

The introduction and development of the theoretical concept of organizational culture has prompted scholars in management to pay attention to the research of values, beliefs, and behavior patterns within organizations. Through the study of organizational culture, researchers in management can better understand and explain the behavior phenomena within the organization, such as the decision-making process of the organization and the motivation and behavior choices of its members. It is conducive to improving the ability to gain insight and predict organizational behavior. Organizational culture is a system of values, beliefs, and behavior patterns that subconsciously guide the organization's members to make each choice and decision (Ortega-Parra & Ángel Sastre-Castillo, 2013). Nowadays, the theory of organizational culture has been well-developed, providing many mature theories and tools for scholars to carry out research, which is of great help to further understand different types of organizational behavior. For example, in 1991, Cameron and Quinn designed the Organizational Cultural Assessment Instrument (OCAI) based on the Competing Values Framework (CVF) (Cameron et al., 2010). This theory incorporates the advantages of many theories, has been widely recognized and applied by scholars around the world, and has been constantly updated with the change of times. In this study, we will apply mature theories and

analysis frameworks related to organizational culture, such as OCAI, in an attempt to further expand these theories.

As for the relationship between organizational culture and employee innovative behavior, although many scholars have explored it from different perspectives, this relationship is changing with the times and scenarios and needs more in-depth research, especially in the context of an increasingly complex market environment and the specific organizational culture of China's state-owned technology enterprises. According to the research of George and Zhou (2001) and T. Wang et al. (2015), employee innovative behavior is the behavior of employees seeking and implementing creative ideas and methods to solve problems and improve work efficiency and performance. That also means employee innovative behavior is a process from creation to realization of innovative ideas that can improve the work performance of individuals, teams, or organizations. In addition, studies on employee innovative behavior often pay attention to contextual and individual factors. For example, the realization of employee innovative behavior requires support from the environment (T. Wang et al., 2015), communication, and mobilizing others to support their novel ideas (Janssen, 2000; Lukes & Stephan, 2017). These studies have also revealed that the relationship between organizational culture and employee innovative behavior is not only about the two but also involves other related factors, such as organizational identification, leadership style, and employee personal characteristics.

The introduction of organizational culture makes researchers in management pay more attention to organizational identification and employee relations and begin to study how to build employees' sense of identity and belonging to the organization and improve their job satisfaction and loyalty through organizational culture. That is of great significance to the organization in employee relationship management and human resource management and has a positive effect on the organization's performance and competitiveness. The model of the organizational identification theory was first proposed by March and Simon (1958). As organizational identification refers to the degree to which employees define themselves as a member of the organization and to what extent they experience a sense of oneness with it, employees who identify more with their organization may be more willing to carry out innovation activities, as they posit that their innovation can have a positive impact on the organization; besides, their trust and loyalty to the organization may also reduce their fear of innovation risks. Therefore, the study of how organizational identification affects employee innovative behavior is conducive to a profound understanding of the internal driving force of employee innovative behavior, thus helping organizations find more effective ways to mobilize

and manage employees' innovative ability (Riketta, 2005; Van Knippenberg, 2000; Walumbwa et al., 2008; Wieseke et al., 2009).

During the development of organizational culture theory, the importance of organizational transformation and leadership was also highlighted, and researchers in management began to pay attention to how to realize organizational transformation and innovation by managing and guiding organizational culture, and have explored how to shape and transform organizational culture to support the organization's strategic goals and resilience. Transformational leadership is a new leadership theory proposed by Bass (1985b) and Burns (1991) successively. The theory posits that leaders, with their unique leadership attractiveness, can influence employees through their role models, create an attractive future vision for employees, care for employees' personal growth, and thus motivate employees to grow and develop with the organization. Since the concept was put forward, it has attracted much attention from academia, and research on transformational leadership has become a new research paradigm on leadership. Through empirical studies on transformational leadership, many scholars have revealed that transformational leadership has a positive effect on performance (Bellé, 2014; Caillier, 2014), work engagement (Kovjanic et al., 2013; Q. Gao & Wu, 2016; Z. Wang et al., 2015), employee innovation (Feng & Zhang, 2014; H. Zhang et al., 2014; Zhao & Chen, 2013), organizational creativity (Y. Sun et al., 2016), and employee creativity (Liu & Zou, 2013; Pei et al., 2013). Therefore, introducing the transformational leadership theory in studies of the relationship between organizational culture and employee innovative behavior is helpful to a further analysis of the internal influencing mechanism between the two.

Moreover, organizational culture is not only affected by the organization's internal characteristics but also the environment at all levels, including employees' personal characteristics. In the context of China's state-owned technology enterprises, a prominent characteristic is employees' traditionality. The traditionality in Chinese culture still has a great influence on modern society. For example, the concept of family and filial piety in Confucian culture still play a key role in contemporary society in China (K.-S. Yang, 1995), and its influence is particularly prominent in state-owned technology enterprises. Riketta (2005) found that when employees' personal cultural values are consistent with organizational culture, the impact of organizational culture on organizational identification is stronger, which also implies the potential role of traditionality in the relationship between organizational culture and organizational identification.

In summary, although the theories of organizational culture, employee innovative behavior, organizational identification, transformational leadership, and traditionality are relatively mature, according to the previous research, the interaction between these factors is not constant but rather changes with time and context. In particular, it needs more in-depth exploration in the increasingly complex market environment and in the specific context of the organizational culture of China's state-owned technology enterprises. This study will focus on the relationship between organizational culture and employee innovative behavior, taking organizational identification, transformational leadership, and traditionality as mediating/moderating factors, to reveal the "black box" of the influence mechanism between these factors in the context of China's state-owned technology enterprises, further enriching the relevant theoretical research.

1.2 Research objectives

The purpose of this study is to understand the impact of organizational culture on employee innovative behavior in Chinese state-owned technology enterprises in three folds:

1) to understand the dominant type of organizational culture(s) in Chinese state-owned technology enterprises;

2) to examine the main effect of the dominant organizational culture(s) on employee innovative behavior;

3) to explore the effect of other factors (other than the direct effect) in the relationship between organizational culture and employee innovative behavior, including the mediation of organizational identification and the moderation of transformational leadership and employees' traditionality. This will help organizations better understand and manage employee innovative behavior, thereby improving the overall innovation capability of the organization.

1.3 Research questions

To understand the relationship between organizational culture and employee innovative behavior in China's state-owned technology enterprises, it is necessary to a) find out the development status and the dominant type of these enterprises' organizational culture, b) to identify the influence mechanism between the dominant organizational culture and employee innovative behavior and the main effect of the former on the latter, and c) to explore other effects other than the direct effect in the relationship between organizational culture and employee innovative behavior.

In summary, this study aims to explore the relationship between organizational culture and employee innovative behavior in China's state-owned technology enterprises by focusing on the three perspectives mentioned above. The specific research questions (RQ) of this thesis are as follows:

RQ1: What are the dominant organizational culture types in China's state-owned technology enterprises?

RQ2: How do the dominant organizational culture types of state-owned technology enterprises promote or hinder the innovative behavior of technology talents?

RQ3: Does organizational identification mediate the effect of organizational culture on employee innovative behavior?

RQ4: To what extent, transformational leadership can motivate and foster the innovative behavior of technology talents?

RQ5: To what extent, traditionality facilitate and enhance members' organizational identification?

1.4 Profile of the case company

The organization involved in this study is a research academy affiliated to a state-owned group. It is China's first state-owned cutting-edge technology innovation platform at the group level, the unit responsible for the group's overall development in artificial intelligence (AI), and the core unit for basic and cutting-edge technology research in AI. This academy, as a leading unit, has been approved to successively establish a number of national innovation platforms to carry out research on basic and cutting-edge technology and its application, according to the state, society, and the group's innovation needs and capability layout in artificial intelligence.

The academy has seven affiliated enterprises and three secondary units. Given its business positioning and development needs, its current organizational structure includes three functions, namely, the Administrative Department, Marketing Department, and Research Department. The Administrative Department has 15 subunits, including the Academy's Office, the Party Committee Office, the Comprehensive Operation Division, the Technology Development Division, and the Human Resources Division, each performing their respective administrative duties. The Marketing Department has four subunits, including the Military Industry Development Center, the Industrial Development Center, the International Business Division, and the Capacity Building Division, mainly responsible for business development and market

exploration. The Research Department includes six research institutes, one national engineering laboratory, and two research centers, serving as the essential force in scientific research.

The scientific research team of the Academy consists of more than 300 people, with doctoral degree holders accounting for more than 60% and master's holders accounting for more than 80%. The team includes seven "state-level talents", two experts from the "overseas talent plan", and 13 provincial or ministerial-level experts. The Academy has more than 2000 employees, with an average age of less than 35 years old. Employees with a bachelor's degree or above account for more than 95%. There are three academicians of the Chinese Academy of Engineering, three experts in direct contact with the central government, and 15 experts with special government allowance from the State Council. The Academy has won national collective awards for major contributions two consecutive times, eight national awards for science and technology progress, and 34 national awards for defense technology progress. In 2014, its academicians won the State Preeminent Science and Technology Award. In 2019, the Academy's accumulated operating revenue exceeded RMB 5.5 billion yuan, and the total profit exceeded RMB 200 million yuan.

The research object of this thesis is the Research Department of the Academy, including six research institutes, one national engineering laboratory, and two research centers. Closely linked to strategic, cutting-edge, and disruptive technologies, the Group is a "national strategic technological force" with typical characteristics of state-owned enterprises on the organizational level. In addition, the nine research units are facing clear and critical requirements for innovation. With differentiated management styles and organizational cultures, technology talents' performance may vary in terms of innovation ability and innovative behavior. Hence, studying the influencing factors of employee innovative behavior in this context is relevant and has both theoretical and practical significance.

1.5 Research method

In this study, the theoretical model was built based on the literature review. Then, the questionnaire was designed by using the relevant, well-established, and valid scales developed by previous researchers. A pilot test was conducted using the preliminary version of the questionnaire. A large data collection was performed only after confirming the reliability and validity of the questionnaire in the pilot, to ensure the survey's scientific and reliable results.

SPSS was used for the empirical analysis of the data obtained from the questionnaire survey. The analyses mainly included descriptive statistical analysis, correlation analysis, analysis of

variance (ANOVA), and regression analysis, through which the hypotheses and model of this study were examined.

1.6 Thesis structure

The research roadmap of this study is presented in Figure 1.2.
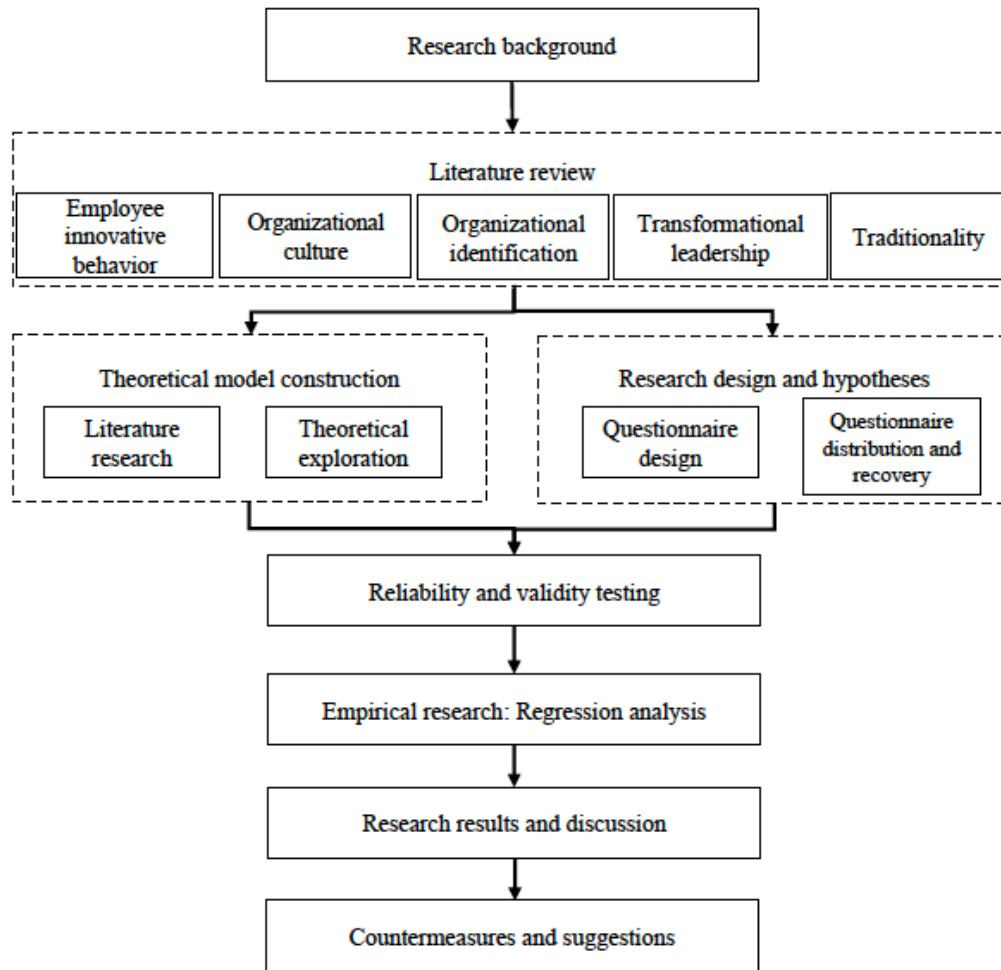
Figure 1.2 Research roadmap

This thesis is composed of five chapters, with the specific contents as follows.

Chapter One is the introduction. It introduces the topic, the background, and the relevance of the research. It also points out the key questions to be addressed and presents the corresponding research method and roadmap. This chapter covers the research background, research questions, its significance, and research framework.

Chapter Two is the literature review. Using the literature research method, it explores the impact of organizational culture, transformational leadership, organizational identification, and employees' traditionality on employee innovative behavior. Based on the literature review, five

hypotheses were put forward and theoretically illustrated.

Chapter Three is the research method. This chapter introduces the main methods used in this study and the questionnaire's design and distribution, as well as the reliability and validity test results.

Chapter Four presents the results. Through regression analysis, the data collected from the questionnaire survey was empirically analyzed, and the proposed hypotheses were supported.

Chapter Five is the discussion and conclusions. This chapter summarizes the main findings and contributions of this research. Based on the findings and the current status of China's state-owned technology enterprises, it puts forward corresponding suggestions. Finally, the study's limitations and the possible topics for future research are also presented.

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Chapter 2 : Literature Review

Based on the research questions, this chapter will conduct a literature review of employee innovative behavior, organizational culture, organizational identification, transformational leadership, and traditionality. Through summarizing and reviewing previous studies, it provides an in-depth understanding of the above concepts, serving as a theoretical basis for the subsequent research. Based on that, the research hypotheses and theoretical model are put forward.

2.1 Employee innovative behavior

2.1.1 Definition

In the constantly changing business environment, continuous and successful transformation and innovation are essential for organizations' survival and competitive advantage (Amabile, 1988; Campo et al., 2014; Rodgers, 2007), and one of the critical cornerstones of organizational innovation is the employee innovative behavior (EIB) (Janssen et al., 2004). Individual employees' innovative behavior constitutes the micro foundation of an organization's innovation and internal entrepreneurship (Felin et al., 2015), is the external manifestation of employees' internal creativity, and is the process of employees generating and implementing new ideas to improve performance or solve work-related problems (Janssen et al., 2004; Zhou & George, 2001). In terms of tendentiousness, employee innovative behavior represents a subjective willingness to introduce new products, new services, or new ways of work during the creation and implementation of ideas (Janssen, 2000; Krizaj et al., 2014; Si Dah et al., 2022).

It should be clear that employee innovative behavior is not only composed of creativity. Creativity only refers to the generation of ideas, while innovative behavior covers a wider range of aspects across the whole process of idea generation, promotion, and realization. Some scholars believe that employee innovative behavior has multiple stages and that creativity is only involved in the first stage. In innovative behavior's first stage, employees first realize the problems existing in their work and then generate new ideas on how to solve them (Larson, 2011). In the second stage, they will unite other employees to support their new ideas (Janssen, 2000). In the later stage, employees will implement the ideas by making new product prototypes

or practicing new methods (Scott & Bruce, 1994). According to West (2002), employee innovative behavior includes all individual behaviors that lead to beneficial novelty. Larson (2011) stated that employee innovative behavior was closely related to employee creativity, but the former must lead to practical benefits. Lukes and Stephan (2017) believed that the innovative behavior of employees includes multiple processes, including the generation, search, exchange, and implementation of ideas, communicating with other parties, and overcoming obstacles.

Based on a review of previous studies, T. Wang et al. (2015) defined employee innovative behavior as a complex behavior composed of three tasks, namely, idea generation, idea promotion, and idea realization: a) Idea generation. Employees' innovative behavior starts with the generation of ideas, more specifically, novel and useful ideas, which are the starting point of innovation (Amabile, 1988). Such ideas or solutions can be either original or adapted from existing products or processes. b) Idea promotion. Employees must be active in the communities where they are to gain recognition and support for their new ideas from other stakeholders. c) Idea realization. Innovators must implement the idea to turn it into tangible products or processes that can improve the profitability and efficiency of individuals, groups, or organizations.

The above-mentioned studies show that employee innovative behavior has two key features: a) the process nature, that is, employee innovative behavior is a process from idea generation to idea realization; b) purposefulness, that is, employee innovative behavior can improve the work performance of individuals, teams, or organizations. Therefore, referring to the definition by Zhou and George (2001), in this thesis, we define employee innovative behavior as employees' behavior of generating, promoting, and implementing creative ideas and methods to solve problems and improve work efficiency and performance.

2.1.2 Factors influencing employee innovative behavior

The above-mentioned literature on employee innovative behavior also took into account contextual factors and personal factors. For example, the realization of employees' innovative behavior requires support from the environment (T. Wang et al., 2015), communicating with and mobilizing others to support their new ideas (Janssen, 2000; Lukes & Stephan, 2017), communicating with other parties, and overcoming obstacles. Zhou and George (2001) were one of the early studies on employee innovative behavior that investigated the interaction of personal factors and contextual factors. They discussed how experience sharing, feedback, and

the nature of tasks interact and affect innovative behavior. The study further revealed that more in-depth research could be done to investigate the interaction of contextual factors and personal factors in fostering or hindering innovative behavior.

2.1.2.1 Employee innovative behavior and contextual factors

Contextual factors can foster or hinder individual employees' innovative behavior. Many studies have shown that innovative behavior requires appropriate contextual support to encourage employees and make them willing to generate, search, communicate, and implement new ideas. Contexts at different layers have varied effects on individual employees (De Leon, 2021; Leung et al., 2011). The context layer closer to the individual (e.g., employees' immediate managers and the organization) will have a greater impact on individuals' innovative behavior than a more distant layer (e.g., the national culture). Moreover, the context at a lower layer is inevitably a part of a higher layer and is influenced by it. For example, leadership style and organizational culture are shaped by national culture, a broader context (House et al., 2004). Previous studies have identified three critical layers that affect employee innovative behavior: their managers, the characteristics of the organization in which they work, and the national culture:

1) Support from managers. Previous studies have explored the impact of different leadership styles on employees, with varied results (Alblooshi et al., 2021; Hammond et al., 2011; Zacher et al., 2011). However, one consensus is that support from leaders/managers can have a positive impact on employees' innovation (Alblooshi et al., 2021; Hunter et al., 2014). Hunsaker (2022) found that employees' innovative behavior was positively affected by spiritual leadership. In addition, spiritual well-being interferes with this relationship, indicating that guidance and support from managers can affect employees' innovative behavior.

2) Organizational support. It mainly refers to the organization's provision of available resources to support the implementation of new ideas and encourage innovative behavior, including support and rewards from the top management. From the perspective of employees, organizational support for innovation is essential as it can motivate them to actively engage in innovative behavior (Amabile et al., 1996; Patterson et al., 2005). West and Farr (1990) identified four organizational factors that foster innovation: vision, participative safety, task orientation, and support for innovation. More specifically, a) team members understand, value, and accept the vision; b) team members believe that they can put forward new ideas and solutions without being judged or criticized; c) internally, the team can have a heated debate and discussion on different possible solutions and conduct a careful review; d) team members

believe that the organization is supporting innovation (Anderson & West, 1998). This theory has been widely applied in research on group innovation and has been supported by some empirical studies (Hülsheger et al., 2009). Lukes and Stephan (2017) believed that support from managers and organizations is the contextual factor with the most direct effect on employee innovative behavior. The study of Y. Zhang et al. (2022) on 291 hotel employees showed that support from the organization had a positive effect on employee innovative behavior.

3) National-level support. Studies investigating contextual factors at the national level have confirmed the correlation between culture and innovation or entrepreneurship (Shane, 1992; Stephan & Uhlaner, 2010). National culture is considered to affect organizational culture since the latter is rooted in the former (House et al., 2004). In addition, previous studies also showed that effective leadership style was influenced by organizational culture and national culture, indicating that deep-rooted social and cultural assumptions shaped the behavior of managers and employees. S. Zhang et al. (2021) found that in the context of the organizational culture in China, the relationship between authoritarian leadership and employee innovative behavior may be different from that in the West. They put forward insights on when and how employee innovative behavior is affected by authoritarian leadership and suggested that in China's organizational culture, authoritarian leadership could have a positive effect on employee innovative behavior to a certain extent.

2.1.2.2 Employee innovative behavior and personal factors

In terms of employees' personality traits, many studies have highlighted the importance of the "Big Five" personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism) in employee innovative behavior. A meta-analysis conducted by Feist (1998) found that innovative individuals usually are more open to new experiences, less conventional, more self-confident, and more self-accepting. However, the relationship between these personality traits and innovative behavior is not linear as it is also affected by various organizational and individual factors (Barrick et al., 2013). Among the five traits:

a) Openness is defined as the openness to and acceptance of new experiences. Employees with greater openness are more willing to accept new ideas and views and are more likely to produce innovative ideas, which has been widely confirmed in the literature (Zhou & George, 2001); in contrast, conventional personal traits may constraint employees' creativity (C. Yang et al., 2021).

b) Conscientiousness is usually negatively related to innovation because employees with higher conscientiousness tend to prefer to abide by rules and procedures; however, some aspects

of conscientiousness, such as ambition and self-efficacy, may be conducive to innovative behavior (Barrick & Mount, 1991).

c) The effect of extroversion on innovative behavior is complex. On the one hand, employees who are more extroverted tend to be more sociable and willing to share their ideas, which may foster innovation; on the other hand, they may rely too much on others' feedback, thus limiting their innovation ability (Grant, 2013).

d) Agreeableness is defined as the tendency to seek harmony with others. Employees who are more agreeable tend to be more willing to cooperate with others; however, they may go along with suggestions made by others to avoid conflict, thus hindering innovation (LePine & Van Dyne, 2001).

e) Neuroticism is defined as the tendency of emotional instability and overreaction. The relationship between neuroticism and innovation has not yet been well explored, but some studies have already shown that neuroticism may hinder innovative behavior, because employees with higher neuroticism may be overly afraid of failure and thus avoid taking risks (George & Zhou, 2001).

In terms of employees' abilities, some studies have shown that employees' innovation ability not only depends on their intellectual intelligence but also on their knowledge, skills, experience, and emotional intelligence (Mumford & Gustafson, 1988): a) Employees with relevant knowledge and skills are more likely to put forward and realize innovative ideas (Leonard-Barton & Swap, 1999). In addition, interdisciplinary knowledge and skills are considered essential drivers of innovation, as they enable employees to uncover the links between different sectors and thereby put forward new ideas (Hargadon & Sutton, 1997). b) Employees with higher intellectual intelligence are usually more likely to show innovative behavior. They have higher problem-solving ability, can handle complex tasks more effectively, and are able to put forward innovative solutions in the face of difficulties and challenges (Mumford et al., 2000). Moreover, learning ability is also considered a key factor of employee innovative behavior, as employees who can quickly learn and adapt to the new environment are more likely to generate and realize innovative ideas (London & Smither, 1999). c) Emotional intelligence is defined as the ability to recognize, understand, and manage emotions. It has been found that employees with higher emotional intelligence are more capable of dealing with difficulties and pressures and thus, are more likely to innovate (Carmeli et al., 2014).

In summary, employees' personality traits and abilities are essential factors that influence their innovative behavior; however, these personal factors do not act independently, as their effects are also interfered with by organizational context, motivation, and other factors.

Therefore, it is necessary to conduct further research by taking into account both the personal and contextual conditions for a more in-depth understanding. In addition, previous studies on employees' personal factors mainly focused on the Big Five personality traits. However, some unique personality traits, especially those formed in distinct cultural contexts (e.g., Chinese traditional culture, the organizational culture of state-owned technology enterprises), still need to be explored.

2.2 Organizational culture

2.2.1 Theoretical basis of organizational culture

With the emergence of the school of human relations, represented by Mayo, Maslow, and Herzbeg, the human factor in management received increasing attention. The Hawthorne Experiment, a landmark turning point, revealed that employees valued not only economic returns, but also social and psychological needs (Gillespie, 1993). The finding is of great significance for understanding the informal social networks and group dynamics in organizations and their influence on employee behavior and attitudes (Herzberg, 2017). Later on, Theory Y of MacGregor (1960) further deepened the understanding of human nature, indicating that people not only work for economic return but also have various social needs. The theory highlights the importance of satisfying employees' needs in management, so as to motivate them and enhance the performance of the organization (MacGregor, 1960). These theories laid a foundation for the theory of organizational culture. In other words, the theory of organizational culture is an extension of the human relations management theory.

Human is regarded as the most valuable resource of the organization and the most essential element of management; the goal of management is to use effective methods to give full play to the strengths of human nature, downplay the weaknesses, and provide an environment that can unleash human potential, wisdom, and creativity, thereby achieving individual and organizational goals simultaneously.

In the 21st century, the learning organization theory put forward the concepts of "learner" and "learning organization", emphasizing that the growth and development of individuals and organizations, as well as industry and technology, all rely on learning (Senge, 2006). This theory reminds us that organizations need to create a working environment that supports employees to pursue an enriched life and provides them with material and spiritual well-being. That requires managers to create an environment conducive to employees' growth and learning, where

employees are encouraged to challenge themselves, thereby realizing both organizational and individual development (Jo & Joo, 2011).

Through the above review of the evolution and development of management theories, we can see their importance in enabling a better understanding of organizational culture and human impact. Initially, organizational culture and human factors were neglected. They gradually received more attention and are accentuated in modern theories of learning organization and human relations management. Human factors are becoming more and more prominent in management theories, and the understanding and attention of organizational culture are increasing. It indicates a continuous development and advancement of management theories, which has great significance for understanding and solving the challenges faced by organizations nowadays.

However, understanding organizational culture is not a simple task. Different management schools and scholars have varied definitions and understandings of organizational culture. Therefore, in the following section, we will review the definitions of organizational culture to further elaborate on this complex yet essential topic.

2.2.2 Definitions of organizational culture

Organizational culture is a system of values, beliefs, and behavior patterns that drive organization members to subconsciously make every choice and decision (Ortega-Parra & Ángel Sastre-Castillo, 2013). According to Schneider et al. (2013), organizational culture is what organization members consider as norms in their working environment, and such norms affect members' behavior and the way to achieve organizational goals. Simoneaux and Stroud (2014) stated that organizational culture is the way organization members interact with each other and with other stakeholders. According to Yirdaw (2014), organizational culture is an adhesive that combines non-human resources and human resources in an organization to build team spirit and generate good performance.

Regarding the definition of organizational culture, scholars have different views and perspectives. Some commonly adopted definitions of organizational culture are presented in Table 2.1.

Table 2.1 Definitions of organizational culture by different scholars

Scholars	Definition
Schein (1985)	Organizational culture is a comprehensive system of shared basic assumptions, values, beliefs, ideas, and expectations created and maintained by an organization's members.
Handy (2007)	Organizational culture is a common understanding and a psychological environment shared by an organization's members, which enables to

	explain their experiences and provide guidance for their actions.
Hofstede (1984)	Organizational culture is the result of collective psychological programming, which affects the thinking and behavior of an organization's members in the working environment.
Cameron et al. (2010)	Organizational culture is a model of common values, beliefs, and behavior and a shared cognitive system in the organization.
Deal and Kennedy (1982)	Organizational culture consists of the organization's history, tradition, values, and beliefs, and the way how people in the organization behave.
Trice and Beyer (1993)	Organizational culture is a common mode of cognition, belief, and behavior shared by an organization's members, which guides their communication and activities in the organization.
Barney (1986)	Organizational culture is a kind of resource that affects how an organization adjusts its behavior to adapt to the environment and that shapes the employees' behavior, attitude, and values.
Alvesson and Sveningsson (2015)	Organizational culture is an evolving concept and a complex of ideas and practices that deeply affect the internal and external relations of an organization.
O'Reilly and Chatman (1996)	Organizational culture is a shared cognitive structure that shapes employees' identity and behavior in the organization and reflects the core values and behavior norms of the organization.

2.2.3 Types of organizational culture

As organizational culture is a complex and diverse concept, its different definitions have covered various cultural characteristics and dimensions, representing different types of organizational culture. In research on organization and management, scholars have proposed various approaches to understand and define organizational culture. They usually focus on the values, beliefs, codes of conduct, and shared assumptions within the organization, based on which organizational culture is categorized into different types.

The Organizational Cultural Assessment Instrument (OCAI) was designed based on the Competing Values Framework (CVF), a theory that incorporates the advantages of many previous theories, has been widely recognized and applied by scholars around the world, and is constantly updated (Cameron et al., 2022).

The theoretical model of the Competing Values Framework was put forward by Quinn and Rohrbaugh (1983). In this framework, the categorization of organization types is determined by three key dimensions: Focus, Structure, and Means-Ends. The Focus dimension reflects the balance between an organization's focus on internal relations and processes (internal focus) and the degree of its adaptation and response to the external environment (external focus). The Structure dimension reflects the balance between an organization's pursuit of flexibility, spontaneity, and autonomy (flexibility/organic structure) and its pursuit of stability, order, and centralized control (stability/mechanical structure). The Means-Ends dimension refers to the Means adopted in pursuing organizational goals (Ends). Based on the Competing Values

Framework model, the third version of OCAI categorized organizational culture into four types, namely, clan culture, adhocracy culture, market culture, and hierarchy culture (Cameron et al., 2010), as shown in Figure 2.1.
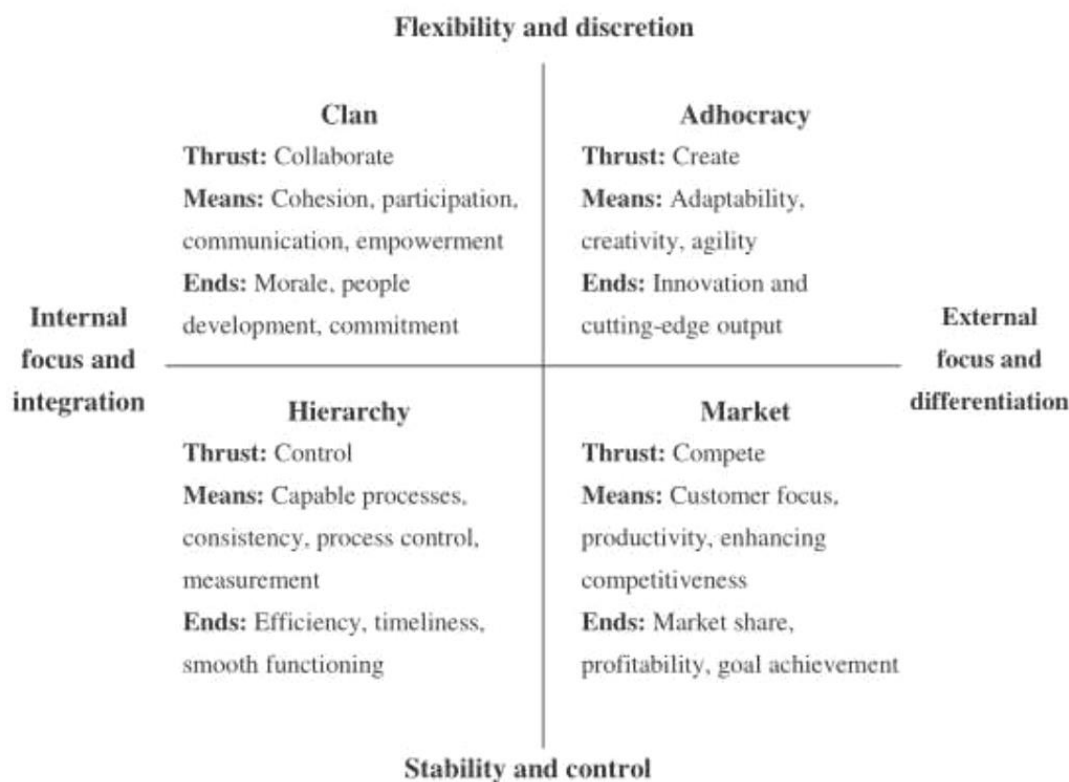
Figure 2.1 Competing Values Framework (CVF)

Source: Cameron et al. (2010)

Hierarchy culture. The hierarchy culture type is internally focused and supported by a control-focused organizational structure. The core assumptions of hierarchy culture are control, stability, and predictability. A principle belief of hierarchy culture is that employees' expectations for work will be met when their roles are clearly defined. Therefore, hierarchy culture is assumed to value precise communication, routinization, formalization, and consistency (Kimberly & Quinn, 1984). Guided by these values, the behaviors show compliance and predictability and are expected to be conducive to efficiency, timeliness, and stable operation (Denison & Spreitzer, 1991). Hierarchy culture involves establishing an effective control system across the organization. Hartnell et al. (2011) showed that in the hierarchy culture, organization members abide by the rules and regulations, and each operation is carried out according to the predefined procedures and norms. Clear communication, consistency, and stability are typical values and assumptions of hierarchy culture.

Clan culture. It is internally focused with a flexible organizational structure. Clan culture involves human subordination and values collaboration, attachment, trust, loyalty, and support

(Fiordelisi & Ricci, 2014). It highlights shared values and goals, as well as cohesion and loyalty among members. In the clan culture, leaders are often thought of as "parent figures". That is because the clan culture emphasizes family and kinship and regards the organization as an extended family. In such a culture, leaders are expected to care for, protect, and guide employees, playing a role similar to parents in a family. This type of organization usually highly values cooperation and celebrates teamwork and individual contribution (Cameron & Quinn, 2001). Miguel (2015) pointed out that in the clan culture, business managers need to create synergies collaboratively to motivate and encourage employees to establish a culture of excellence within the organization. Clan culture celebrates collaboration, participation, and open communication (Carlos Pinho et al., 2014). According to Yirdaw (2014), in the clan culture, enterprise managers encourage teamwork and tend to empower employees. As pointed out by Nongo and Ikyanyon (2012), business managers encourage employees to show commitment to their participation in the organization because employees who are committed can effectively perform their tasks and duties. The core of the clan culture is to improve employees' performance through participation, collaboration, commitment, a sense of ownership, obligation, and accountability (Han, 2012; Murphy et al., 2013; Nongo & Ikyanyon, 2012). Some studies have shown that the clan culture is conduvice to improving organizational performance (de Man & Luvison, 2014; Han, 2012; Murphy et al., 2013). However, Givens (2012) suggested that the clan culture is more about employee relations. The view of Kotrba et al. (2012) was somewhere in between, indicating that the clan culture plays an indirect role in improving performance but a direct role in enhancing employee efficiency and effectiveness.

Adhocracy culture. This adhocracy culture is externally focused and is supported by a flexible organizational structure. A basic assumption of adhocracy culture is that change fosters the creation or acquisition of new resources. Therefore, its core belief is that idealism and novel vision will drive members' creativity and encourage them to take risks, and that employees believe that innovation and change are essential to improving organizational performance (Fiordelisi & Ricci, 2014). In the adhocracy culture, managers tend to devote more resources to R&D and encourage employees to pursue innovative business ideas (Sok et al., 2014). According to Hartnell et al. (2011), growth, adventure, creativity, diversity, independence, and adaptability are the values and assumptions of the adhocracy culture. In such a culture, organization members need clear directions for their work assignments so as to understand the importance and impact of their work on achieving organizational goals (Veiseh et al., 2014). Engelen et al. (2014) found that adhocracy culture had a positive relationship with

entrepreneurial orientation. From a long-term perspective, Hartnell et al. (2011) found a positive relationship between adhocracy culture and enterprise performance.

Market culture. The market culture is externally focused and is supported by a control-focused organizational structure. Within the Competing Values Framework, an essential assumption of the market culture is that results-oriented values will drive employees' competitiveness and initiative, thus generating productivity and creating value for shareholders in the short term (Cameron & Quinn, 2001). The market culture focuses on high income, high market share, high profit, rapid growth, and productivity (Hartnell et al., 2011). According to Miguel (2015), the core elements of the market culture are open communication, competition, ability, and achievement. In the market culture, enterprise management ensures competitiveness through market achievements. To succeed in a competitive market, business managers must understand their customers and market needs. Han (2012) pointed out that in the market culture, enterprise managers' other imperative is to satisfy shareholders. In an effective market culture, managers maintain the enterprise's sustainable competitiveness in the market by mobilizing employees' values, behaviors, and strengths.

The characteristics of the above-mentioned four types of organizational culture are summarized in Table 2.2.

Table 2.2 Four organizational culture types based on the Competing Values Framework

Culture type	Assumption	Believes	Values	Means (behavior)	Effectiveness criteria
Hierarchy	Stability	When people have clear roles, and the procedures are formally defined by rules and norms, they will behave in compliance.	Communication, routinization, formalization, and consistency	Consistency and predictability	Efficiency, timeliness, and smooth operation
Clan	Human belonging	When people trust, are loyal, and become members, their behavior will be appropriate in the organization.	Attachment, belonging, collaboration, trust, and support	Teamwork, participation, employee engagement, and open communication	Employee satisfaction and commitment
Adhocracy	Change	When people understand the importance and impact of the environment, they will make appropriate	Growth, incentives, diversity, autonomy, and attention to detail	Risk-taking spirit, creativity, and adaptability	Innovation

		behavior.			
Market	Results	When people have clear goals and are rewarded for their achievements, they will behave appropriately.	Communication, competition, ability, and achievement	Customer and competitor information collection, goal setting, plans, mission priorities, competitiveness, and aggressiveness	Improvement in market share, profit, product quality, and productivity

Source: Cameron & Quinn (2001)

The organizational culture of China's state-owned enterprises has its unique characteristics, mainly due to the socialist system with Chinese characteristics, Chinese historical traditions, and the domestic and international market environment.

The organizational culture of China's state-owned enterprises is often characterized by political orientation, collectivism, stability, hierarchy, and relationship orientation. In terms of development orientation, these enterprises are usually considered important means for the government to implement economic policies and development strategies (K. J. Lin et al., 2020). Their strategic objectives and business goals are usually closely related to national policies. Therefore, political orientation has a big impact on the culture of state-owned enterprises (Boisot & Child, 1999). In terms of values, collectivism is deeply rooted in state-owned enterprises, and it is in line with the concepts of harmonious coexistence, solidarity, and mutual assistance valued in the traditional Confucian culture (M.-J. Chen & Miller, 2011). In state-owned enterprises, employees tend to keep close cooperation with the team, striving to achieve their shared goals. As an important pillar of the national economy, state-owned enterprises often undertake the responsibility of maintaining social stability and improving people's well-being (Y. Huang, 2008). In terms of organizational culture, state-owned enterprises aim for long-term and stable development instead of short-term benefits to ensure sustainable development. In terms of the system, the organizational structure of state-owned enterprises is usually pyramid-shaped, where senior executives have greater authority and influence on the enterprise's decision-making (L.-W. Lin, 2017). Under such a hierarchical system, employees tend to respect and follow the instructions and decisions of the leaders, rather than questioning and challenging them. In terms of interpersonal relationships, in state-owned enterprises, the relationship (network) among employees is of great significance in career development and resource allocation (Z. Zhang et al., 2012). Relationship oriented culture helps to build mutual trust and cooperation, but it may also lead to cronyism and corruption.

Therefore, Chinese state-owned enterprises are closely related to the hierarchy-type of organizational culture. Hierarchy culture emphasizes hierarchy, centralized decision-making, authority, and obedience, which are particularly prominent in state-owned enterprises. Chinese state-owned enterprises tend to adopt a centralized decision-making model, with power and resources controlled by a few senior executives (Boisot & Child, 1999). Such a centralized decision-making model is conducive to maintaining the stability and consistency of the organization, but may hinder innovation and change (M.-J. Chen & Miller, 2011). Hierarchy culture values compliance with norms and procedures, whereas state-owned enterprises often strictly follow regulations and processes in the management and operation (K. J. Lin et al., 2020). Such a culture that emphasizes norms and procedures is conducive to organizational order but may lead to bureaucracy and inefficiency (Warner, 2000). Compared with state-owned enterprises, private enterprises are more market-oriented and pay more attention to innovation, and their organizational culture tends to be more flexible and agile (Luo & Chung, 2005). With respect to foreign-funded enterprises, they often introduce the management experience and culture of their home country into China, forming an organizational culture with cross-cultural characteristics, valuing global vision and diversity (F. Chen, 2011).

However, some studies have shown that hierarchy culture is not the only dominant culture of Chinese state-owned enterprises. Tsui et al. (2006) found that Chinese state-owned enterprises did not clearly show a single organizational culture. Instead, the sample enterprises in the study all showed an even distribution of four types of organizational culture (the culture types in the study are hierarchy culture, market oriented culture, moderately integrative culture, and highly integrative culture). About 21% of the state-owned enterprises were described by their employees as having a highly integrative culture. Further analysis showed that the average years of establishment of those with a highly integrative culture was 22 years, significantly lower than that of those with a hierarchy culture, which is about 36 years. This can preliminarily shed light on why some state-owned enterprises can carry out reform in spite of the tradition's constraint, while others cannot. In terms of social and cultural background, China has a deep-rooted tradition of collectivism and familism (Hofstede, 2001). Such a culture and tradition emphasize teamwork, shared goals, and shared values, which are exactly the core elements of clan culture. In addition, in China's state-owned enterprises, employees usually have long-term or even permanent employment contracts. Such stable employment is conducive to the establishment and maintenance of a clan culture. In terms of management, the leaders of China's state-owned enterprises usually play the role of "parents" or "mentors", and their responsibility is not only to achieve organizational goals but also to ensure the well-being and development

of employees (X.-P. Chen et al., 2014), which is consistent with the teamwork and kinship emphasized in the clan culture.

We hold that in China's state-owned technology enterprises, the hierarchy and clan cultures are more dominant than adhocracy and market cultures. First, based on Cameron and Quinn's (2001) Competing Values Framework, Chinese state-owned enterprises have typical internal focus characteristics. According to this Framework, the internal focus dimension emphasizes the importance of internal factors and internal values in organizational culture. A higher score in this dimension means that the organization focuses more on internal stability and control and pays more attention to rules and procedures to ensure normal operation and reduce internal uncertainty, but pays less attention to market competition and external changes. The reason why Chinese state-owned enterprises conform to the internal focus dimension owes to their ownership type, supervision by the government, cultural values, and pursuit of long-term stability. These factors collectively shape the organizational culture of these enterprises, making them more inclined to pursue internal management and internal goals. Therefore, internal focus is one of the common characteristics of the organizational culture of China's state-owned enterprises. As one type of state-owned enterprises, state-owned technology enterprises retain this characteristic to a large extent, and thus, their organizational culture tends to emphasize internal focus, that is, being a clan culture or hierarchy culture. As mentioned above, China's state-owned enterprises are closely related to the hierarchy culture characterized by internal focus. Since these enterprises are technology research organizations, group work is more dominant as scientific research is carried out in the form of team projects, which makes their organizational culture different from that of other state-owned enterprises. For example, H. Lin et al. (2019) found that Chinese scientific research institutions generally had a clan-type organization. That is due to the following reasons: a) it is difficult for early-career individuals to constantly win projects and research funding, so they need to rely on a large laboratory or a big project team; b) in scientific research, the leader of the project team plays a significant role. Therefore, in state-owned technology enterprises, the clan type of organizational culture, which is also internally oriented, is also likely to be one of the dominant cultures.

Accordingly, the first hypothesis is proposed:

Hypothesis 1 (H1): *In China's state-owned technology enterprises, hierarchy culture and clan culture are more prominent than adhocracy culture and market culture.*

2.2.4 The impact of organizational culture on employee innovative behavior

We reviewed the definitions and types of organizational culture in the above sections, laying a key foundation for investigating how an organization's cultural values and characteristics are related to employees' innovative behavior. Studying this relationship will enable us to further explore how organizational culture shapes employees' attitudes, behavior, and innovation willingness.

Schein (2010) believes that organizational culture is a social force, which is generally invisible but yet very powerful. Empirical evidence has shown that organizational culture significantly affects an organization's market behavior orientation and performance (Homburg & Pflesser, 2000; Naveed et al., 2022), employee attitude, and organizational efficiency (Gregory et al., 2009). In certain aspects, the significance and efficiency of its effect can be even higher than that of organizational strategy and organizational structure (Zheng et al., 2010). Therefore, an effective organizational culture can strongly influence employees' behavior, going beyond the formal management system, procedures, and authority (Hogan & Coote, 2014). In addition, effective organizational culture is essential for motivating and retaining capable and trustworthy employees in the organization (Eaton & Kilby, 2015; Wilderom et al., 2012). Since employees are not only the actors in realizing organizational innovation, but also the perceiver of organizational culture, organizational culture has various direct or indirect effects on the innovative behavior of organizations and employees (Imran et al., 2022).

According to Schein's (1985) model, based on visibility, organizational culture can be divided into three levels: values, norms, and artifacts. In a series of subsequent studies, these three levels were found to have a close connection with employee innovative behavior:

1) Values. The impact of values on employee innovative behavior is multifaceted. Values can stimulate employees' interest and motivation for innovation. When organizational values emphasize innovation, exploration, and progress, employees are more likely to show positive innovative behavior. Such values highlight the importance and encouragement of innovation and make employees realize that their innovation efforts are recognized and significant (Dose, 1997; Rokeach, 1973). According to Social Learning Theory, individuals learn values, attitudes, behaviors, and skills by observing others in a social environment (Bandura, 1986). Therefore, values also have an impact on knowledge sharing and collaboration. When organizational values emphasize knowledge sharing, openness, and collaboration, employees are more willing to share their knowledge and experience, thus promoting innovative knowledge flow and cross-functional cooperation. Such values support communication and cooperation on innovation,

providing a good environment and platform for innovative behavior. In summary, the impact of values on employee innovative behavior lies in motivating innovation, influencing decision-making and behavior orientation, supporting the formation of innovation culture, promoting knowledge sharing and collaboration, and shaping employees' identity and sense of belonging. Organizations can promote and support employee innovative behavior by clarifying and emphasizing innovation-related values (Anderson et al., 2014; Bunderson & Sutcliffe, 2003).

2) Norms. The impact of norms on employee innovative behavior can be analyzed from multiple perspectives. First of all, organizational norms are social expectations based on potential organizational values. They represent the codes of conduct for actions within a group and imply specific penalties for violations of these expectations (O'Reilly & Chatman, 1996). Previous studies have shown that organizational norms related to enhancing creativity (e.g., the expectation and encouragement of risk-taking) or fostering project implementation (e.g., the expectation and encouragement of teamwork, such as coordination and information exchange) are significantly associated with employee innovation (O'Reilly III et al., 2014). When these organizational norms exist, individuals are more likely to propose new and creative solutions and put such creative ideas into action (Dewett, 2004; O'Reilly III et al., 2014).

Secondly, the degree to which an organization values and expects certain behaviors (e.g., achievement, service, efficiency, employee appreciation, autonomy, cross-functional cooperation, and innovation) affects employees' work behaviors (Gibson & Zellmer-Bruhn, 2001). The verbal and non-verbal language used to support expected behavior provides employees with basic information about their work-related roles, scope, goals, and members' expectations. In addition, such verbal or non-verbal language may produce a sense of psychological security, which may lead to team innovation.

Moreover, the basic values and corresponding norms of the organization can also be presented in the physical space, for example, in office design. Office design visually expresses the basic values and corresponding norms of an organization, and over time, it creates a specific atmosphere, sensation, and meaning for employees (Elsbach & Bechky, 2007). As a visible part of organizational culture, office design and decoration symbolize the social order of the organization (Schein, 1992). For example, an organization dedicated to promoting a culture of equality among groups will prevent and remove visible identity symbols, such as executive lunchrooms and luxury offices for senior managers. Similarly, the organizational culture that expects collaboration, open communication, and problem-solving among teams will promote and encourage the creation of the corresponding atmosphere and sensation in the office design,

thereby imperceptibly influencing employees' norms and values. For example, in Facebook's Silicon Valley Office in the United States, an open space has been created by removing the walls between most of the compartments. For office design, professional artists have been entrusted to carry out creative painting, integrating the popular graffiti culture into the office environment, making the whole space full of creativity, which is conducive to motivating employees for innovation.

3) Artifacts. The artifacts of organizational culture refer to the characteristics of organizational culture that are easy to observe, including stories, rituals, organizational structures, and language (Schein, 1992). These artifacts provide employees with a channel to understand the organization's vision (Meyer & Allen, 1991). For example, rituals and ceremonies can convey organizational values and norms; by celebrating successful events, the importance of expected behavior is emphasized (Higgins & McAllaster, 2002). Rituals can confirm and convey the organization's basic values and norms to its members in a more specific and visible way, so as to create and maintain its culture (Trice & Beyer, 1993).

Language, as a part of organizational culture, through the use of metaphor and meaning structure, provides instruction for appropriate and inappropriate behavior. It is critical to improving employees' innovative behavior and innovation ability and ensuring the organization's effective operation and management. For example, Martin et al. (1983) showed that the way of storytelling has a significant impact on shaping employees' attitudes and behaviors. Through a positive way of story-telling, employees are depicted as diligent, persistent, and creative in dealing with obstacles, thus enhancing their sense of control over the results. Organizations can use strategic storytelling to motivate members to work in the desired direction. As Bartel and Garud (2009) suggested, innovation stories not only demonstrate the expected behavior but also provide a way to share information, stimulate new ideas, and promote coordinated action. when employees can find their place in the story, their sense of commitment and engagement in practical actions is enhanced, thereby improving their enthusiasm for innovation.

In a word, with the impact of the corresponding organizational culture on the levels of values, norms, and artifacts, innovative behavior is likely to emerge in response to the environment shaped by the organizational culture. Hogan and Coote (2014) conducted an empirical analysis on more than 100 law firms, and the results showed that organizational culture had a positive impact on innovative behavior on all three levels – values, norms, and artifacts.

In summary, generally, organizational culture has a relatively positive impact on employee innovative behavior. Based on the objectives of this study and Hypothesis 1 proposed above, in the following, we will address the relationship of hierarchy and clan cultures with employee innovative behavior.

Clan culture may also support various processes of employee innovative behavior. The clan culture is internally oriented, and the assumption is that human belonging will produce positive emotions for the organization. A core concept of clan culture is that the organization's trust and commitment to employees foster open communication and employee participation. The clan-type organizations emphasize attachment, subordination, membership, and support. Behaviors related to such values include teamwork, participation, employee engagement, and open communication (Cameron & Quinn, 2001; Hartnell et al., 2011). These behaviors are conducive to strengthening and improving employee morale, satisfaction, and commitment, thus promoting employee innovative behavior.

In terms of creativity generation, due to employees' close relationships and high commitment to the organization, they may be more willing to share knowledge and ideas, which is conducive to generating creativity (Jaskyte, 2011). According to Tsai (2011), leaders in clan culture are usually regarded as mentors or coaches rather than authority figures. Such a close and mentorship-based relationship may enhance employee satisfaction because employees perceive that they are provided with more freedom and more opportunities to learn and grow, which may increase employees' willingness to innovate. In terms of supporting the realization of employees' creativity, Sarros et al. (2008) investigated how to establish an innovation atmosphere through clan culture. They found that in a clan culture, employees may feel safer and are more risk-tolerant because they know that the team will support them even if they fail. This is conducive to innovation as innovation often requires the acceptance of a certain level of risk and failure. In addition, clan culture emphasizes individual learning and development. In such an environment, employees may be more willing to learn new knowledge and skills, which can help to improve their ability to realize innovation (Berson et al., 2008).

Hierarchy culture may also have a positive impact. For instance, the hierarchy culture defines clear responsibilities and resource allocation to ensure the orderly distribution of resources, which is conducive to accelerating the implementation of certain innovation projects. As to long-term innovation projects, the hierarchy culture may provide them with the required stability and sustainability.

However, the inherent characteristics of hierarchy culture may impose certain constraints on employee innovative behavior, making its promoting effect on innovation weaker than that of clan culture.

One reason is that, in a hierarchy-type organization, authority and hierarchy are the dominant factors. The decision-making power is concentrated in senior executives, and employees rarely have the opportunity to participate in decision-making or share their voices. Such an authoritarian environment can easily hinder employees' innovation desire, because they may feel that their ideas cannot be adopted or recognized anyway (O'Reilly III et al., 2014), or they are afraid of offending their leaders by putting forward new ideas. This innovation-curbing atmosphere may easily lead to employees' conservative attitude toward new things, thus limiting the play of their innovation ability (Carmeli et al., 2010).

Second, hierarchy-type organizations usually have many strict rules, regulations, and procedures. Excessive rules and procedures may limit employees' creativity and innovation ability and restrict innovation. Worrying that their ideas may not conform to the established rules, employees may suppress their innovative behavior (Cameron & Quinn, 2001). In organizations with a hierarchy culture, employees' promotion usually depends on the evaluation by their leaders. This may make them care too much about their leaders' opinions while ignoring their own innovation ability. Due to the lack of incentives for innovation, employees may not be willing to invest time and effort in innovation attempts (Amabile, 1998).

Moreover, the hierarchy-type of organizational culture usually emphasizes the boundaries between departments/functions, which may lead to information barriers and make resource sharing difficult. Cross-functional cooperation is an important source of innovation, whereas hierarchy culture may hinder the development of such cooperation and thus limit the generation of innovation (Tsai, 2001). Third, the hierarchy-type of organizational culture usually encourages employees to follow rules and regulations and avoid risks. Employees and management are often highly sensitive to risks. They tend to maintain the status quo and avoid taking risks. Such a conservative attitude limits the organization's attempts at new ideas and methods, thus reducing employees' enthusiasm for innovation (Jansen et al., 2006). Afraid of failure, employees may opt for conservative strategies rather than making attempts at new ideas and methods, which will hinder the organization's innovation atmosphere and ability (Sitkin & Pablo, 1992).

The above discussion shows that hierarchy culture significantly hinders innovation in a bottom-up manner, which is consistent with the findings of Tierney and Farmer (2002) and Zhou and Shalley (2003). Tierney and Farmer (2002) revealed that in the hierarchy culture,

employees might feel that they lack the necessary ability or authority to propose or implement new ideas, thus reducing their self-efficacy in innovation. Zhou and Shalley (2003) pointed out that in a strong hierarchy culture, fixed norms and processes could limit employees' creativity; however, it has certain unique advantages in promoting innovation in a top-down manner.

First of all, the hierarchy culture can ensure the orderly distribution of resources, which can sometimes accelerate the implementation of innovative projects. The direction and objectives of innovation are usually decided by senior executives or the management team. With the decision-making power at the top management level, it helps to ensure that the entire organization responds clearly and rapidly to the decisions and acts in the same direction, whereas resources, funds, and personnel are allocated to key innovation projects quickly and effectively (Oldham & Cummings, 1996).

Second, for some long-term innovation projects, the hierarchy culture may bring the required stability and sustainability. As innovation decision-making and direction are clarified from top to bottom, the conflict between employees may be reduced because the team is clear about the organization's goals and direction. The leaders can provide clear support, guidance, and feedback, which may encourage employees to put forward and implement innovative ideas (Axtell et al., 2000; Janssen, 2005). Therefore, as a type of organizational culture, hierarchy culture can have a positive impact on employee innovative behavior; however, compared to clan culture, it may rely more on certain contextual conditions, resulting in a weaker positive correlation between hierarchy culture and employee innovative behavior.

Therefore, we put forward,

Hypothesis 2 (H2): *Clan culture has a stronger positive relationship with employee innovative behavior than hierarchy culture does*.

2.3 Organizational identification

2.3.1 Definition

With society and organizations being increasingly turbulent and the relationship between individuals and organizations becoming increasingly fragile, individuals' desire for work-related identification is also increasing (Ashforth et al., 2008). While there are many different cognitive paradigms for organizational identity, the conceptualization of organizational identification has gained a better consensus (Shaikh et al., 2022). Social Identity Theory has been widely applied to explain the employee-organization relationship (Ashforth et al., 2008;

Ashforth & Mael, 1989; Dutton et al., 1994; Hogg & Terry, 2014). From the perspective of social identity, there is a general consensus that organizational identification is one's perception of being a member of a (or more) social group and identification with the values and emotional significance related to his membership (Ashforth & Mael, 1989; Haslam, 2004; Tajfel, 1978). Organization is a social form, with which people can establish a sense of identification (Ashforth & Mael, 1989; Hogg & Terry, 2000). When employees perceive the unity with their organization and have a sense of belonging, organizational identification is generated. Therefore, organizational identification generally refers to the degree to which organization members define themselves according to their organizational identity (Ashforth & Mael, 1989).

Organizational identification has the potential to enhance employee motivation and the organization's results, leading to low turnover intention, organizational citizenship behavior, employee satisfaction and well-being, and employee performance (Ashforth et al., 2008; Riketta, 2005). According to Social Exchange Theory, the relationship between employees and organizations depends on the obligation of employees to repay the organization for the fair and beneficial treatment they receive from the organization (Coyle-Shapiro & Conway, 2005; Cropanzano & Mitchell, 2005). Therefore, in explaining the relevance of employees' organizational identification, its basic assumption is that when the organization benefits employees by meeting their social and emotional needs, employees have an obligation to repay the organization with their social and emotional attachment to the organization.

The formation of organizational identification has been addressed from different perspectives in previous studies. For example, according to the Group Engagement Model (Blader & Tyler, 2009; Tyler & Blader, 2003), when employees perceive higher procedural justice in the organization, they tend to have stronger organizational identification. In addition, some studies (e.g., the Leader-Member Exchange theory) indicate that the interaction between leaders and members is an important prerequisite for the formation of organizational identification (Tangirala et al., 2007). Finally, employees' perception of organizational support (i.e., the degree to which organizations value employees' contributions and care about their well-being and social and emotional needs) can have a positive impact on employees' organizational identification (Edwards, 2009; Edwards & Peccei, 2010).

In addition, subsequent studies of the organizational identification theory showed that the objects of organizational identification had various dimensions/levels, mainly including the relationship with leaders (Carmeli et al., 2011; Johnson, 2010; Sluss & Ashforth, 2007; Walumbwa & Hartnell, 2011), the occupation/profession (Hekman et al., 2009; Vough, 2012), and the work unit/group/team (Olkkonen & Lipponen, 2006; Shaikh et al., 2022; Vough, 2012).

2.3.2 Organizational identification and organizational culture

Through a series of empirical studies on different industries and organization types, it has been found that organizational identification and organizational culture are related at various levels.

First, organizational culture provides employees with a foundation for identification. When employees agree with the values, beliefs, and norms of the organization, they are more likely to form a sense of identification with the organization. For example, O'Reilly and Chatman (1986) showed that the consistency and strength of organizational culture were positively related to employees' organizational identification. Dobni (2010) found a positive relationship between organizational identification and innovative organizational culture, thereby confirming that when employees have a stronger organizational identification, the organization has a stronger innovation ability. Earley and Mosakowski (2000) conducted a study on multinational companies through a combination of questionnaire surveys and interviews. They found that in these companies, employees' organizational identification was positively related to a diversified organizational culture, indicating that organizational identification was conducive to cross-cultural cooperation and reduced cultural conflicts, thus improving organizational performance.

Second, there may be a complementary relationship between organizational identification and organizational culture. For example, the "dual-core" model proposed by Goffee and Jones (1996) emphasizes the complementary relationship between organizational identification and organizational culture: organizational identification can affect employees' dissemination and maintenance of organizational culture. That is, when employees have stronger identification with the organization, they are more willing to follow the norms of the organization and actively participate in organizational activities, thereby disseminating and maintaining the organizational culture. Van Knippenberg and Sleebos (2006) showed that organizational identification was positively related to the maintenance and dissemination of organizational culture. The stronger employees are identified with the organization, the more they are likely to accept and adapt to the organizational culture; meanwhile, a positive, open, and innovative organizational culture can enhance employees' organizational identification. This complementary relationship is conducive to consistency and stability within the organization, thus improving organizational performance.

Third, organizational identification and organizational culture may create synergies in organizational behavior. Some studies have found that organizational identification can moderate the effect of organizational culture on employees' behavior and psychology. When facing difficulties, employees with higher organizational identification are more likely to adhere

to the organization's values and codes of conduct, which is conducive to maintaining the organizational culture (Bouncken et al., 2022). In addition, organizational identification may also moderate the relationship between organizational culture and organizational performance. For example, Dutton et al. (1994) found that organizational identification played a moderating role in the effect of organizational culture on organizational innovation. The synergy between organizational identification and organizational culture may have a positive impact on the organization. A healthy organizational culture can enhance employees' identification, whereas employees' organizational identification helps to maintain and disseminate organizational culture. This synergy can enhance the cohesion, innovation ability, and competitive advantage of the organization. For example, such as synergy is highlighted in the Competing Values Framework model proposed by Cameron et al. (2010).

The above-mentioned literature shows that organizational identification has an interactive relationship with organizational culture in multiple dimensions. In the following, we will address its impact on employee innovative behavior.

2.3.3 Organizational identification and employee innovative behavior

Some scholars have attempted to explain the relevance of organizational identification in employee creativity and found that organizational identification has a positive effect on employee creativity (Hirst et al., 2009; Madjar et al., 2011), which is consistent with the view of the organizational identification theory. As employees tend to put more creative efforts into their work, their creativity is enhanced, which is favorable to the interests of both the employees and the organization.

In the literature on the impact of organizational identification on employee innovative behavior from the perspective of individual differences, scholars attempted to explore the mechanism of the generation of employee innovative behavior from various perspectives. One is from the social-political perspective (Baer, 2012; Yuan & Woodman, 2010). According to this view, the satisfaction of employees' individual interests is the primary factor for their innovative behavior. Similarly, Scott and Bruce (1994) also showed that employees' perception that innovation can bring them individual benefits was the premise for an organization to realize innovation. Studies by Yuan and Woodman (2010) and Baer (2012) both showed that when employees realize that they can get more benefits if they make efforts to carry out and realize innovation, they will be more motivated to put their new ideas into practice. It can be seen that employees consider whether innovation can benefit themselves, whereas organization management tends to expect employees to consider the interests of the organization. Only when

the interests of employees are in line with the interests of the organization, can employees actively and spontaneously generate innovative behavior. As stated by West and Farr (1990), the ultimate goal of employee innovative behavior is to benefit both individuals and organizations. From this perspective, the reason why organizational identification can promote employee innovative behavior is that it incorporates both individual and organizational interests: high identification makes employees believe that if the organization achieves better performance, their personal interests will be satisfied – the individual and organization interests are aligned. Pratt and Hedden (2023) found that without organizational identification, employees would not be able to perceive the connection between the meaning and goals of their work.

However, some studies pointed out that organizational identification might potentially hinder innovation. Rotondi Jr (1975) found that R&D personnel's organizational identification might be negatively related to innovation. Albert et al. (1998) indicated that if organizational identification is overly strong, employees may blindly trust the organization, thus hindering their organizational learning. According to Tangirala and Ramanujam (2008), employees with higher organizational identification would be less likely to put forward their suggestions and views on the organization. Bouchikhi and Kimberly (2003) showed that employees with high organizational identification might resist organizational change. Haslam and Reicher (2006) found that employees with high organizational identification may be overly attached to failing projects and unable to make more rational decisions.

Therefore, in practice, the effect of organizational identification on employee innovative behavior may be more complex. On the one hand, organizational identification unifies the interests of individuals and organizations, as employees who strongly identify with enterprises tend to align their interests with the enterprise's interests. Therefore, organizational identification is one of the effective ways to stimulate innovative behavior. On the other hand, high organizational identification may hinder employee innovative behavior under certain conditions (Pierce & Aguinis, 2013), which requires a new approach to explain the impact of organizational identification on employee innovative behavior. Some previous studies focused on creativity-related organizational identification, such as creative self-efficacy (Tierney & Farmer, 2002), creative role identity (Farmer et al., 2003), and creative personal identity (Jaussi et al., 2007).

This study posits that organizational identification may play a mediating role between organizational culture and employee innovative behavior, that is, organizational culture affects

employee innovative behavior by influencing employees' organizational identification.

On the one hand, organizational culture can effectively stimulate organizational identification. Organizational culture is a shared set of values, beliefs, and codes of conduct. It provides a common framework for employees within an organization, enabling them to better understand each other and the organization's goals (Schein, 2010). When employees identify with these values and beliefs, they are more likely to have organizational identification and a sense of belonging (Ashforth & Mael, 1989). According to Social Identity Theory, people tend to incorporate themselves into a group to obtain self-esteem and identity (Tajfel & Turner, 2004). When the organizational culture can meet employees' social identity needs, they are more likely to develop organizational identification. Organizational culture influences organizational identification through employees' organizational commitment. Employees' identification with the values and goals of the organization can enhance their organizational commitment, thereby strengthening their organizational identification (Meyer & Allen, 1991). A positive organizational culture encourages communication, cooperation, and exchange among employees, which is conducive to their trust and emotional ties. Good internal interaction helps employees develop a sense of belonging and identification with the organization (Van Knippenberg & Sleebos, 2006).

On the other hand, organizational identification has various positive effects on employee innovative behavior. Employees who strongly identify with the organization are more likely to generate positive emotions and psychological security, which makes them more willing to make efforts for the interests and goals of the organization by trying new methods and ideas (Mael & Ashforth, 1992). Organizational identification helps employees establish good cooperation and develop trust within the organization, which is conducive to innovative behavior as employees are more likely to make innovation attempts in a supportive and tolerant environment (Kahn, 1990). When employees are identified with the organization, they are more likely to show strong autonomy and responsibility, which will drive them to actively participate in innovation activities and strive to create value for the organization (Carmeli et al., 2017). Organizational identification can foster knowledge and experience sharing among employees and motivate them to participate in learning activities within the organization. Knowledge sharing and learning are the key factors of innovation and can help employees develop new skills and improve innovation ability (Cabrera & Cabrera, 2005).

Therefore, we propose,

Hypothesis 3 (H3): *Organizational identification mediates the relationship of hierarchy and clan culture with employee innovative behavior.*

2.4 Transformational leadership

2.4.1 Evolution of the Transformational Leadership Theory

Transformational Leadership Theory was developed in the late 20th century by Burns (1978) in the analysis of political leaders. Before that, people had paid a lot of attention to the styles of leaders who successfully transformed organizations, and transformational leadership was one of the typical characteristics. Since the 1980s, Burns' Transformational Leadership Theory has been continuously expanded and updated and has been applied in the practice of organizational management (Bass, 1985a; Bass, Waldman, et al., 1987; Radi Afsouran et al., 2022; Tichy & Devanna, 1986). Subsequently, Bass (1985a) further improved and expanded Burns' theory. His pioneering work on transformational leadership, namely, *Leadership and Performance Beyond Expectations*, has attracted widespread attention in the past decades. In the existing studies, the mainstream view is that transformational leadership has four main characteristics: charisma, inspirational motivation, intellectual stimulation, and individualized consideration (Bass & Riggio, 2006).

1) Charisma. First, transformational leaders usually have high moral standards and good personality qualities, which makes them recognized and followed by other followers and subordinates. In addition, transformational leadership is a leadership style with foresight and vision that guides the development of the organization. Transformational leaders will take the full initiative in the organization's construction. In the organization, transformational leaders are the main proposers of vision, mission, goals, and culture and lead the organizational layout based on core values and common goals (Hickman, 2009).

2) Inspirational motivation. Transformational leaders encourage team members to overlook individual interests and pursue common goals; they also provide employees with support and development opportunities. Burns described transformational leadership as: when transformational leaders interact with others, both leaders and followers will enhance their motivation and morality. From the perspective of Maslow's hierarchy of needs theory, transformational leadership can raise the needs of followers from a lower level to a higher level. Transactional leaders clarify expectations and reward followers if these expectations are fulfilled, whereas transformational leaders encourage their followers to go beyond individual interests and strive for group interests (Avolio & Yammarino, 2002; Bass, 1985a; Burns, 1978).

3) Intellectual stimulation. Transformational leaders have the ability to motivate and influence team members and can create a positive working atmosphere and organizational

culture, thereby achieving performance beyond expectation. Taking Mahatma Gandhi and John F. Kennedy as examples, Bass (1985a) proposed that transformational leaders can enhance the confidence of followers and the intrinsic value of performance, thus generating a higher level of motivation. Therefore, while transactional leadership may lead to performance consistent with expectations, transformational leadership can bring performance beyond expectations.

4) Individualized consideration. Transformational leaders will interact with subordinates more actively, create a supportive atmosphere, consider employees' personal needs, be willing to help employees solve life- and family-related problems, and help followers achieve personal and career development. As reliable leaders, they make commitments for their followers, thus generating a common sense of purpose in the company and individuals' development (Waddock & Post, 1991). Under transformational leadership, team members care about each other, stimulate each other's wisdom, inspire each other, and identify with the team's goals. At the same time, transformational leaders often play the role of teachers and advisors, helping individuals with their self-realization. Research has found that leaders with more effective leadership and higher subordinate satisfaction tend to be more transformative rather than transactional (Avolio et al., 1991).

2.4.2 Impact of transformational leadership on employee innovative behavior

With the continuous development of the study of management, Transformational Leadership Theory has received great attention in research. Its theoretical framework and practical application have been extended continuously. One of the research areas is how transformational leadership affects employee behavior in the organization.

Previous studies have shown that transformational leadership has a direct effect on organizational citizenship behavior/performance (Koh et al., 1995; MacKenzie et al., 2001; Podsakoff et al., 1996; Purwanto, 2022). In particular, in terms of its impact on employee innovative behavior, transformational leadership can influence and stimulate employees' enthusiasm and creativity by enhancing their organizational citizenship behavior, generating and maintaining common beliefs and values, and incentivizing and encouraging them (Alblooshi et al., 2021; Koh et al., 1995; Purwanto, 2022).

First, transformational leadership has a significant effect on organizational culture. Many studies have indicated the significant relationship between transformational leadership and organizational operation. Transformational leadership has a high correlation with a number of evaluation indicators of organizational operation, such as employees' commitment to the organization (Barling et al., 1996), job satisfaction, and satisfaction with leaders (Koh et al.,

1995; Lowe et al., 1996). According to Trice and Beyer (1993) and Schein (1985), leadership can change and maintain organizational culture by generating new or strengthening established beliefs, common values, best practices, and norms in the organization. Trust in the workplace can also be developed through organizational leadership (Creed et al., 1996). According to the literature, trust is the core feature of the relationship between transformational leadership and its followers (Butler Jr et al., 1999; Gillespie & Mann, 2000; Podsakoff et al., 1996). In addition, studies on different types of organizations, such as the military (Bass, Avolio, et al., 1987), religious organizations (Smith et al., 1984), industry (Bass, Avolio, et al., 1987), scientific research environment (Waldman et al., 1987), and state-owned institutions (Purwanto, 2022), have shown that transformational leadership is a leadership style that leads to effective organizations. The results of Weese (1995) showed that with transformational leadership, organizations tend to have a stronger organizational culture, and the leaders can perform better in carrying out activities for organizational culture construction.

Second, transformational leadership has a significant direct effect on employee behavior. The impact of transformational leadership on organizational culture can be reflected in the employees working in the organization (Tucker & Russell, 2004). Transformational leaders help subordinates discover who they are and what role they play in helping the organization achieve its mission. Through such interaction, transformational leaders can effectively enhance subordinates' loyalty to the organization. In addition, transformational leadership can also influence organizational culture through its impact on organizational productivity (Radi Afsouran et al., 2022). As transformational leaders emphasize organizational values and culture, the organization's productivity and innovation will be improved (Niehoff et al., 1990). Moreover, transformational leaders influence organizational culture by enabling the organization to view the world differently (Mink, 1992). With change in the external environment of the organization, transformational leaders affect the organizational culture by helping the organization adapt to the new environment (Smith & Bell, 2011). To make the organizational culture more transformative, senior managers must clarify what changes are needed. Some studies found that one aspect of transformational leadership, namely, leader inspirational motivation, has a positive moderation effect on the relationship between team identification and creative effort, but did not have a main effect (Hirst et al., 2009). Regarding the negative impact of hierarchy culture on innovation, transformational leadership may play a mitigating role. As an influential leadership style, transformational leadership emphasizes stimulating employees' potential, creating vision, and promoting organizational change. In

organizations with a hierarchy culture, transformational leadership can have a positive moderation effect on employee innovative behavior, mitigating the hierarchy culture's negative effect on innovation.

Third, transformational leadership can motivate employees to innovate by enhancing their organizational citizenship behavior (Hamid et al., 2022; Mastur et al., 2022). Organizational citizenship behavior is described as employees' non mandatory voluntary behavior that is beyond their regular work duties and is not related to any type of organizational reward system (Farh et al., 1990). According to Engelbrecht and Schlechter (2006), organizational citizenship behavior is essentially an extremely positive and ideal behavior phenomenon and is the behavior that organizations hope to promote and encourage. Besides, organizational citizenship behavior is selfless because it involves mutual assistance among employees without expecting any return from the receivers (Nguni et al., 2006). Since transformational leaders are assumed to motivate subordinates to perform beyond expectations (Bass, 1985a), they may stimulate subordinates' organizational citizenship behavior to improve their job performance (Podsakoff et al., 1990). Bass and Avolio (1994a) believed that transformational leadership can cultivate employees who are selfless, loyal, and closely connected with the organization. The performance of such employees usually exceeds the expectations of their job requirements (Bass, 1985a).

Studies have shown that transformational leadership is correlated with various organizational citizenship behaviors, including civic virtue, assistance, sportsmanship, courtesy, and altruism (MacKenzie et al., 2001; Pillai et al., 1999; Podsakoff et al., 1990). Based on previous empirical research, Engelbrecht and Schlechter (2006) suggested that transformational leadership had both direct and indirect effects on organizational citizenship behavior. Aarons (2006) believes that leadership is related to organizational and employee performance; it is necessary to view leadership honestly as its styles may positively or negatively affect individual and organizational behaviors. Organizational citizenship behavior provides various supports for enhancing employees' innovation willingness. It creates an environment conducive to innovation by establishing mutually beneficial relationships, enhancing employees' loyalty and identification, fostering information sharing and knowledge transfer, and creating a positive working atmosphere. Such an environment can stimulate employees' potential for innovation and provide them with the opportunity to implement and realize their innovative ideas. With the support of organizational citizenship behavior, employees participate in innovation activities more actively, promoting the organization's development in innovation, thereby enhancing the competitiveness and sustainable development ability of the organization (Hamid

et al., 2022; Susanto et al., 2023).

In summary, transformational leadership can have a direct and strong influence on organizational culture and individual employees. Based on the characteristics of transformational leadership and the mechanism of its influence on the organization, transformational leadership can have a positive impact on employee innovative behavior in organizations with a hierarchy culture in the following ways: a) Transformational leadership can stimulate employees' innovative thinking. Transformational leaders encourage employees to actively put forward innovative ideas and support them to innovate in the face of difficulties, which helps to mitigate the negative effect of hierarchy culture on innovative thinking and motivate employees' innovative behavior (Bass, 1999; Gumusluoglu & Ilsev, 2009). b) Transformational leadership can support employee innovation through the management mechanism. Transformational leaders encourage information and resource sharing across departments/functions, so as to alleviate the problems of information barriers and resource sharing difficulty caused by hierarchy culture and create favorable conditions for employee innovative behavior (Bass & Avolio, 1994b). Transformational leaders consider employees' personal development and provide them with rewards and promotions according to their performance in innovation. This helps to enhance employees' motivation for innovation, making up the insufficient driving force of promotion mechanism on innovative behavior in the hierarchy culture (Jung et al., 2003). c) Transformational leaders acknowledge the possible failures in the process of innovation and encourage employees to try and take risks, which is conducive to enhancing employees' innovation willingness in the hierarchy culture. They encourage open communication and speaking up, are more tolerant of failure, and minimize the negative consequences resulting from employees' fear of risk or failure, which helps to improve employees' psychological security. In this environment, under transformational leadership, employees are more willing to put forward new ideas and try new methods (Detert & Burris, 2007; Edmondson, 1999).

However, transformational leadership may not have any moderation effect in organizations with a clan culture. Clan culture is a culture that emphasizes collective cooperation, close ties, and traditional values. In this culture, leaders are often regarded as "parent figures". They are responsible for maintaining social cohesion, inheriting values, and maintaining team harmony. Therefore, in the clan culture, due to its emphasis on team spirit and a family-like atmosphere, team members tend to establish a close family-like relationship, which makes it difficult for transformational leaders to exert their charismatic influence. Therefore, transformational

leadership tends to have a weaker impact on employee behavior in organizations with clan culture.

Therefore, this thesis proposes,

Hypothesis 4 (H4): *In hierarchy culture other than clan culture, transformational leadership moderates the positive relationship between organizational culture and employee innovative behavior such that with a higher level of transformational leadership, the positive relationship between hierarchy culture and employee innovative behavior is stronger, and vice versa.*

2.5 Traditionality

2.5.1 Definition

Traditionality is often defined as a long-lasting feature of society and culture, which includes a set of beliefs, values, customs, rules, and behavior patterns accepted by members of society and passed down across generations (Hobsbawm & Ranger, 1983). At the same time, traditionality can also be understood as a maintenance mechanism of social order, which maintains social stability and continuity through imitating and repeating the past (Handler & Linnekin, 1984). However, this does not mean that traditionality is constant. Shils (1981) believes that traditionality is not the anonym of modernity; rather, they interact and shape with each other.

There have been a lot of discussions on the role of traditionality in social change. For example, Bourdieu (1977) put forward the "habitus" theory, which emphasizes the significant role of traditionality in social member identity and behavior norms. However, this influence of traditionality may vary due to globalization, technological advancement, and other factors (Tomlinson, 1999). That is consistent with the view of Inglehart and Baker (2000), who regard traditionality as a dynamic concept, the content and form of which will change with social changes and the course of history.

In the Chinese context, the meaning of traditionality usually contains China's unique historical, cultural, and social background. Besides traditional cultural elements such as the philosophy of Confucius and Mencius, the ideology of Taoism, and the doctrines of Buddhism, China's traditionality also contains social systems and codes of conduct such as Confucian ethics, patriarchal system, etiquette, and customs (D. Li et al., 2022; Tu, 1985). Moreover, China's traditionality is also reflected in various practices and customs in daily life, such as food culture, clothing culture, architecture, and art (Fei et al., 1992).

It is worth noting that China's traditionality still has a significant influence on modern society (D. Li et al., 2022). For example, as indicated by K.-S. Yang (1995), the family concept and filial piety in Confucian culture still play a key role in contemporary Chinese society. In addition, with the rise of China's economy and its global position, China's traditional culture and values are having an increasing influence on the international community (Gries & Rosen, 2004). K.-S. Yang et al., (1989) developed a scale called the "Chinese Cultural Orientation Scale". It contains two main dimensions: traditionality and modernity, which are used to measure individuals' orientation between traditional and modern cultural values. The traditionality dimension mainly includes identification with traditional Confucian values such as filial piety, loyalty, humility, and destiny, while the modernity dimension pays attention to modern values such as individualism, scientific rationality, democracy, and equality. Through this scale, researchers can measure more accurately and understand better how traditionality and modernity affect individual behavior and psychological processes in the context of Chinese culture. K.-S. Yang's contribution to research on traditionality goes beyond the development of the scale. He and his research team also conducted a series of empirical studies to explore the impact of traditionality on social behavior, mental health, and work attitude, among others. They found that in the samples of Taiwan and Mainland China, traditionality was positively associated with social behaviors such as conservatism, obedience, and respect for the elderly, but was negatively associated with openness, critical thinking, and anti-authority behavior (K.-S. Yang, 1995). K.-S. Yang's research provided an important tool and theoretical framework for understanding and measuring traditionality in the context of Chinese culture. It highlighted the significant impact of traditionality on social behavior, mental health, and work attitude and serves as a theoretical and empirical reference for understanding and dealing with social changes and individual behavior in the context of Chinese culture.

In general, traditionality is a complex concept with multiple facets. It involves many disciplines and has different meanings and forms in different social and cultural contexts. To conduct research on traditionality, there are many challenges. Since it covers a wide range of fields and is affected by many factors, it is necessary to apply an interdisciplinary research method and have an in-depth understanding of different social and cultural backgrounds (Regina, 1997). In the Chinese context, traditionality is a manifest of China's history, culture, and social values, and has a far-reaching impact on the evolution of modern Chinese society. It is still significantly influencing the modern society. Therefore, it is meaningful to conduct further research on traditionality so as to explore its role in the modern environment and the

context of China's state-owned technology enterprises.

2.5.2 Impact of traditionality on the organization

In the organizational environment of China, traditionality is not only a cultural value but also a key factor influencing employee behavior. With higher traditionality, individuals prioritize role obligations and traditional societal norms, exhibit greater sensitivity to leadership authority, and experience a relatively smaller impact of organizational psychological ownership. In contrast, with lower traditionality, individuals focus more on personal rights and individual expression and are more willing to provide suggestions and feedback. This cultural characteristic has a significant impact on leadership styles, employee relations, and employee behavior, providing profound insights into the dynamics of leader-employee interactions in Chinese organizational culture. Traditionality is deeply rooted in Chinese culture, and state-owned enterprises typically feature bureaucratic organizational structures with multiple decision-making levels and a clear authority system. Employees with high traditionality are more likely to adapt to such organizational structures and be willing to follow leaders' instructions, thus contributing to the stability and authority of the organization. Individuals with high traditionality may be more inclined to stable career paths, being willing to engage in long-term employment with the same company, and thus, they may find the relatively stable employment environment of state-owned enterprises more acceptable.

In terms of organizational culture, some studies have focused on the role of traditionality in shaping organizational values, norms, and behavior patterns. Traditionality is regarded as an important cultural resource that can enhance the cohesion of the organization, guide the decision-making process, and influence the behavior of the members (Schein, 2010). According to the literature, traditionality is also associated with organizations' innovation ability. For example, some studies have found that although traditionality may restrict organizational change and innovation, in some cases, it can provide stability and continuity, thus enabling organizations to maintain stability in environments with uncertainties (Chatman & O'Reilly, 2016).

With respect to organizational identification, some studies have shown that employees' personal cultural values affect organizational identification. For example, Kirkman and Shapiro (2001) showed that employees' personal cultural values moderated the relationship between organizational culture and organizational identification. They found that when employees' personal cultural values were in line with organizational culture, organizational culture would have a stronger effect on organizational identification; when employees' personal cultural

values were inconsistent with organizational culture, the impact of organizational culture on organizational identification would be weaker. In addition, some studies found a significant positive relationship between employees' traditionality and organizational identification, which also implies the moderating role of traditionality between organizational culture and organizational identity (Riketta, 2005). Traditionality can provide a common cultural background for organization members, thus enhancing their sense of belonging to and identification with the organization (Albert et al., 2000). Traditionality can enhance the moral and ethical standards of organization members, thus further enhancing their loyalty and commitment to the organization (Simons et al., 2007). According to Q. Wang et al. (2020), traditionality can moderate the relationship between employees' affective commitment to the organization and followers taking charge. In addition, employees' traditionality may also affect employees' attitudes toward organizational change, thus further affecting their organizational identification (Oreg & Berson, 2011).

Therefore, when employees have higher traditionality, they may be more inclined to accept and follow the norms and values in the organizational culture (Song, 2022). Therefore, employees' traditionality may accentuate the positive effect of organizational culture on organizational identification. That means, among employees with higher traditionality, organizational culture may have a stronger impact on organizational identification; meanwhile, employees with lower traditionality may be less influenced by organizational culture, and hence, the impact of organizational culture on organizational identification would be relatively weak. That means traditionality may play a moderating role in the relationship between organizational culture and organizational identification.

However, this moderation effect may show significant differences in different organizational cultures:

a) In organizations with a hierarchy culture, employees' traditionality may moderate the relationship between hierarchy culture and organizational identification, because employees with higher traditionality are more likely to identify with and accept the organizational culture that emphasizes rules, order, and hierarchical structure. It may be more likely for traditional employees to identify with such an orderly organizational culture, thus enhancing their organizational identification and keeping them in line with the values and rules of the organization (Kimberly & Quinn, 1984). Therefore, in the hierarchy culture, the traditionality of employees acts as a moderator, accentuating the positive relationship between organizational culture and organizational identification.

b) However, it may not be the case in a clan culture. Clan culture usually emphasizes close ties, kinship, and common values (Fiordelisi & Ricci, 2014). In such a culture, individuals' traditionality may no longer play a moderating role, because the overall culture emphasizes unity and common identity. In a clan culture, employees tend to develop organizational identification based on common traditions and common values, and individuals' traditionality may no longer be a key factor affecting organizational identification. In this case, the common values and kinship in the clan culture may have a more significant effect on organizational identification, without being intertwined with the individual employees' traditionality (Han, 2012; Murphy et al., 2013). Therefore, in a clan culture, even if employees show traditionality, it may have little or no moderation effect on organizational identification.

Hence, we put forward,

Hypothesis 5 (H5): *In hierarchy culture rather than clan culture, the traditionality of employees moderates the positive relationship between organizational culture and organizational identification such that with stronger traditionality, the positive relationship between hierarchy culture and organizational identification is stronger, and vice versa.*

Based on the proposed research hypotheses, the research model of this study is presented in Figure 2.2.
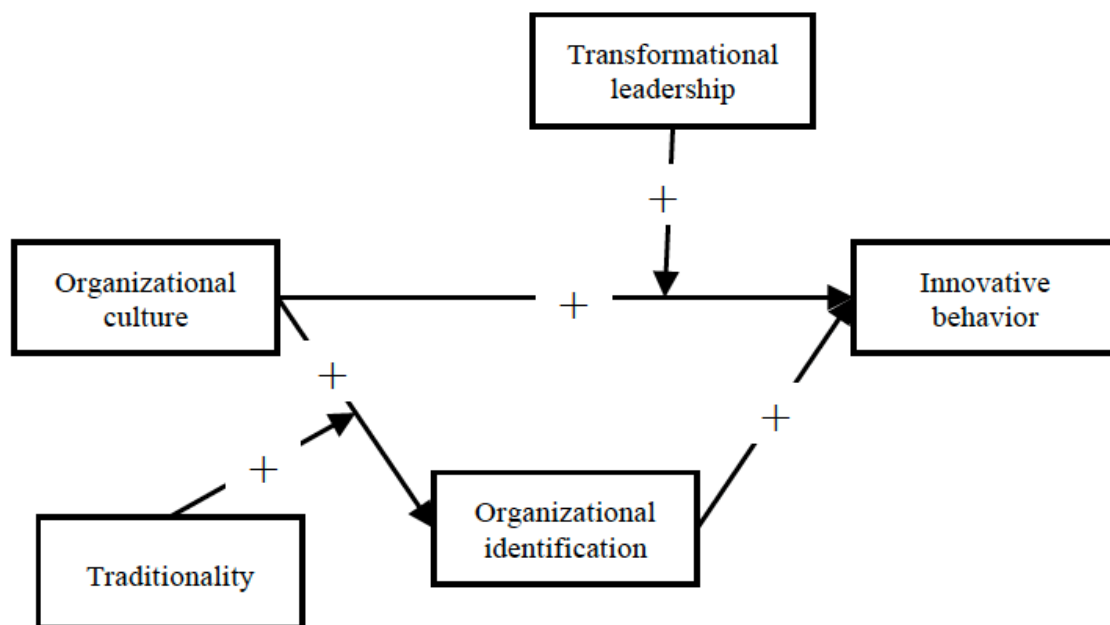
Figure 2.2 Research model

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Chapter 3 : Research Method and Design

3.1 Research method

The purpose of this study is to explore the impact of organizational culture, organizational identification, transformational leadership, and traditionality on employee innovative behavior in state-owned technology enterprises. To achieve this goal, this study conducted a literature review on organizational culture, organizational identification, transformational leadership, and traditionality's effect on employee innovative behavior, based on which five hypotheses were put forward.

Based on the literature review, we decided to conduct a questionnaire survey to test the hypotheses. Questionnaire survey is a widely applied method in social science research and has its advantages and applicability. As a quantitative research method, it enables to collect a large number of data for statistical analysis, so as to reveal the relationship and influence mechanism between variables (Bryman & Cramer, 2012). For research on the innovative behavior of state-owned technology enterprises, through a questionnaire survey, it is possible to effectively obtain the views and detect the attitudes of employees, management, and other stakeholders, which is conducive to an in-depth understanding of the innovation status within the organization. In addition, the questionnaire allows for better control and standardization (Fowler Jr, 2013). By using a unified questionnaire, researchers can ensure that all respondents answer questions under the same conditions, which helps to reduce bias in data collection. Moreover, anonymity can be achieved in the questionnaire survey, which enables respondents to fill in information and respond more truthfully, thus ensuring the validity and effectiveness of the research.

3.2 Variable measurement

This study used some well-established scales, including the organizational culture scale, employee innovative behavior scale, organizational identification scale, transformational leadership scale, and traditionality scale to measure the variables. The questionnaire also included a section for basic information.

3.2.1 Organizational culture

The Organizational Cultural Assessment Instrument (OCAI) was designed based on the Competing Values Framework (CVF), which incorporates the advantages of many previous theories, has been widely recognized and applied by scholars around the world, and is constantly updated with the change of times. The third edition of OCAI categorized organizational culture into four types (clan culture, adhocracy culture, market culture, and hierarchy culture) (Cameron et al., 2010). It includes six aspects (dominant characteristics, organizational leadership, management of employees, organization glue, strategic emphases, and criteria of success) and 24 items. Each aspect includes four items, which correspond to four types of organizational culture and are used to measure organizational effectiveness.

Since we used a separate scale to measure transformational leadership, we only included the remaining five aspects in the organizational culture scale of this study:

1) Dominant characteristics

A1: The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.

A2: The organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.

A3: The organization is very results-oriented. A major concern is with getting the job done. People are very competitive and achievement-oriented.

A4: The organization is a very controlled and structured place. Formal procedures generally govern what people do.

2) Management of employees

A5: The management style in the organization is characterized by teamwork, consensus, and participation.

A6: The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.

A7: The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.

A8: The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.

3) Organizational glue

A9: The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.

A10: The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.

A11: The glue that holds the organization together is the emphasis on achievement and goal accomplishment.

A12: The glue that holds the organization together is formal rules and policies. Maintaining a smoothrunning organization is important.

4) Strategic emphases

A13: The organization emphasizes human development. High trust, openness, and participation persist.

A14: The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.

A15: The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.

A16: The organization emphasizes permanence and stability. Efficiency, control, and smooth operations are important.

5) Criteria of success

A17: The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.

A18: The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.

A19: The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.

A20: The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling, and low-cost production are critical.

3.2.2 Employee innovative behavior

The scale related to employee innovative behavior in George and Zhou (2001) was selected as the employee innovative behavior scale in this study. That is because this scale is more relevant to scientific and technological innovation, whereas other general questionnaires on employee innovative behavior usually focus on non-technical employees' innovation in other aspects such as working methods. In addition, the scale of George and Zhou (2001) is a relatively comprehensive scale for measuring employee innovative behavior, as it involves not only innovative behavior but also innovation tendency and innovation effectiveness.

The scale includes the following statements regarding the respondent's organization:

B1: I am able to suggest new ways to achieve goals or objectives.

B2: I often have a fresh approach to problems.

B3: I am willing to search out new technologies, processes, techniques, and/or product ideas.

B4: I often have new and innovative ideas.

B5: I am a good source of creative ideas.

B6: I am not afraid to take risks.

B7: I develop adequate plans for the implementation of new ideas.

B8: I am willing to exhibit creativity on the job when given the opportunity to.

B9: I develop adequate plans and schedules for the implementation of new ideas.

B10: I can come up with creative solutions to problems.

B11: I am able to suggest new ways of performing work tasks.

B12: I can come up with new and practical ideas to improve performance.

B13: I am able to suggest new ways to increase quality.

3.2.3 Organizational identification

The organizational identification scale used in this study was derived from the classic organizational identity scale developed by Mael and Ashforth (1992), which has been used in numerous studies, including the empirical research of Ge and Su (2010) on Chinese technology manufacturing enterprises and the research of Z. Wang and Sun (2011). In addition, this scale is quite suitable for the context of China.

The scale includes the following statements:

E1: When someone compliments my organization, it feels like a personal compliment.

E2: I am very interested in what others think of my organization.

E3: It feels like a personal insult when someone criticizes my organization.

E4: When I talk about my organization, I usually say "we" rather than "them".

E5: The success of my organization is my success.

E6: I would feel embarrassed if media coverage criticized my organization.

3.2.4 Transformational leadership

This study used the Transformational Leadership Questionnaire (TLQ) designed by C. Li and Shi (2005), which is suitable for China's national conditions. This transformational leadership scale includes four dimensions, namely moral role model, charisma, vision incentive, and

individualized consideration. The reliability and validity of the Transformational Leadership Questionnaire were verified in a number of studies in China, and it has become one of the most commonly used scales to measure transformational leadership in China.

The original scale had 26 items. Considering the length limit of the questionnaire, we removed 9 items with high similarity to other items in their respective dimension, thus forming a transformational leadership scale with 17 items. More specifically, it includes the following statements regarding the respondent's direct supervisor:

C1: He/she is honest and is serving the public instead of seeking personal benefits.

C2: He/she prioritizes work over personal enjoyment.

C3: He/she does not spare efforts at work and does not care about personal gains and losses.

C4: He/she can sacrifice personal interests for the benefit of the department/unit.

C5: He/she can put personal interests behind the interests of the collective and others.

C6: He/she can make employees understand the development prospects of the unit/department.

C7: He/she can make employees understand the unit's business philosophy and development goals.

C8: He/she explains to employees the long-term significance of their work.

C9: He/she describes a promising future to others.

C10: When dealing with employees, he/she considers their personal conditions.

C11: He/she is willing to help employees solve life- and family-related problems.

C12: He/she frequently communicates with employees to understand their work, life, and family situation.

C13: He/she patiently mentors employees and answers their questions.

C14: He/she possesses excellent professional ability.

C15: He/she is open-minded and has a strong sense of innovation.

C16: He/she loves his/her job and has strong ambition and enterprising spirit.

C17: He/she is committed to work and maintains high enthusiasm.

3.2.5 Traditionality

This study selected the dimension of "obedience to authority" from the Chinese Traditionality Scale (CTS) developed by K.-S. Yang et al. (1991) to form a scale with a total of six items (Xie et al., 2008). The CTS was specially designed to study traditionality in the context of Chinese culture. Besides showing good internal consistency and structural validity, it also has high

cultural sensitivity and applicability for measuring Chinese people's traditionality.

The scale includes the following statements:

D1: The leader of an organization is like the parent of a family, and employees should obey all his/her decisions on organizational issues.

D2: Children should respect those whom their parents respect.

D3: Respect for authority and elders are virtues that one must possess.

D4: Strong leadership is more important than a sound legal system.

D5: The best way to avoid making mistakes is to follow the instructions of the elders.

D6: When a dispute arises, decisions should be made by the person with the most seniority.

3.3 Sampling

The research object of this survey is a number of research units in a state-owned technology group. They are the overall unit for the group's AI technology development and core units of basic and frontier technology research of intelligence, undertaking important tasks of scientific and technological innovation.

The target enterprise is headquartered in Beijing High-Tech Park, with a total area of 83,000 square meters for scientific research and offices. It also has science and technology parks and technology industrial bases in many provinces and cities, with a total planning area of more than 920,000 square meters and an investment budget of more than RMB 5 billion yuan. Based on functions, the organization is currently divided into the Administrative Department, Marketing Department, and Research Department. The Administrative Department has 15 subunits, including the Academy's Office, the Party Committee Office, the Comprehensive Operation Division, the Technology Development Division, and the Human Resources Division, each performing their respective administrative duties. The Marketing Department has four subunits, including the Military Industry Development Center, the Industrial Development Center, the International Business Division, and the Capacity Building Division, mainly responsible for business development and market exploration. The Research Department includes six research institutes, one national engineering laboratory, and two research centers, serving as the essential force in scientific research – they constitute the object of our questionnaire survey. As of the end of 2022, the target enterprise had more than 2000 employees, with an average age of less than 35 years old; employees with a bachelor's degree or above accounted for more than 95%; the scientific research team consisted of more than 300 people,

with doctoral degree holders accounting for more than 60% and master's holders accounting for more than 80%, including seven "state-level talents", two experts from the "overseas talent plan", and 13 provincial or ministerial-level experts; there were three academicians of the Chinese Academy of Engineering, three experts in direct contact with the central government, and 15 experts with special government allowance from the State Council. It has won national collective awards for major contributions two consecutive times, eight national awards for science and technology progress, and 34 national awards for defense technology progress.

The sample was selected for many reasons: a) The research object is a good representative of the industry. It includes the group's overall unit for AI technology development and core units of basic and cutting-edge technology research on intelligence, undertaking important tasks of scientific and technological innovation. That makes the research results highly representative of the industry, thus enabling us to reveal the related factors and influence mechanism of innovative behavior in state-owned technology enterprises. b) The target enterprise has regional diversity. It is located in Beijing High-tech Park and has multiple technology industrial parks and technology industrial bases in many provinces and cities, showing regional diversity, which is conducive to enhancing the generalizability of the research results. c) The target enterprise has a sophisticated organizational structure. Based on functions, it is divided into the Administrative department, Marketing department, and Research department, covering all levels of enterprise operation, which is conducive to researchers' comprehensive understanding of the innovative behavior within the organization. d) The employees of the target enterprise are mostly high-quality talents. It has highly educated and highly skilled scientific research teams, of which more than 60% are doctoral degree holders, and more than 80% are master's holders. In addition, the target enterprise also has a number of state-level talents and experts. These high-quality talents are conducive to the enterprise's innovation ability, which can make our research results more significant. e) The target enterprise has numerous achievements and awards. In the field of scientific and technological innovation, it has made remarkable achievements and won many awards, such as national awards for science and technology progress and awards for defense technology progress. These results show that the target enterprise is strong in scientific and technological innovation, enabling our research results to provide a reference for other state-owned technology enterprises.

In summary, it is rational and advantageous to select the research units of this state-owned technology group as the sample of our survey. This sample selection enables us to comprehensively explore the relevant factors and influence mechanism of the innovative behavior in state-owned technology enterprises, so as to provide a useful reference for policy-

making and enterprise practice.

3.4 Data collection procedure

The questionnaires were distributed and recovered at the end of 2022. The vast majority of them were distributed and recovered on-site. After communicating with the person in charge of the administrative office during working hours, we went to the site of the relevant units to distribute and collect the questionnaire on the spot. In a few cases, the respondents scanned or took a photo of the filled-in paper-and-pencil questionnaire and sent the digital copy back to the researcher. A total of 649 questionnaires were distributed and 615 were recovered, with a recovery rate of 94.76%. We excluded 20 invalid questionnaires (due to a large number of identical answers or missing responses), and the remaining 595 valid questionnaires were included in the data analysis.

This survey was conducted only in the form of paper-and-pencil questionnaires, which has the following advantages:

1) Higher response rate. Compared with online questionnaires, paper-and-pencil questionnaires tend to obtain a higher response rate. That is because the paper-and-pencil questionnaire survey can be conducted in an environment without the Internet, enabling the researcher to communicate face-to-face with the respondents to enhance the respondents' willingness to participate.

2) Bias control. The paper-and-pencil questionnaire enables better bias control, as the researcher can monitor the process of respondents' filling in the questionnaire on-site to ensure that they follow the procedure appropriately and ensure the authenticity of the answers.

3) Ensure the recovery of the questionnaire. Compared with the online questionnaire, paper-and-pencil questionnaires enable higher authenticity in questionnaire filling and collection as questionnaires can be recovered on the spot, and the number of unrecovered questionnaires can be determined according to the number of copies distributed.

4) Privacy protection. The paper-and-pencil questionnaire is more anonymous, which is conducive to protecting the privacy of respondents. Compared with the online questionnaire, through paper-and-pencil questionnaires, respondents' personal information is less likely to be tracked, which makes respondents more willing to respond truthfully.

5) Easy to record and store. The paper-and-pencil questionnaire can be filled out easily without additional equipment. In addition, recovered paper-and-pencil questionnaires can be

conveniently archived and stored, which facilitates data processing and analysis.

6) Reduced risk of data tampering. Compared with the online questionnaire, it is more difficult to tamper with the data of paper-and-pencil questionnaires. Using the paper-and-pencil questionnaire, the researcher can verify the authenticity of the data by reviewing the original copies.

3.5 Reliability and validity testing

The descriptive statistical results of each item are presented in Table 3.1.

Table 3.1 Descriptive statistics of questionnaire items

Item	Sample size	Mean	SD	Variance	Kurtosis	Skewness
A1	591	4.942	0.93	0.864	0.917	-0.749
A2	591	4.9	0.943	0.89	1.17	-0.93
A3	591	4.92	0.92	0.846	1.659	-0.943
A4	591	5.02	0.892	0.796	1.287	-0.945
A5	591	5.047	0.893	0.798	1.053	-0.938
A6	591	4.81	1.077	1.161	0.668	-0.948
A7	591	4.88	0.98	0.96	1.12	-0.961
A8	591	4.975	0.919	0.845	0.957	-0.869
A9	591	5.019	0.905	0.818	0.587	-0.822
A10	591	4.934	0.926	0.858	0.907	-0.844
A11	591	5.007	0.856	0.732	0.264	-0.681
A12	591	5.024	0.915	0.837	0.958	-0.94
A13	591	4.956	0.972	0.944	1.565	-1.058
A14	591	4.936	0.96	0.921	1.774	-1.037
A15	591	4.959	0.897	0.805	0.202	-0.655
A16	591	5.024	0.894	0.799	1.207	-0.946
A17	591	4.946	0.964	0.929	1.418	-1.019
A18	591	4.934	0.959	0.919	1.226	-0.944
A19	591	4.942	0.922	0.851	0.973	-0.861
A20	591	4.998	0.92	0.846	1.504	-0.967
B1	591	4.758	0.891	0.794	0.664	-0.631
B2	591	4.807	0.891	0.793	0.788	-0.696
B3	591	4.87	0.92	0.846	0.343	-0.618
B4	591	4.794	0.961	0.923	0.014	-0.532
B5	591	4.721	1.006	1.012	0.656	-0.792
B6	591	4.748	1.049	1.101	1.432	-1.02
B7	591	4.807	0.919	0.844	-0.091	-0.464
B8	591	4.944	0.899	0.809	0.043	-0.606
B9	591	4.902	0.919	0.845	0.278	-0.619
B10	591	4.844	0.949	0.901	0.332	-0.603
B11	591	4.854	0.951	0.904	0.55	-0.691
B12	591	4.909	0.92	0.846	0.139	-0.579
B13	591	4.829	0.993	0.986	0.295	-0.663
C1	591	4.981	0.905	0.818	0.884	-0.777
C2	591	5.005	0.892	0.795	1.006	-0.816
C3	591	4.998	0.938	0.88	0.517	-0.763
C4	591	4.942	0.995	0.99	0.985	-0.91
C5	591	4.939	0.965	0.932	0.514	-0.819

C6	591	5.015	0.882	0.778	0.335	-0.699
C7	591	5.007	0.913	0.834	0.822	-0.871
C8	591	4.968	0.889	0.79	0.646	-0.75
C9	591	4.902	0.9	0.811	0.592	-0.686
C10	591	4.927	0.944	0.891	1.704	-1.019
C11	591	4.91	0.96	0.922	1.163	-0.868
C12	591	4.836	0.994	0.988	0.585	-0.788
C13	591	4.946	0.973	0.946	0.54	-0.812
C14	591	5.022	0.905	0.818	0.971	-0.857
C15	591	5.034	0.89	0.792	0.702	-0.804
C16	591	5.071	0.853	0.727	0.44	-0.696
C17	591	5.157	0.852	0.726	1.015	-0.933
D1	591	3.873	1.288	1.66	-0.681	-0.082
D2	591	4.23	1.166	1.361	-0.594	-0.224
D3	591	4.332	1.085	1.178	-0.391	-0.177
D4	591	3.966	1.3	1.69	-0.538	-0.211
D5	591	3.826	1.279	1.636	-0.455	-0.11
D6	591	3.922	2.714	7.363	226.685	12.806
E1	591	4.616	1.007	1.013	0.78	-0.655
E2	591	4.567	0.975	0.951	0.474	-0.585
E3	591	4.53	1.043	1.087	0.561	-0.588
E4	591	4.817	0.935	0.875	0.288	-0.576
E5	591	4.553	1.051	1.105	0.649	-0.681
E6	591	4.579	1.051	1.105	1.049	-0.823
Age (years)	591	37.054	8.695	75.6	-0.481	0.443
Tenure (years)	591	9.306	6.914	47.809	0.229	0.917

3.5.1 Reliability test

Cronbach's α an internal consistency measurement index that is widely used in social science research. It is mainly used to evaluate the consistency of multiple items for measuring the same concept or construct in terms of measurement error. The calculation formula is $\alpha = (k/(k-1))*(1-(\Sigma\sigma^2 i/\sigma^2 T))$, where k is the number of items, $\sigma^2 i$ is the variance of each term, $\sigma^2 T$ is the population variance. The reliability analysis results of the questionnaire are shown in Table 3.2.

Table 3.2 Reliability testing results

Scale mean if item deleted	Corrected item-total correlation (CITC)	Cronbach's α
A1	0.809	0.965
A2	0.8	
A3	0.75	
A4	0.712	
A5	0.784	
A6	0.675	
A7	0.736	
A8	0.719	
A9	0.754	
A10	0.719	
A11	0.753	
A12	0.723	
A13	0.777	

A14	0.79	
A15	0.713	
A16	0.735	
A17	0.775	
A18	0.743	
A19	0.725	
A20	0.758	
B1	0.776	0.953
B2	0.792	
B3	0.739	
B4	0.752	
B5	0.785	
B6	0.663	
B7	0.773	
B8	0.706	
B9	0.711	
B10	0.792	
B11	0.782	
B12	0.8	
B13	0.826	
C1	0.805	0.966
C2	0.816	
C3	0.818	
C4	0.794	
C5	0.831	
C6	0.787	
C7	0.78	
C8	0.726	
C9	0.716	
C10	0.752	
C11	0.782	
C12	0.775	
C13	0.788	
C14	0.709	
C15	0.757	
C16	0.774	
C17	0.771	
D1	0.712	0.868
D2	0.678	
D3	0.637	
D4	0.653	
D5	0.731	
D6	0.397	
E1	0.794	0.91
E2	0.769	
E3	0.795	
E4	0.643	
E5	0.746	
E6	0.755	

According to mainstream opinion, if Cronbach's $\alpha \geq 0.9$, the reliability of the scale is excellent; if $0.8 \leq$ Cronbach's $\alpha < 0.9$, the reliability is good; if $0.7 \leq$ Cronbach's $\alpha < 0.8$, the reliability is acceptable; if $0.6 \leq$ Cronbach's $\alpha < 0.7$, reliability is questionable; if $0.5 \leq$ Cronbach's $\alpha < 0.6$, the reliability is poor; and if Cronbach's $\alpha < 0.5$, the questionnaire should

be redesigned. The Cronbach's α of this questionnaire indicated excellent reliability.

The results of item total statistics showed that after deleting item D6, Cronbach's α was 0.89, which is significantly higher than its value before item deletion, being 0.799. Therefore, reanalysis was considered with this item deleted. The corrected item-total correlation (CITC) and Cronbach's α after item deletion showed good results, indicating that there was no need to modify the scale items.

3.5.2 KMO test and Bartlett's test

Kaiser-Meyer-Olkin (KMO) is a statistical index used to measure the goodness-of-fit of data. The KMO value ranges from 0 to 1. A higher KMO value (usually greater than 0.6) indicates that the data is suitable for factor analysis. If KMO ≥ 0.9, the data is considered very adequate for factor analysis; if $0.8 \leq$ KMO < 0.9, it is relatively adequate; if $0.7 \leq$ KMO < 0.8, it is adequate: if $0.6 \leq$ KMO < 0.7, it is fairly adequate; if $0.5 \leq$ KMO < 0.6, it is not adequate: if KMO < 0.5, factor analysis should be abandoned. The KMO test showed that there was a correlation between the variables, thus meeting the requirements of factor analysis.

Bartlett's test is another method to evaluate whether the data is adequate for factor analysis. It is used to test whether the correlation between the observed variables is significant. The null hypothesis of Bartlett's test is that the correlation matrix between the variables is an identity matrix (i.e., there is no significant correlation between variables). If the *p*-value of Bartlett's test is significant (usually less than 0.05), the null hypothesis is rejected, indicating that there is a significant correlation between the variables and the data is adequate for factor analysis.

The results of the KMO test showed that the KMO was 0.968. At the same time, the results of Bartlett's spherical test showed that the *p*-value was 0.000****, indicating significance. Therefore, the null hypothesis was rejected. The variables were correlated, and factor analysis would be useful and adequate.

3.5.3 Factor loadings

Factor analysis is a multivariate statistical method that aims to identify the latent constructs (i.e., factors) between the observed variables and to reduce the dimensions of data. The table of factor loadings shows the correlation between the observed variables and each latent factor, which enables us to understand the explanatory power of each factor to the observed variables and the relationship between the variables, so as to reveal the correlation pattern between them.

The table of factor loadings provides the loading value of each observed variable on each latent factor, which is used to evaluate each factor's explanatory power to the observed variable. A higher loading value indicates a stronger explanatory power of the factor to the observed variable. Through the table of factor loadings, researchers can classify the observed variables according to their correlation with the latent factors, so as to simplify the data structure and identify key constructs.

The table of factor loadings can be used to evaluate the effectiveness of the factor model. Generally, a loading value greater than 0.4 is considered significant, indicating that the factor model has good explanatory power. By evaluating the table of factor loadings, researchers can examine the goodness of fit between the proposed theoretical model and the actual data. By analyzing the factor loadings, researchers can better understand the internal structure of the research target, which serves as the basis for subsequent theoretical construction and empirical research.

According to Table 3.3, for items A1-A20, the highest factor loading was all with Factor 1; for items B1-B13, the highest factor loading was all with Factor 2; and for items C1-C17, the highest factor loading was all with Factor 3. The data structure was very clear, and different constructs could be effectively distinguished, indicating excellent validity.

Table 3.3 Table of factor loadings

| | Rotated factor loading | | | | |
	Factor 1	Factor 3	Factor 2	Factor 4	Factor 5
A1	**0.808**	0.117	0.186	0.057	-0.008
A2	**0.794**	0.13	0.167	0.085	0.037
A3	**0.758**	0.081	0.144	0.053	0.067
A4	**0.737**	0.062	0.102	0.075	0.009
A5	**0.795**	0.122	0.074	0.036	0.078
A6	**0.653**	0.266	-0.003	0.081	0.27
A7	**0.714**	0.248	0.082	0.025	0.147
A8	**0.728**	0.051	0.174	0.059	0.045
A9	**0.771**	0.09	0.119	-0.008	0.051
A10	**0.729**	0.127	0.083	0.058	0.05
A11	**0.76**	0.123	0.136	0.067	-0.003
A12	**0.727**	0.085	0.183	0.033	0.06
A13	**0.782**	0.133	0.123	0	0.071
A14	**0.788**	0.11	0.134	0.066	0.08
A15	**0.714**	0.128	0.147	0.036	0.032
A16	**0.739**	0.066	0.207	0.07	0.016
A17	**0.769**	0.18	0.122	0.041	0.061
A18	**0.74**	0.169	0.111	0.018	0.088
A19	**0.733**	0.161	0.1	-0.022	0.041
A20	**0.77**	0.085	0.149	0.022	0.029
B1	0.217	**0.659**	0.392	0.079	0.172
B2	0.171	**0.714**	0.333	0.145	0.124
B3	0.227	**0.642**	0.317	0.178	0.129

B4	0.171	**0.707**	0.243	0.171	0.168
B5	0.194	**0.726**	0.295	0.13	0.14
B6	0.208	**0.599**	0.24	0.128	0.239
B7	0.24	**0.644**	0.355	0.169	0.148
B8	0.228	**0.653**	0.285	0.09	0.071
B9	0.182	**0.595**	0.383	0.148	0.091
B10	0.203	**0.692**	0.369	0.136	0.106
B11	0.163	**0.668**	0.415	0.165	0.063
B12	0.188	**0.692**	0.396	0.187	0.036
B13	0.165	**0.708**	0.412	0.216	0.046
C1	0.22	0.234	**0.742**	0.077	0.217
C2	0.171	0.237	**0.764**	0.057	0.204
C3	0.202	0.235	**0.767**	0.104	0.138
C4	0.222	0.21	**0.752**	0.106	0.105
C5	0.185	0.265	**0.778**	0.096	0.112
C6	0.194	0.263	**0.726**	0.103	0.135
C7	0.155	0.25	**0.739**	0.096	0.111
C8	0.088	0.281	**0.688**	0.074	0.112
C9	0.091	0.291	**0.644**	0.186	0.137
C10	0.121	0.221	**0.717**	0.153	0.091
C11	0.103	0.272	**0.748**	0.126	0.051
C12	0.196	0.214	**0.717**	0.219	0.079
C13	0.145	0.238	**0.735**	0.184	0.122
C14	0.132	0.207	**0.668**	0.117	0.169
C15	0.121	0.237	**0.708**	0.104	0.192
C16	0.168	0.224	**0.731**	0.094	0.154
C17	0.162	0.16	**0.749**	0.099	0.17
D1	0.04	0.162	0.185	**0.824**	0.127
D2	0.087	0.166	0.162	**0.814**	0.09
D3	0.055	0.173	0.221	**0.745**	0.117
D4	0.073	0.196	0.149	**0.714**	0.208
D5	0.093	0.19	0.172	**0.733**	0.277
D6	0.014	0.123	0.137	**0.463**	0.064
E1	0.139	0.217	0.428	0.209	**0.659**
E2	0.111	0.221	0.3	0.233	**0.703**
E3	0.114	0.143	0.312	0.201	**0.78**
E4	0.17	0.21	0.427	0.214	**0.453**
E5	0.08	0.233	0.302	0.242	**0.709**
E6	0.168	0.158	0.349	0.193	**0.708**

Among items D1-D6, D6 showed the lowest factor loading. Amog items E1-E5, the factor loading of E4 was relatively low. Generally, if the factor loading is low (usually with 0.4 as the threshold), this item can be considered to be deleted.

Results of the reliability analysis and factor loadings in this study showed that among the six key constructs, the items for organizational culture, transformational leadership, and employee innovative behavior showed validity since the relevant indicators met the threshold in these tests; for the constructs of traditionality and organizational identification, since items D6 and E4 failed the tests, they were removed for subsequent analyses.

3.5.4 Common method bias

For homologous questionnaire survey data, it is necessary to pay attention to the common method bias. In this study, Harman's single factor method was used to detect common method bias. Harman's single factor test is an exploratory factor analysis of the questionnaire's measurement scale. It has two main criteria: a) There is more than one factor with an eigenvalue greater than 1; b) The percentage of variance explained by the first factor is less than 40% (Tang & Wen, 2020). In this study, the results of Harman's single factor test showed that there was more than one factor with an eigenvalue greater than 1, and the percentage of cumulative explained variance after rotation was 66.596%. The percentage of variance explained by the first factor was 20.493%, which is less than half of the total variance explained, 66.596%. Therefore, there was no serious common method bias.

3.5.5 Confirmatory factor analysis

Confirmatory factor analysis (CFA) is an analysis method of structural equation modeling (SEM) mainly used to test the goodness-of-fit between the preset theoretical model and the actual data. Unlike exploratory factor analysis (EFA), CFA requires researchers to preset the relationship between observed variables and latent factors according to the theory or the results of previous research. CFA can evaluate the parameter estimation, fitting index, and measurement error of the model and examine the latent factors. In order to test the discriminant validity between all variables, we selected seven models, including five-factor, four-factor, three-factor, two-factor, and single-factor models, to test their fitting degree by performing confirmatory factor analysis. As Table 3.4 shows, the five-factor model was the best. That means the hypothesized model in this study had the best fitting degree (χ^2/df = 3.084, GFI = 0.756, RMSEA = 0.059, RMR = 0.039, CFI = 0.882, TLI = 878).

Table 3.4 Model comparison results

Model	χ^2	df	p	χ^2/df	GFI	RMSEA	RMR	CFI	TLI
M0	5243.555	1700	0.000	3.084	0.756	0.059	0.039	0.882	0.878
M1	7749.872	1823	0.000	4.251	0.647	0.074	0.120	0.807	0.800
M2	10038.773	1823	0.000	5.507	0.447	0.087	0.130	0.733	0.723
M3	11000.334	1826	0.000	6.024	0.432	0.092	0.134	0.702	0.691
M4	11421.239	1826	0.000	6.255	0.424	0.094	0.145	0.688	0.677
M5	12464.535	1828	0.000	6.819	0.404	0.099	0.145	0.654	0.642
M6	14783.396	1828	0.000	8.087	0.295	0.109	0.123	0.579	0.564
M7	16213.618	1829	0.000	8.865	0.285	0.115	0.135	0.532	0.516

Note:

M0 is a five-factor model (organizational culture, employee innovative behavior, transformational leadership, traditionality, organizational identification);

M1 is a four-factor model (organizational culture+organizational identification, employee innovative

behavior, transformational leadership, and traditionality);

M2 is a four-factor model (organizational culture+employee innovative behavior, transformational leadership, traditionality, organizational identification),

M3 is a three-factor model (organizational culture+employee innovative behavior, transformational leadership, traditionality+organizational identification);

M4 is a three-factor model (organizational culture+employee innovative behavior, transformational leadership+traditionality, and organizational identification);

M5 is a two-factor model (organizational culture+employee innovative behavior, transformational leadership+traditionality+organizational identification);

M6 is a two-factor model (organizational culture+employee innovative behavior+transformational leadership, traditionality+organizational identification);

M7 is a single-factor model (organizational culture + employee innovative behavior + transformational leadership + traditionality + organizational identification)

For the five-factor model M0 (organizational culture, employee innovative behavior, transformational leadership, traditionality, organizational identification), which showed the best fitting, we further tested other indicators, including composite reliability and convergent validity.

Composite reliability (CR) and average variance extracted (AVE) are important indicators to evaluate the validity and reliability of latent factor measurement models. Similar to Cronbach's α, CR measures the consistency of the observed variables for measuring the same latent factor in terms of measurement error. Generally, CR values greater than 0.7 are considered to have acceptable reliability, indicating that the observed variables show high consistency in measuring the same latent factor. AVE is an index to evaluate the convergent validity of latent factor measurement models. It measures the ratio between the variance explained by the observed variables of a latent factor and the measurement error. AVE is calculated as follows: sum up the square of the loading of each observed variable on the latent factor, and then divide it by the total number of observed variables. Generally, AVE greater than 0.5 is considered to have good convergent validity, indicating that the latent factor can explain most of the variance of the observed variables.

The results of confirmatory factor loadings are presented in Table 3.5.

Table 3.5 Confirmatory factor loadings

Factor	Variable	Standardized loading	AVE & CR
OC	A1	0.829	AVE: 0.58
	A2	0.82	CR: 0.965
	A3	0.766	
	A4	0.728	
	A5	0.797	
	A6	0.686	
	A7	0.744	
	A8	0.732	
	A9	0.768	
	A10	0.73	
	A11	0.766	
	A12	0.74	

	A13	0.794	
	A14	0.801	
	A15	0.724	
	A16	0.749	
	A17	0.789	
	A18	0.754	
	A19	0.737	
	A20	0.773	
EIB	B1	0.797	AVE: 0.612
	B2	0.812	CR: 0.953
	B3	0.758	
	B4	0.767	
	B5	0.797	
	B6	0.675	
	B7	0.787	
	B8	0.72	
	B9	0.735	
	B10	0.811	
	B11	0.814	
	B12	0.833	
	B13	0.857	
TL	C1	0.833	AVE: 0.626
	C2	0.84	CR: 0.966
	C3	0.841	
	C4	0.818	
	C5	0.851	
	C6	0.803	
	C7	0.791	
	C8	0.735	
	C9	0.727	
	C10	0.759	
	C11	0.791	
	C12	0.785	
	C13	0.795	
	C14	0.721	
	C15	0.764	
	C16	0.783	
	C17	0.78	
TRA (with D6 deleted)	D1	0.855	AVE: 0.625
	D2	0.831	CR: 0.892
	D3	0.764	
	D4	0.728	
	D5	0.769	
OI (with E4 deleted)	E1	0.835	AVE: 0.667
	E2	0.818	CR: 0.909
	E3	0.847	
	E5	0.792	
	E6	0.793	

Note: EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality.

Factor loadings were used to screen the measured variables for the factors. According to the general standard, if the measured variable passes the significance test ($p < 0.05$), and its standardized loading is greater than 0.6, it indicates that the measured variable meets the

requirements for measuring the factor. If the results are far from what is required, the variable can be considered to be deleted. In this study, the standard loading of the measurement items on the factors organizational culture, employee innovative behavior, transformational leadership, traditionality, and organizational identification were all greater than 0.6, thus passing the explained variance percentage threshold. It can be deemed that these variables can be explained by the factors.

In addition, Table 3.5 also presents the results of AVE and CR indicators, which can be used to examine variables' convergent validity for the same factor. The AVE of the five factors were all greater than 0.5, and the CR values were all greater than 0.7, indicating good variance extraction and good convergent validity.

Table 3.6 presents the results of Pearson correlation analysis and the square root of AVE. The correlation test was conducted by using the mean value of the factors to examine these factors' discriminant validity. The numbers on the diagonal are the square root of AVE, which is used to indicate the correlation strength within the factor. If the square root of the AVE of a factor is greater than the Pearson correlation coefficient of other factors, it indicates that this factor has good discriminant validity. From Table 3.6, we can see that all factors showed excellent discriminant validity.

Table 3.6 Discriminant validity testing results

	Discriminant validity: Pearson's correlation and square root of AVE				
	OC	EIB	TL	TRA	OI
OC	0.762				
EIB	0.466	0.782			
TL	0.408	0.732	0.791		
TRA	0.216	0.491	0.443	0.791	
OI	0.321	0.567	0.627	0.537	0.817

Note: ***, **, * represent the significance level 1%, 5%, and 10%, respectively; diagonal numbers are the root of AVE; EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality.

3.5.6 Summary of reliability and validity testing results

In summary, overall, this questionnaire showed excellent reliability and validity, as most items met the criteria of relevant indicators. Only items D6 and E4 showed unsatisfactory results, and therefore, we considered deleting D6 and E4 for subsequent analysis.

3.6 Statistical analysis

Based on the collected questionnaire data, descriptive statistics, Pearson correlation analysis,

one-way ANOVA, and regression analysis were performed to analyze the independent variables and test the hypotheses.

Descriptive statistics can provide information about the central trend, dispersion degree, and distribution of the variables in the data set. In this study, independent variables' mean, median, standard deviation, and percentile were calculated to gain insight into their distribution and variability, so as to understand the overall characteristics of each variable.

Pearson correlation analysis was used to evaluate the strength and direction of the linear relationship between two continuous variables. By calculating the Pearson correlation coefficient between the independent variable and other variables, we preliminarily determined whether there was a significant correlation between the independent variable and other variables and whether there was collinearity.

Based on different types of organizational culture, this study adopted one-way ANOVA to find out whether the mean difference between the groups was significant. Therefore, one-way ANOVA enabled us to determine whether there were statistical differences between the variables.

Finally, regression analysis was performed to further explore the relationship between independent variables and dependent variables. Through regression analysis, we built a mathematical model to predict the value of the dependent variable based on the independent variables. By establishing an appropriate regression model, calculating the regression coefficient and intercept, and conducting hypothesis testing, we determined whether the effect of independent variables on dependent variables was significant and examined the possible mediating and moderation effects.

The descriptive statistics, Pearson correlation analysis, one-way ANOVA, and regression analysis of the independent variables helped us to find out their characteristics, their relationship with other variables, and their effect on the dependent variables. Through hypothesis testing, we determined whether the results were statistically significant. In this study, these analyses enabled us to gain valuable insights into the role and significance of the independent variables. The results of the above-mentioned analyses will be summarized and presented in Chapter Four.

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Chapter 4 : Empirical Analysis

This chapter reports the main statistical analysis results, including descriptive analysis, correlation analysis, analysis of variance (ANOVA), and regression analysis for hypothesis testing.

4.1 Descriptive statistics

The demographic statistics of the respondents in the questionnaire survey are presented in Table 4.1. In terms of gender, the majority of respondents were male, which is in line with the general characteristics of scientific research institutions. In terms of educational level, the number of respondents with a master's degree or above was more than that of undergraduates, indicating that overall, the educational level of the research object's employees was high. In terms of technical titles, more than half of the employees had middle-level or senior titles. In terms of the department, more than 70% were working for research or technical departments. In terms of the job position, 58% of the respondents were research personnel, and 12% had management positions. In terms of ranking, 10.77% of the respondents were senior managers, 39.56% were middle-level managers, and 46.8% were ordinary employees. Therefore, the survey covered all levels of employees in the research object. In general, from the demographic characteristics of the sample, it can be seen that the respondents of the questionnaire generally had high educational level and professional qualifications. They were mostly research or technical personnel, which is in line with the overall characteristics of the target enterprise. That also ensured the quality of the responses since highly qualified individuals are more capable of accurately understanding and answering the questions of the questionnaire. Besides, the survey also covered all levels of other types of personnel, with a normal distribution, which helps to enhance the sample's representativeness in reflecting the characteristics of the research object.

Table 4.1 Demographic statistics of the sample

Item	Options	Percentage
Gender	Male	58.32%
	Female	41.68%
Educational level	College or bellow	1.85%
	Underguaduate	43.70%
	Master	37.48%
	Doctor or above	16.97%
Technical title	Junior	30.08%
	Middle-level	35.97%
	Senior	20.34%
	Others	13.61%
Department	Research	42.52%
	Technical	30.42%
	Administrative	30.42%
	Others	4.20%
Job position	Research	58.49%
	Logistics	8.24%
	Administration	16.81%
	Management	12.77%
	Others	3.70%
Ranking	Senior managers	10.77%
	Middle-level managers	39.56%
	Ordinary employees	46.80%
	Others	2.86%
Age (years)	Mean: 37.08; Median: 36; SD: 8.07	

The descriptive statistics of the variables studied in this thesis are presented in Table 4.2. From the mean value and standard deviation (SD), it can be seen that transformational leadership (TL) scored higher than employee innovative behavior (EIB), organizational culture (OC), organizational identification (OI), and traditionality (TRA), which is different from the general impression that the leaders of Chinese state-owned enterprises are conservative and value stability. It may be due to the nature of the research object. They are scientific research units, which have higher requirements for innovation than for profitability, resulting in certain differences between their leadership style and that of traditional non-research institutions. Another possible reason may be the influence of China's political environment – the whole country is striving for innovation. The central government regards innovation-driven development as the priority of the new development strategy, stating that "innovation is the primary driving force for development", requiring the leaders of state-owned enterprises to make a difference. The results also showed that the score of traditionality was relatively low, while its SD was high, which may be due to the significant differences among different age groups in traditionality. The mean of the respondents' organizational tenure (represented as "tenure" in the table) was relatively high, being 9.31 years, indicating the high stability of the

research object, which is in line with the general characteristics of China's state-owned enterprises.

Table 4.2 Descriptive statistics of the variables

Variable	Mean±SD	Variance	Q1	Median	Q3	Standard error	95% CI (LL)	Kurtosis	Skewness	Coefficient of variation (CV)
EIB	4.834±0.754	0.569	4.385	4.923	5.462	0.031	4.773	0.481	-0.734	15.601%
OC	4.959±0.727	0.528	4.550	5.100	5.450	0.030	4.901	1.661	-1.153	14.654%
OI	4.568±0.879	0.772	4.000	4.600	5.000	0.036	4.497	0.509	-0.584	19.241%
TL	4.980±0.743	0.551	4.529	5.118	5.529	0.030	4.920	1.821	-1.150	14.913%
TRA	4.046±1.022	1.045	3.200	4.000	4.800	0.042	3.964	-0.625	0.088	25.265%
Tenure	9.314±6.918	47.859	4.000	8.000	14.000	0.285	8.755	0.223	0.914	74.279%
Size	2.319±0.948	0.898	2.000	2.000	3.000	0.039	2.243	-0.879	0.194	40.855%

Note: EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality, Tenure = organizational tenure, Size = organization size.

With respect to distribution, the absolute values of kurtosis and skewness of all variables were quite low (below 3), indicating that the survey data overall showed characteristics of normal distribution.

Regarding the degree of dispersion, the coefficient of variation (CV) is a statistic describing the data's degree of variation, which is used to compare the relative dispersion of different variables or data sets. It is the ratio of the standard deviation to the mean, usually represented as a percentage. The formula for calculating the coefficient of variation is as follows: CV = (SD/Mean)×100%. A smaller CV value indicates lower relative dispersion and less variation of the data. Coefficient of variation is often used to compare the dispersion of variables in different units or dimensions. As it can standardize the standard deviation of different variables to compare them with the mean, it enables a better understanding and a comparison of the dispersion of variables without being affected by their units or dimensions. In this study, the CV of "organizational tenure" was significantly higher than that of other variables, indicating that the respondents' organizational tenure in the research object had a high degree of dispersion.

4.2 Correlation analysis

Table 4.3 presents the correlation coefficient and its significance of the total sample and the sample groups based on organizational culture type. We preliminarily found that employee innovative behavior was significantly related to organizational culture, organizational identification, transformational leadership, and traditionality. In addition, the correlation coefficient of each independent variable with the dependent variable was lower than 0.8. Therefore, it can preliminarily be determined that there was no collinearity.

Table 4.3 Correlation

	Mean	SD	1	2	3	4	5	6	7	8
					Total sample ($n = 595$)					
EIB	4.834	0.754	1							
OC	4.959	0.727	0.467***	1						
OI	4.568	0.879	0.565***	0.322***	1					
TL	4.98	0.743	0.731***	0.409***	0.625***	1				
TRA	4.046	1.022	0.489***	0.217***	0.535***	0.441***	1			
Gender	1.417	0.493	-0.015	-0.013	-0.005	0.011	0.023	1		
Tenure	9.314	6.918	0.288***	0.104**	0.287***	0.239***	0.227***	-0.103**	1	
Size	2.319	0.948	0.004	-0.052	0.063	-0.038	-0.033	-0.055	0.185***	1
					Hierarchy culture ($n = 293$)					
	Mean	SD	1	2	3	4	5	6	7	8
EIB	4.842	0.767	1							
OC	4.965	0.725	0.495***	1						
OI	4.59	0.889	0.544***	0.336***	1					
TL	5.036	0.679	0.748***	0.448***	0.609***	1				
TRA	4.129	1.02	0.503***	0.263***	0.558***	0.493***	1			
Gender	1.396	0.49	-0.086	-0.028	0.008	-0.017	0.066	1		
Tenure	9.384	7.066	0.330***	0.161***	0.339***	0.291***	0.195***	-0.122**	1	
Size	2.372	0.948	-0.098*	-0.06	-0.006	-0.096*	-0.083	-0.06	0.169***	1
					Clan culture ($n = 149$)					
	Mean	SD	1	2	3	4	5	6	7	8
EIB	4.866	0.695	1							
OC	5.051	0.638	0.446***	1						
OI	4.552	0.859	0.531***	0.232***	1					
TL	4.976	0.737	0.751***	0.426***	0.577***	1				
TRA	3.883	0.997	0.431***	0.131	0.415***	0.277***	1			
Gender	1.416	0.495	-0.008	-0.1	0.025	0.051	-0.065	1		
Tenure	9.027	6.545	0.284***	0.099	0.233***	0.143*	0.326***	-0.094	1	
Size	2.356	0.966	0.121	-0.122	0.175**	0.002	0.087	0.028	0.262***	1
					Adhocracy culture ($n = 90$)					
	Mean	SD	1	2	3	4	5	6	7	8
EIB	4.866	0.695	1							
OC	5.051	0.638	0.446***	1						
OI	4.552	0.859	0.531***	0.232***	1					
TL	4.976	0.737	0.751***	0.426***	0.577***	1				
TRA	3.883	0.997	0.431***	0.131	0.415***	0.277***	1			
Gender	1.416	0.495	-0.008	-0.1	0.025	0.051	-0.065	1		
Tenure	9.027	6.545	0.284***	0.099	0.233***	0.143*	0.326***	-0.094	1	
Size	2.356	0.966	0.121	-0.122	0.175**	0.002	0.087	0.028	0.262***	1
					Market culture ($n = 63$)					
	Mean	SD	1	2	3	4	5	6	7	8
EIB	4.737	0.778	1							
OC	4.777	0.842	0.205	1						
OI	4.537	0.845	0.552***	0.249**	1					
TL	4.858	0.784	0.756***	0.118	0.583***	1				
TRA	4.067	0.99	0.481***	0.047	0.535***	0.484***	1			
Gender	1.476	0.503	0.15	0.047	0.095	0.095	0.116	1		
Tenure	9.18	7.584	0.366***	0.072	0.298**	0.344***	0.309**	0.021	1	
Size	2.222	0.906	-0.044	-0.043	-0.091	-0.116	-0.099	-0.094	0.066	1

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$; EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality, Tenure = organizational tenure, Size = organization size.

Among the 595 questionnaires collected in this survey, the number of respondents who considered the organizational culture a hierarchy culture was the highest ($n = 293$), followed by clan culture ($n = 193$), while the number of adhocracy culture and market culture was lower. Therefore, Hypothesis 1 (H1) of this thesis was supported, that is, *"In state-owned technology enterprises, hierarchy culture and clan culture are more prominent than adhocracy culture and market culture"*.

4.3 Analysis of variance (ANOVA)

The results of one-way ANOVA based on the sample's demographic characteristics are presented in Table 4.4. Among the characteristics, the educational level, technical title, department, job position, and ranking showed significant between-group differences. However, no significant difference was detected between different gender groups for the five variables.

Table 4.4 ANOVA results of demographic characteristics

Item		OC	EIB	OI	TL	TRA
Gender	Male	4.97±0.72	4.84±0.75	4.57±0.91	4.97±0.73	4.03±1.03
(Mean ± SD)	Female	4.95±0.73	4.82±0.76	4.56±0.84	4.99±0.76	4.07±1.01
	F	0.1	0.13	0.01	0.07	0.32
	p	0.75	0.72	0.91	0.8	0.57
Educational	College or bellow	4.66±0.94	4.94±1.04	4.42±1.12	4.49±1.28	4.29±0.81
level	Underguaduate	4.78±0.68	4.62±0.61	4.36±0.70	4.81±0.62	3.97±0.86
(Mean ± SD)	Master	4.95±0.76	4.81±0.85	4.48±1.00	4.98±0.82	3.85±1.07
	Doctor or above	5.48±0.45	5.43±0.46	5.30±0.55	5.45±0.53	4.64±1.11
	F	26.84	32.59	33.77	21.25	16
	p	0.00***	0.00***	0.00***	0.00***	0.00***
Technical title	Junior	4.95±0.63	4.71±0.65	4.29±0.78	4.90±0.59	3.81±0.85
(Mean ± SD)	Middle-level	4.99±0.71	4.92±0.67	4.68±0.86	5.03±0.70	4.07±1.10
	Senior	5.00±0.96	5.18±0.92	4.90±1.01	5.26±0.91	4.40±1.10
	Others	4.84±0.54	4.38±0.61	4.38±0.67	4.60±0.70	3.95±0.88
	F	1.03	23.31	15.35	14.72	8.58
	p	0.38	0.00***	0.00***	0.00***	0.00***
Department	Research	5.16±0.70	5.07±0.77	4.81±0.91	5.19±0.71	4.17±1.16
(Mean ± SD)	Technical	4.89±0.75	4.77±0.69	4.43±0.89	4.92±0.74	3.91±0.96
	Administrative	4.75±0.65	4.58±0.65	4.34±0.68	4.77±0.70	3.99±0.84
	Others	4.57±0.67	4.28±0.73	4.34±0.84	4.49±0.76	4.10±0.65
	F	13.69	19.89	12.08	15.43	2.45
	p	0.00***	0.00***	0.00***	0.00***	0.06*
Job position	Research	5.11±0.74	4.99±0.78	4.69±0.97	5.11±0.77	4.13±1.12
(Mean ± SD)	Logistics	4.92±0.46	4.54±0.52	4.46±0.62	4.83±0.62	3.61±0.71
	Administration	4.68±0.72	4.56±0.68	4.32±0.72	4.74±0.71	3.93±0.88
	Management	4.71±0.68	4.72±0.68	4.39±0.73	4.93±0.62	4.02±0.91
	Others	4.78±0.52	4.60±0.61	4.55±0.59	4.59±0.68	4.27±0.62
	F	10.95	10.58	4.74	7.5	3.48
	p	0.00***	0.00***	0.00***	0.00***	0.01***

Ranking (Mean ± SD)	Senior managers	5.07±0.86	5.24±0.83	5.01±0.91	5.26±0.90	4.52±1.05
	Middle-level managers	5.04±0.74	5.06±0.70	4.81±0.86	5.16±0.70	4.16±1.12
	Ordinary employees	4.87±0.68	4.59±0.68	4.29±0.79	4.81±0.67	3.84±0.89
	Others	4.80±0.48	4.34±0.67	4.15±0.69	4.22±0.71	4.09±0.47
	F	3.09	29.41	24.22	19.73	9.98
	p	0.03**	0.00***	0.00***	0.00***	0.00***

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$; EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality.

In order to explore the significance level of the difference between each group, we performed post-hoc multiple comparisons using the least significant difference, with Cohen's *d* as the effect size index, and the results are provided in Table B.1 of Annex B. It is generally considered that 0.20, 0.50, and 0.80 represent small, medium, and large effect size, respectively (Armstrong, 2014).

For groups with different educational levels, the ANOVA results showed significant between-group differences in all five variables: organizational culture ($F = 26.84$, $p < 0.00$), employee innovative behavior ($F = 32.59$, $p < 0.01$), organizational identification ($F = 33.77$, $p < 0.01$), transformational leadership ($F = 21.25$, $p < 0.01$), and traditionality ($F = 16.00$, $p < 0.01$).

More specifically, groups with different educational levels showed significance in organizational culture at the level of 1%. The comparisons showing significant between-group differences in means are as follows: a) The score of "doctor or above" (Mean = 5.48 ± 0.45) was higher than that of "master" (Mean = 4.95 ± 0.76), "undergraduate" (Mean = 4.78 ± 0.68), and "college or below" (Mean = 4.66 ± 0.94); b) the score of "master" was higher than that of "undergraduate" (mean=4. 78 ± 0. 68). Groups with different educational levels also showed significance in employee innovative behavior at the level of 1%: a) the score of "doctor or above" (Mean = 5.43 ± 0.46) was higher than that of "master" (Mean = 4.81 ± 0.85), "undergraduate" (Mean = 4.62 ± 0.61), and "college or below" (Mean = 4.94 ± 1.04); b) the score of "master" (Mean = 4.81 ± 0.85) was higher than that of "undergraduate" (Mean = 4.62 ± 0.61).

Moreover, groups with different educational levels showed significance in organizational identification at the level of 1%. The comparisons showing significant between-group differences are as follows: The score of "doctor or above" (Mean = 5.30 ± 0.55) was higher than that of "master" (Mean = 4.48 ± 1.00), "undergraduate (Mean = 4.36 ± 0.70), and "college or below" (Mean = 4.42 ± 1.12). Different educational level groups also showed significance in transformational leadership at the level of 1%: a) the score of "doctor or above" (Mean =

5.45 ± 0.53) was higher than that of "master" (Mean = 4.98 ± 0.82), "undergraduate" (Mean = 4.81 ± 0.62), and "college or below" (Mean = 4.49 ± 1.28); b) the score of "master" (Mean = 4.98 ± 0.82) was higher than that of "undergraduate" (Mean = 4.81 ± 0.62) and "college or below" (Mean = 4.49 ± 1.28). As to traditionality, there was also a between-group difference: the score of "doctor or above" (Mean = 4.64 ± 1.11) was higher than that of "undergraduate" (Mean = 3.97 ± 0.86) and "master" (Mean = 3.85 ± 1.07).

For groups with different technical titles, the ANOVA results showed significant differences in four variables: employee innovative behavior (F = 23.31, p < 0.00), organizational identification (F = 15.35, p < 0.00), transformational leadership (F = 14.72, p < 0.00), and traditionality (F = 8.58, p < 0.00). However, no significant between-group difference was detected in the scores of organizational culture (F = 1.03, p = 0.38).

According to the ANOVA results presented above, groups with different technical titles did not show significant differences in the scores of organizational culture, but showed differences in employee innovative behavior, organizational identification, transformational leadership, and traditionality. More specifically, between-group difference was detected in employee innovative behavior at the significance level of 1%: a) the score of "senior" technical titles (Mean = 5.18 ± 0.92) was higher than that of "middle-level" technical titles (Mean = 4.92 ± 0.67), "junior" technical titles (Mean = 4.71 ± 0.65), and "others" (Mean = 4.38 ± 0.61); b) the score of "middle-level" (Mean = 4.92 ± 0.67) was higher than "junior" (Mean = 4.71 ± 0.65) and "others" (Mean = 4.38 ± 0.61); 3) the score of "junior" technical titles (Mean = 4.71 ± 0.65) was higher than "others" (Mean = 4.38 ± 0.61). Between-group difference was also detected in organizational identification at the significance level of 1%: a) the score of "senior" technical titles (Mean = 4.90 ± 1.01) was higher than "middle-level" technical titles (Mean = 4.68 ± 0.86), "junior" technical titles (Mean = 4.29 ± 0.78), and "others" (Mean = 4.38 ± 0.67); b) the score of "middle-level" technical titles (Mean = 4.68 ± 0.86) was higher than "junior" technical titles (Mean = 4.29 ± 0.78) and "others" (Mean = 4.38 ± 0.67).

Moreover, there were significant between-group differences in scores of transformational leadership at the level of 1%: a) the score of "senior" technical titles (Mean = 5.26 ± 0.91) was higher than that of "middle-level" technical titles (Mean = 5.03 ± 0.70), "junior" technical titles (Mean = 4.90 ± 0.59), and "others" (Mean = 4.60 ± 0.70); b) the score of "middle-level" technical titles (Mean = 5.03 ± 0.70) was higher than that of "junior" technical titles (Mean = 4.90 ± 0.59) and "others" (Mean = 4.60 ± 0.70). Traditionality also showed significant between-group differences: a) the score of "senior" technical titles (Mean = 4.40 ± 1.10) was higher than that of "middle-level" technical titles (Mean = 4.07 ± 1.10), "junior" technical titles (Mean =

3.81 ± 0.85), and "others" (Mean = 3.95 ± 0.88); b) the score of "middle-level" technical titles (Mean = 4.07 ± 1.10) was higher than that of "junior" technical titles (Mean = 3.81 ± 0.85).

For groups working for different types of departments, the ANOVA results showed significant between-group differences in all five variables: organizational culture ($F = 13.69$, $p < 0.00$), employee innovative behavior ($F = 19.89$, $p < 0.01$), organizational identification ($F = 12.08$, $p < 0.01$), transformational leadership ($F = 15.43$, $p < 0.01$), and traditionality ($F = 2.45$, $p < 0.1$).

More specifically, groups of different department types showed significant differences in scores of organizational culture at the level of 1%: a) the score of "research" departments (Mean = 5.16 ± 0.70) was higher than that of "technical" departments (Mean = 4.89 ± 0.75), "administrative" departments (Mean = 4.75 ± 0.65), and "others" (Mean = 4.57 ± 0.67); b) The score of "technical" departments (Mean = 4.89 ± 0.75) was higher than that of "administrative" departments (Mean = 4.75 ± 0.65) and "others" (Mean = 4.57 ± 0.67). Between-group differences were also detected in scores of employee innovative behavior at the significance level of 1%: a) the score of "research" departments (Mean = 5.07 ± 0.77) was higher than that of "technical" departments (Mean = 4.77 ± 0.69), "administrative" departments (Mean = 4.58 ± 0.65), and "others" (Mean = 4.28 ± 0.73); b) The score of "technical" departments (Mean = 4.77 ± 0.69) was higher than that of "administrative" departments (Mean = 4.58 ± 0.65) and "others" (Mean = 4.28 ± 0.73); c) the score of "administrative" departments (Mean = 4.58 ± 0.65) was higher than "others" (Mean = 4.28 ± 0.73).

Moreover, groups of different department types also showed significant differences in scores of organizational identification at the level of 1%: the score of "research" departments (Mean = 4.81 ± 0.91) was higher than that of "technical" departments (Mean = 4.43 ± 0.89), "administrative" departments (Mean = 4.34 ± 0.68), and "others" (Mean = 4.34 ± 0.84). Between-group differences were also detected in scores of transformational leadership at the significance level of 1%: a) the score of "research" (Mean = 5.19 ± 0.71) was higher than that of "technical" departments (Mean = 4.92 ± 0.74), "administrative" departments (Mean = 4.77 ± 0.70), and "others" (Mean = 4.49 ± 0.76); b) The score of "technical" departments (Mean = 4.92 ± 0.74) was higher than that of "administrative" departments (Mean = 4.77 ± 0.70) and "others" (Mean = 4.49 ± 0.76); c) the score of "administrative" departments (Mean = 4.77 ± 0.70) was higher than "others" (Mean = 4.49 ± 0.76). Furthermore, there was significant between-group difference at the level of 1% in scores of traditionality: the score of "research"

departments (Mean = 4.17 ± 1.16) was higher than that of "technical" departments (Mean = 3.91 ± 0.96) and "administrative" departments (Mean = 3.99 ± 0.84).

For groups of different job positions, results showed significant between-group differences in all five variables: organizational culture (F =10.95, p < 0.00), employee innovative behavior (F = 10.58, p < 0.01), organizational identification (F = 4.74, p < 0.01), transformational leadership (F = 7.5, p < 0.01), and traditionality (F = 3.48, p < 0.01).

More specifically, groups of different job positions showed significant differences in scores of organizational culture at the level of 1%: a) the score of "research" position (Mean = 5.11 ± 0.74) was higher than that of "administration" (Mean = 4.68 ± 0.72), "management" (Mean = 4.71 ± 0.68), "logistics" (Mean = 4.92 ± 0.46), and "others" (Mean = 4.78 ± 0.52); b) the score of "logistics" positions (Mean = 4.92 ± 0.46) was higher than that of "administration" (Mean = 4.68 ± 0.72). Significant between-group differences were also detected in scores of employee innovative behavior at the significance level of 1%: the score of "research" positions (Mean = 4.99 ± 0.78) was higher than that of "logistics" (Mean = 4.54 ± 0.52), "administration" (Mean = 4.56 ± 0.68), "management" (Mean = 4.72 ± 0.68), and "others" (Mean = 4.60 ± 0.61).

Moreover, groups of different job positions showed significant between-group differences at the level of 1% in scores of organizational identification: the score of "research" positions (Mean = 4.69 ± 0.97) was higher than that of "administration" (Mean = 4.32 ± 0.72), "management" (Mean = 4.39 ± 0.73), and "logistics" (Mean = 4.46 ± 0.62). Significant between-group differences at the significance level of 1% were also found in scores of transformational leadership: a) the score of "research" positions (Mean = 5.11 ± 0.77) was higher than that of "logistics" (Mean = 4.83 ± 0.62), "administration" (Mean = 4.74 ± 0.71), "management" (Mean = 4.93 ± 0.62), and "others" (Mean = 4.59 ± 0.68); b) the score of "management" positions (Mean = 4.93 ± 0.62) was higher than that of "administration" (Mean = 4.74 ± 0.71) and "others" (Mean = 4.59 ± 0.68). There were also significant between-group differences at the level of 1% in scores of traditionality: a) the score of "research" positions (Mean = 4.13 ± 1.12) was higher than that of "logistics" (Mean = 3.61 ± 0.71) and "administration" (Mean = 3.93 ± 0.88); b) the score of "management" positions (Mean = 4.02 ± 0.91) was higher than that of "logistics" (Mean=3.61 ± 0.71); c) the score of "administration" positions (Mean = 3.93 ± 0.88) was higher than the "logistics" (Mean=3.61 ± 0.71); d) The score of "others" (Mean = 4.27 ± 0.62) was higher than that of "logistics" (Mean=3.61 ± 0.71).

For groups of different rankings, the ANOVA results showed significant between-group differences in all five variables: organizational culture (F = 3.09, p < 0.05), employee innovative

behavior ($F = 29.41$, $p < 0.01$), organizational identification ($F = 24.22$, $p < 0.01$), transformational leadership ($F = 19.73$, $p < 0.01$), and traditionality ($F = 9.98$, $p < 0.01$).

More specifically, groups of different rankings showed a 5% level significance for organizational culture: a) the score of "senior managers" (Mean = 5.07 ± 0.86) was higher than that of "ordinary employees" (Mean = 4.87 ± 0.68); b) the score of "middle-level managers" (Mean = 5.04 ± 0.74) was higher than that of "ordinary employees" (Mean = 4.87 ± 0.68). There were between-group differences at 1% significance level for employee innovative behavior: a) the score of "senior managers" (Mean = 5.24 ± 0.83) was higher than that of "middle-level managers" (Mean = 5.06 ± 0.70), "ordinary employees" (Mean = 4.59 ± 0.68), and "others" (Mean = 4.34 ± 0.67); b) the score of "middle-level managers" (Mean = 5.06 ± 0.70) was higher than "ordinary employees" (Mean = 4.59 ± 0.68) and "others" (Mean = 4.34 ± 0.67). Between-group differences were detected at 1% significance level for organizational identification: a) the score of "senior managers" (Mean = 5.01 ± 0.91) was higher than that of "middle-level" managers (Mean = 4.81 ± 0.86), "ordinary employees" (Mean = 4.29 ± 0.79), and "others" (Mean = 4.15 ± 0.69); b) the score of "middle-level" managers (Mean = 4.81 ± 0.86) was higher than "ordinary employees" (Mean = 4.29 ± 0.79) and "others" (Mean = 4.15 ± 0.69).

Moreover, there were between-group differences at 1% significance level for transformational leadership: a) the score of "senior managers" (Mean = 5.26 ± 0.90) was higher than that of "ordinary employees" (Mean = 4.81 ± 0.67) and "others" (Mean = 4.22 ± 0.71); b) the score of "middle-level managers" (Mean = 5.16 ± 0.70) was higher than "ordinary employees" (Mean = 4.81 ± 0.67) and "others" (Mean = 4.22 ± 0.71); c) the score of "ordinary employees" (Mean = 4.81 ± 0.67) was higher than that of "others" (Mean = 4.22 ± 0.71). Moreover, significant between-group differences were detected at the level of 1% in scores of traditionality:a) the score of "senior managers" (Mean = 4.52 ± 1.05) was higher than that of "middle-level" managers (Mean = 4.16 ± 1.12) and "ordinary employees" (Mean = 3.84 ± 0.89); b) the score of "middle-level" managers (Mean = 4.16 ± 1.12) was higher than "ordinary employees" (Mean = 3.84 ± 0.89).

Subsequently, by using the least significant difference (LSD), we compared each pair of groups, and the results are summarized in Table 4.5.

Table 4.5 Post-hoc multiple comparisons

Group/difference significance	OC	EIB	OI	TL	TRA
Educational level					
Doctor or above	Higher than all the others	Higher than all the others	Higher than all the others	Higher than all the others	> Master > Undergr.
Master	> Undergr.	/	/	> College or bellow	/
Underguaduate	/	/	/	/	/
College or bellow	/	/	/	/	/
Technical title					
Senior	/	Higher than all the others	Higher than all the others	Higher than all the others	Higher than all the others
Middle-level	/	> Junior > Others	> Junior > Others	> Junior > Others	> Junior
Junior	/	> Others	/	> Others	/
Others	/	/	/	/	/
Department					
Research	Higher than all the others	Higher than all the others	Higher than all the others	Higher than all the others	> Technic. > Adminis.
Technical	> Adminis. department > Others	> Adminis. department > Others	/	> Adminis. department	> Others
Administrative	/	> Others	/	> Others	/
Others	/	/	/	/	/
Job position					
Research	Higher than all the others	Higher than all the others	> Adminis. > Managem. > Logistics	Higher than all the others	> Logistics > Adminis.
Management	/	/	/	/	> Logistics
Administration	/	/	/	/	> Logistics
Logistics	> Adminis.	/	/	/	/
Others	/	/	/	/	> Logistics
Ranking					
Senior managers	> Ordinary employees	Higher than all the others	Higher than all the others	> Ordinary employees > Others	> Middle-level > Ordinary employees
Middle-level managers	/	> Ordinary employees > Others	> Ordinary employees > Others	> Ordinary employees > Others	> Ordinary employees
Ordinary employees	> Ordinary employees	/	/	> Others	/
Others	/	/	/	/	/

Note: ">" means "significantly higher than"; "/" means "no significant difference"; EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality.

From the above-presented results, we can see that groups with different educational levels or different department types showed significant between-group differences in all variables. Therefore, we further plotted Figure 4.1, which, in the form of boxplots, illustrates the variation among different combinations of educational levels and departments in the distribution of each variable.
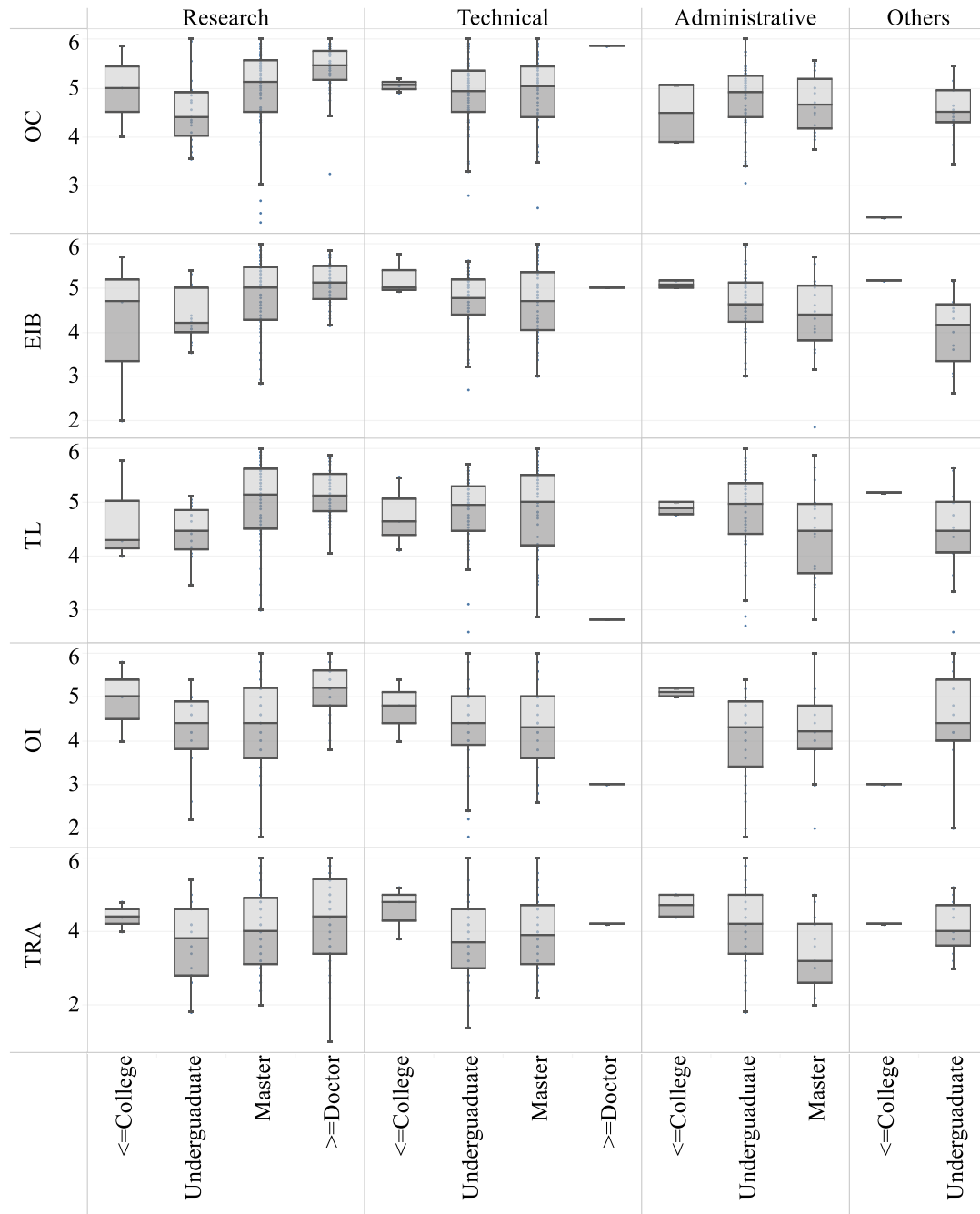
Figure 4.1 Boxplots of the distribution of variables across different departments/educational levels

As shown by the figure, "research" departments have the widest distribution of doctoral degree holders, while "technical" departments have only a small number of doctoral degree holders. "Administrative" departments have no doctoral degree holders, while "other" departments have neither master's nor doctoral degree holders. In "research" departments, the overall distribution of the variables' perceptions is higher among doctoral degree holders than the other groups.

Table 4.6 presents the results of one-way ANOVA using organizational culture as the single factor. It can be seen that, except that groups of different organizational cultures showed

significant differences at the level of 10% in organizational culture ($p = 0.082$), they showed no significant differences ($p > 0.05$) in other factors, including employee innovative behavior, organizational identification, transformational leadership, traditionality, gender, organizational tenure, and organization size. That meant, groups of different organizational cultures showed consistency for the above variables, as there was no significant between-group difference.

Table 4.6 One-way ANOVA of organizational culture

| | Organizational culture (Mean ± SD) | | | | F | p |
	Clan culture ($n = 149$)	Hierarchy culture ($n = 293$)	Market culture ($n = 63$)	Adhocracy culture ($n = 90$)		
EIB	4.866±0.695	4.842±0.767	4.737±0.778	4.821±0.793	0.453	0.715
OC	5.051±0.638	4.965±0.725	4.777±0.842	4.914±0.767	2.247	0.082*
OI	4.552±0.859	4.590±0.889	4.537±0.845	4.544±0.914	0.125	0.945
TL	4.976±0.737	5.036±0.679	4.858±0.784	4.890±0.899	1.564	0.197
TRA	3.883±0.997	4.129±1.020	4.067±0.990	4.031±1.076	1.927	0.124
Gender	1.416±0.495	1.396±0.490	1.476±0.503	1.444±0.500	0.572	0.633
Organizational tenure	9.027±6.545	9.384±7.066	9.180±7.584	9.644±6.646	0.169	0.917
Educational level	2.738±0.800	2.683±0.757	2.635±0.725	2.711±0.782	0.324	0.808
Age	37.758±8.831	36.911±8.671	35.984±8.933	37.267±8.431	0.685	0.561
Organization size	2.356±0.966	2.372±0.948	2.222±0.906	2.156±0.935	1.496	0.215

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$; EIC = Employee innovative behavior, OC = Organizational culture, OI = Organizational identification, TL = Transformational leadership, TRA = Traditionality.

4.4 Regression analysis

4.4.1 Main effect testing

Table 4.7 provides the results of the regression analysis on the main effect of hierarchy and clan cultures on employee innovative behavior.

Table 4.7 Regression analysis of hierarchy and clan cultures on employee innovative behavior

| Variable | Model 1 Group: Hierarchy culture | | Model 2 Group: Clan culture | |
	Unstandardized coefficient	Standardized coefficient	Unstandardized coefficient	Standardized coefficient
Constant	4.896*** (31.080)	-	4.344*** (21.769)	-
Gender	-0.077 (-1.007)	-0.049 (0.315)	0.075 (0.734)	0.053 (0.464)
Organizational tenure	0.030*** (5.410)	0.273 (0.000***)	0.023*** (2.823)	0.212 (0.005***)
Organization size	-0.095** (-2.375)	-0.118 (0.018**)	0.089 (1.622)	0.122 (0.107)
OC	0.466*** (8.909)	0.440 (0.000***)	0.490*** (6.124)	0.448 (0.000***)
Sample size	292		147	
R^2	0.322		0.274	

| Variable | Model 1 | | Model 2 | |
| | Group: Hierarchy culture | | Group: Clan culture | |
	Unstandardized coefficient	Standardized coefficient	Unstandardized coefficient	Standardized coefficient
Adjusted R^2	0.313		0.254	
F	$F(4,287) = 34.085, p = 0.000$		$F(4,142) = 13.432, p = 0.000$	

Note: OC = Organizational culture.

Model 1 and Model 2 are regression models of samples with different organizational cultures. Model 1 is the regression model of the sample dominated by hierarchy culture. The regression coefficient of the independent variable "organizational culture" was 0.466, and the t-value was 8.909, which was positively significant at the 1% significance level, indicating that organizational culture had a significant positive effect on employee innovative behavior.

Model 2 is the regression model of the sample dominated by clan culture. The regression coefficient of the independent variable "organizational culture" was 0.490, and the t-value was 6.124, which was positively significant at the 1% significance level, indicating that organizational culture also had a significant positive effect on employee innovative behavior.

Among the control variables, it is worth noting that the "organizational tenure" showed a positive significance at the level of 1% in all four models, which means employees' longer years serving the organization are more conducive to their innovation. On the one hand, it may be because, with longer organizational tenure, employees are more familiar with the enterprise's culture and values and can better understand the enterprise's strategy and technological development direction, which helps them generate more innovative ideas and solutions for the enterprise. At the same time, employees with longer organizational tenure may have accumulated more technical experience and knowledge and have a better understanding of the enterprise's technical status and market demand, which enables them to provide the enterprise with better technical services and product solutions. In addition, the longer the employees work in the organization, the more likely they are to have established broad and close interpersonal relationships and cooperation networks, which can foster the exchange and sharing of knowledge and technology, so as to promote the innovation ability of technology talents.

In both Model 1 and Model 2, the effect of "organizational culture" on "employee innovative behavior" was significant at the 1% level, indicating that the organizational culture dominated by hierarchy or clan type can positively affect employee innovative behavior. In terms of standardized coefficient, its value in clan culture (0.448) and in hierarchy culture (0.440) were close; in terms of model fitting, the fitting degree of hierarchy culture (R = 0.313) was higher than that of clan culture (R = 0.254); regarding the correlation coefficient, the correlation coefficient of hierarchy culture on employee innovative behavior (0.495) was higher

than that of clan culture on employee innovative behavior (0.446). Therefore, both clan and hierarchy organizational cultures showed a positive effect on employee innovative behavior; however, based on the current statistical results, there is no significant evidence to conclude that compared to hierarchy culture, clan culture had a stronger positive correlation with employee innovative behavior. Hence, Hypothesis 2 was not supported.

4.4.2 Mediation effect testing

Table 4.8 provides the regression analysis results of the sample dominated by hierarchy culture. Model 3 is the regression model of direct effect. The results showed that "organizational culture" was positively associated with "employee innovative behavior" at 1% significance level.

Model 4 is the regression model with "organizational identification" as the dependent variable, aiming to examine the relationship between the independent variable "organizational culture" and the mediating variable, "organizational identification". The results showed that the regression coefficient of the independent variable "organizational culture" was 0.352, and the t-value was 5.342, with a positive significance at the 1% level, indicating that organizational culture had a significant positive effect on organizational identification.

Model 5 is basically Model 3 but with the mediator "organizational identification" added. The aim was to examine the relationship between the mediator "organizational identification" and the dependent variable "employee innovative behavior". The regression coefficient of the independent variable (organizational culture) was 0.351, and the t-value was 7.009, with positive significance at the 1% level; the regression coefficient of the mediator "organizational identification" was 0.327, and the t-value was 7.654, with positive significance at the 1% level.

Table 4.8 Mediation effect in hierarchy culture ($n = 293$)

	Model 3 EIB	Model 4 OI	Model 5 EIB
Constant	2.582***	2.434***	1.786***
	(8.476)	(6.340)	(6.015)
Gender	-0.077	0.094	-0.108
	(-1.007)	(0.971)	(-1.540)
Organizational tenure	0.030***	0.038***	0.017***
	(5.410)	(5.585)	(3.234)
Organization size	-0.095**	-0.036	-0.084**
	(-2.375)	(-0.709)	(-2.280)
OC	0.466***	0.352***	0.351***
	(8.909)	(5.342)	(7.009)
OI			0.327***
			(7.654)
Sample size	292	292	292
R^2	0.322	0.201	0.437
Adjusted R^2	0.313	0.189	0.427

	Model 3 EIB	Model 4 OI	Model 5 EIB
F	$F(4,287) = 34.085$, $p = 0.000$	$F(4,287) = 17.996$, $p = 0.000$	$F(5,286) = 44.453$, $p = 0.000$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, OI = Organizational identification.

From Table 4.8, it can be seen that we involved three models in the mediation effect analysis, the results of which are as follows:

Employee innovative behavior = 2.582 - 0.077 × Gender + 0.030 × Organizational tenure - 0.095 × Organization size + 0.466 × Organizational culture

Organizational identification = 2.434 + 0.094 × Gender + 0.038 × Organizational tenure - 0.036 × Organization size + 0.352 × Organizational culture

Employees' innovative behavior = 1.786 - 0.108 × Gender + 0.017 × Organizational tenure - 0.084 × Organization size + 0.351 × Organizational culture + 0.327 × Organizational identification

In determining the mediation effect, six related indicators were mainly involved and are described as follows (Wen et al., 2004):

c is the regression coefficient of X on Y (when mediating variable M is not involved in the model), i.e., the total effect; a is the regression coefficient of X on M, b is the regression coefficient of M on Y, and a*b is the product of a and b, i.e., the mediation effect; c' is the regression coefficient of X on Y (when mediating variable M is not involved in the model), i.e., the direct effect; if a and b are significant, but c' is not significant, it is considered a full mediation; if a and b are significant, c' is significant, and a*b has the same sign (positive/negative) as c', it is considered a partial mediation. According to this determination method, in the above model, a = 0.352, b = 0.327, c = 0.466, c' = 0.351, and therefore, the mediation effect in this model is partial mediation. Hence, H3 was supported, that is, in hierarchy culture, organizational identification mediates the relationship of organizational culture with employee innovative behavior. In this study, we used the percentile bootstrap method to examine the mediation effect. In the results presented in Table 4.9, "95% BootCI" represents the 95% confidence interval (CI) calculated by bootstrap sampling; as long as it does not include 0, the mediation effect is deemed significant.

Table 4.9 Bootstrapping results

Total indirect effect	Boot SE	z	p	BootLLCI	BootULCI
0.120	0.045	2.683	0.007	0.026	0.202

*Note: BootLLCI refers to the lower limit of bootstrap sampling 95% CI; BootULCI refers to the upper limit of bootstrap sampling 95% CI; bootstrap type: percentile bootstrap method.

In addition, the proportion of mediation effect is calculated as a*b/c. Therefore, according to the total effect c = 0.466, the mediation effect a*b = 0.115, and the direct effect c' = 0.351, the proportion of the mediation effect was calculated as a*b/c = 24.721%.

Table 4.10 provides the regression analysis results of the sample dominated by clan culture. Model 6 represents the results of the direct effect, in which "organizational culture" was positively associated with "employee innovative behavior" at the 1% significance level.

Model 7 is the regression model with "organizational identification" as the dependent variable aiming to examine the relationship between the independent variable "organizational culture" and the mediator "organizational identification". The regression coefficient of the independent variable "organizational culture" was 0.357, and the t-value was 3.362, which was positively significant at the 1% significance level, indicating that organizational culture had a significant positive effect on organizational identification.

Model 8 is basically Model 6 but with the mediator "organizational identification" added to test the relationship between the mediator and the dependent variable "employee innovative behavior". The regression coefficient of the independent variable "organizational culture" was 0.370, and the t-value was 4.956, which was positively significant at the 1% significance level. The regression coefficient of the mediator "organizational identification" was 0.335, and the t-value was 5.913, which was positively significant at the 1% significance level.

Table 4.10 Mediation effect in clan culture ($n = 149$)

Variable	Model 6 EIB	Model 7 OI	Model 8 EIB
Constant	1.874***	2.045***	1.188***
	(3.988)	(3.276)	(2.713)
Gender	0.075	0.087	0.046
	(0.734)	(0.644)	(0.497)
Organizational tenure	0.023***	0.021*	0.016**
	(2.823)	(1.977)	(2.133)
Organization size	0.089	0.170**	0.032
	(1.622)	(2.339)	(0.632)
OC	0.490***	0.357***	0.370***
	(6.124)	(3.362)	(4.956)
OI			0.335***
			(5.913)
Sample size	147	147	147
R^2	0.274	0.144	0.419
Adjusted R^2	0.254	0.120	0.398
F	$F(4,142) = 13.432$, $p = 0.000$	$F(4,142) = 5.962$, $p = 0.000$	$F(5,141) = 20.306$, $p = 0.000$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, OI = Organizational identification.

As shown in the above table, the mediation effect analysis involved three models, the results of which are presented as follows:

Employee innovative behavior = 1.874 + 0.075 × Gender + 0.023 × Organizational tenure + 0.089 × Organization size + 0.490 × Organizational culture

Organizational identification = 2.045 + 0.087 × Gender + 0.021 × Organizational tenure + 0.170 × Organization size + 0.357 × Organizational culture

Employee innovative behavior = 1.188 + 0.046 × Gender + 0.016 × Organizational tenure + 0.032 × Organization size + 0.370 × Organizational culture + 0.335 × Organizational identification.

Similarly, according to the determination method for mediation effect, based on the regression analysis results of the sample dominated by clan culture, the mediating variable "organizational identification" showed a partial mediation effect, which is consistent with the results of the sample dominated by hierarchy culture. According to the calculation formula for the proportion of mediation effect a*b/c, since the total effect c = 0.490, the mediation effect a*b = 0.119, and the direct effect c' = 0.370, the proportion of the mediation effect was calculated as a*b/c = 24.466%.

4.4.3 Moderation effect testing

4.4.3.1 Transformational leadership

In the analysis of moderation effects, we centered the independent and moderating variables in the model to reduce multicollinearity and facilitate the interpretation and understanding of the interaction coefficient. When interactions are introduced into the regression analysis, the original predictors (e.g., X1 and X2) and their products (interactions, e.g., x1*x2) may be highly correlated. In this case, multicollinearity may occur, leading to the instability of parameter estimation and difficulty in interpretation. Centering, which means subtracting the mean value from the value of the variable, can effectively reduce multicollinearity. After centralization, the mean value of the variables becomes 0, making the regression equation easier to explain. For example, in a regression model with moderation, the coefficient of the main effect can be directly interpreted as the effect when the moderation effect is at its average level. In addition, centralization can also help to reduce the error caused by the interaction between variables.

The regression analysis results in hierarchy culture with "transformational leadership" as a moderator are provided in Table 4.11. Model 3 is the main effect model, Model 9 is the regression model with the moderator added, and Model 10 is the model with the moderator and its interaction added. The regression coefficient of the independent variable was 0.233, and the t-value was 5.326, which was positively significant at the 1% significance level; the regression

coefficient of the moderator was 0.713, and the t-value was 14.917, which was positively significant at the 1% significance level; the regression coefficient of the interaction between the moderator and the independent variable was 0.193, and the t-value was 3.544, with positive significance at the 1% level. The results showed that "transformational leadership" had a significant moderation effect on the relationship between "organizational culture" and "employee innovative behavior". That means "transformational leadership" accentuates the positive effect of hierarchy culture on "employee innovative behavior".

Table 4.11 Moderation effect of transformational leadership in hierarchy culture (dependent variable: employee innovative behavior) ($n = 293$)

Variable	Model 3	Model 9	Model 10
Constant	4.896***	4.941***	4.899***
	(31.080)	(41.159)	(41.408)
Gender	-0.077	-0.093	-0.106*
	(-1.007)	(-1.581)	(-1.844)
Organizational tenure	0.030***	0.013***	0.011**
	(5.410)	(2.988)	(2.578)
Organization size	-0.095**	-0.040	-0.024
	(-2.375)	(-1.290)	(-0.792)
OC	0.466***	0.203***	0.233***
	(8.909)	(4.637)	(5.326)
TL		0.703***	0.713***
		(14.437)	(14.917)
OC×TL			0.193***
			(3.544)
Sample size	292	292	292
R^2	0.322	0.608	0.624
Adjusted R^2	0.313	0.601	0.617
F	$F(4,287) = 34.085$, $p = 0.000$	$F(5,286) = 88.664$, $p = 0.000$	$F(6,285) = 78.968$, $p = 0.000$
$\triangle R^2$	0.322	0.286	0.017
$\triangle F$	$F(4,287) = 34.085$, $p = 0.000$	$F(1,286) = 208.438$, $p = 0.000$	$F(1,285) = 12.563$, $p = 0.000$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, TL = Transformational leadership.

Figure 4.2 shows the effect strength (slope) of the independent variable "organizational culture" on the dependent variable "employee innovative behavior" when "transformational leadership" is at different levels. It can be seen that with a higher score of "transformational leadership", the effect of "organizational culture" on promoting "employee innovative behavior" is stronger.
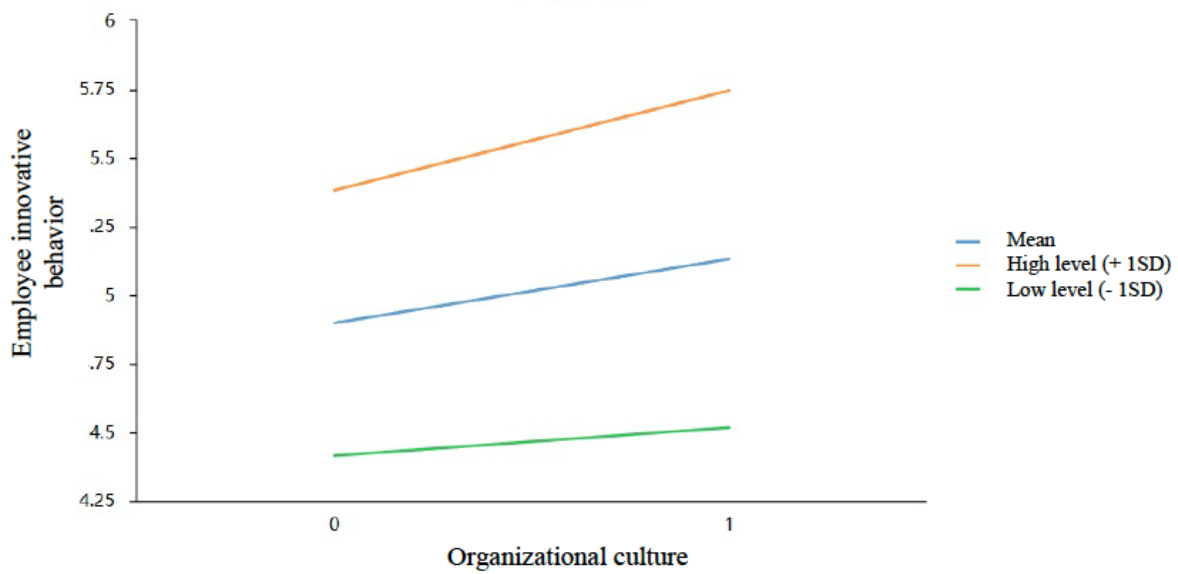
Figure 4.2 Slope plot for the moderation of transformational leadership

The regression analysis results in clan culture with "transformational leadership" as a moderator are provided in Table 4.12. Model 6 is the main effect model, Model 11 is the regression model with the moderator added, and Model 12 is the model with the moderator and its interaction. The results showed that neither the moderator nor its interaction had significant effects, indicating that in clan culture, "transformational leadership" did not have a significant moderation effect on the relationship between "organizational culture" and "employee innovative behavior". Thus, hypothesis 4 is supported.

Table 4.12 Moderation effect of transformational leadership in clan culture (dependent variable: employee innovative behavior) ($n = 149$)

	Model 6	Model 11	Model 12
Constant	4.344***	4.617***	4.605***
	(21.769)	(32.656)	(32.395)
Gender	0.075	-0.015	-0.012
	(0.734)	(-0.208)	(-0.164)
Organizational tenure	0.023***	0.016***	0.014**
	(2.823)	(2.891)	(2.299)
Organization size	0.089	0.051	0.056
	(1.622)	(1.330)	(1.450)
OC	0.490***	0.123*	0.129**
	(6.124)	(1.931)	(2.022)
TL		0.683***	0.698***
		(12.212)	(11.936)
OC×TL			0.069
			(0.886)
Sample size	147	147	147
R^2	0.274	0.647	0.649
Adjusted R^2	0.254	0.635	0.634

F	$F_{(4,142)} = 13.432$, $p = 0.000$	$F_{(5,141)} = 51.780$, $p = 0.000$	$F_{(6,140)} = 43.215$, $p = 0.000$
$\triangle R^2$	0.274	0.373	0.002
$\triangle F$	$F_{(4,142)} = 13.432$, $p = 0.000$	$F_{(1,141)} = 149.128$, $p = 0.000$	$F_{(1,140)} = 0.785$, $p = 0.377$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, TL = Transformational leadership.

4.4.3.2 Traditionality

The regression analysis results in hierarchy culture with "traditionality" as a moderator are presented in Table 4.13. Model 3 is the main effect model, Model 13 is the regression model with the moderator added, and Model 14 is the model with the moderator and its interaction added. As shown in the table, the regression coefficient of the independent variable "organizational culture" was 0.245, and the t-value was 4.052, which was positively significant at the 1% significance level; the regression coefficient of the moderator "traditionality" was 0.391, and the t-value was 9.001, which was positively significant at the 1% significance level; the regression coefficient of the interaction between the independent variable and the moderator was 0.110, and the t-value was 1.790, which was positively significant at the 10% significance level. The results showed that "traditionality" had a significant moderation effect on the relationship between "organizational culture" and "organizational identification". That means traditionality accentuates the positive effect of hierarchy culture on organizational identification.

Table 4.13 Moderation effect of traditionality in hierarchy culture (dependent variable: organizational identification) ($n = 293$)

	Model 3	Model 13	Model 14
Constant	4.182*** (21.069)	4.291*** (24.764)	4.274*** (24.729)
Gender	0.094 (0.971)	0.019 (0.220)	0.021 (0.248)
Organizational tenure	0.038*** (5.585)	0.028*** (4.520)	0.026*** (4.258)
Organization size	-0.036 (-0.709)	0.006 (0.125)	0.008 (0.182)
OC	0.352*** (5.342)	0.220*** (3.731)	0.245*** (4.052)
TRA		0.408*** (9.607)	0.391*** (9.001)
OC×TRA			0.110* (1.790)
Sample size	292	292	292
R^2	0.201	0.396	0.402
Adjusted R^2	0.189	0.385	0.390
F	$F_{(4,287)} = 17.996$, $p = 0.000$	$F_{(5,286)} = 37.433$, $p = 0.000$	$F_{(6,285)} = 31.968$, $p = 0.000$
$\triangle R^2$	0.201	0.195	0.007
$\triangle F$	$F_{(4,287)} = 17.996$, $p = 0.000$	$F_{(1,286)} = 92.286$, $p = 0.000$	$F_{(1,285)} = 3.203$, $p = 0.075$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, TRA = Traditionality.

Figure 4.3 shows the effect strength (slope) of the independent variable "organizational culture" on the dependent variable "organizational identification" when the moderator "traditionality" is at different levels. As can be seen from the figure, the higher the score of employees' traditionality, the stronger the effect of organizational culture on promoting organizational identification.
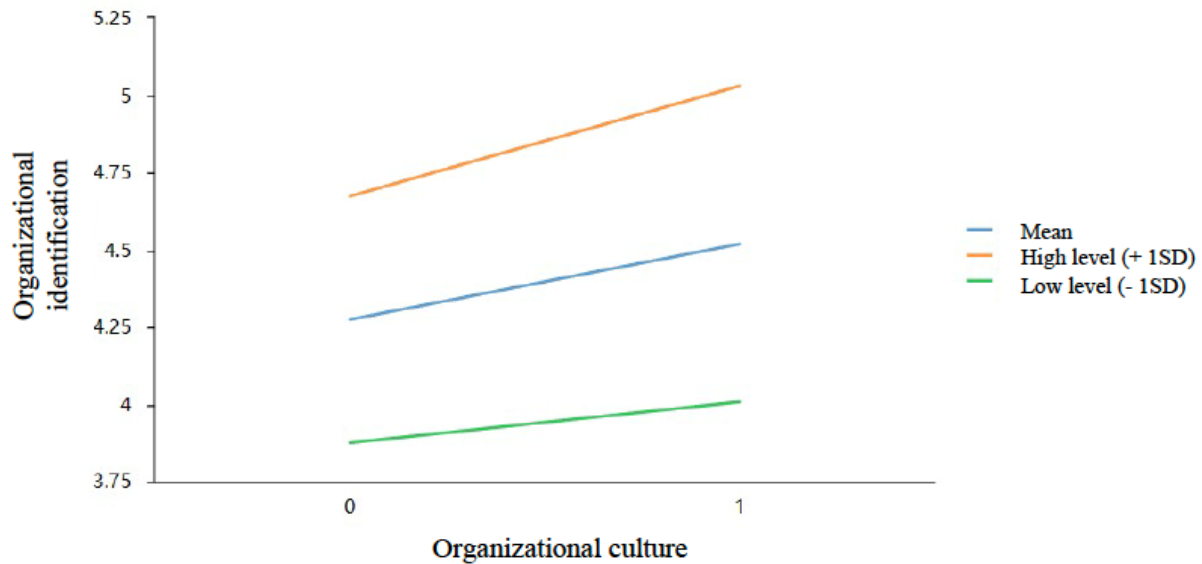
Figure 4.3 Slope plot for the moderation of traditionality

The regression analysis results in clan culture with "traditionality" as a moderator are provided in Table 4.14. Model 6 represents the main effect, Model 15 is the regression model after adding the moderator, and Model 16 is the model after adding both the moderator and its interaction. The results showed that although the moderator had a significant direct effect on the dependent variable, its interaction did not show a significant effect, indicating that in the clan culture, traditionality did not have a significant moderation effect on the relationship between organizational culture and organizational identification. Thus, hypothesis 5 is supported.

Table 4.14 Moderation effect of traditionality in clan culture (dependent variable: organizational identification) ($n = 149$)

	Model 6	Model 15	Model 16
Constant	3.847***	3.973***	3.984***
	(14.509)	(15.988)	(16.124)
Gender	0.087	0.099	0.098
	(0.644)	(0.788)	(0.779)
Organizational tenure	0.021*	0.006	0.001
	(1.977)	(0.600)	(0.083)
Organization size	0.170**	0.166**	0.177**
	(2.339)	(2.451)	(2.610)

OC	0.357^{***}	0.309^{***}	0.319^{***}
	(3.362)	(3.106)	(3.222)
TRA		0.313^{***}	0.293^{***}
		(4.747)	(4.399)
OC×TRA			0.189
			(1.654)
Sample size	147	147	147
R^2	0.144	0.262	0.276
Adjusted R^2	0.120	0.236	0.245
F	$F(4,142) = 5.962,$ $p = 0.000$	$F(5,141) = 10.000,$ $p = 0.000$	$F(6,140) = 8.892,$ $p = 0.000$
$\triangle R^2$	0.144	0.118	0.014
$\triangle F$	$F(4,142) = 5.962,$ $p = 0.000$	$F(1,141) = 22.537,$ $p = 0.000$	$F(1,140) = 2.736,$ $p = 0.100$

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t value in brackets; OC = Organizational culture, TRA = Traditionality.

4.5 Summary of regression analysis results

In §4.4 above, we conducted regression analyses on the relationship between organizational culture, employee innovative behavior, organizational identification, transformational leadership, and employees' traditionality in two different organizational cultures (i.e., hierarchy culture and clan culture) to examine the possible direct, indirect, and moderating effects.

Based on the presented regression analyses, the results of the empirical analysis in this study are summarized in Table 4.15 below.

Table 4.15 Summary of regression analysis results

Hypotheses	Testing results
Hypothesis 1 (H1): In state-owned technology enterprises, hierarchy culture and clan culture are more prominent than adhocracy culture and market culture.	Supported
Hypothesis 2 (H2): Clan culture has a stronger positive relationship with employee innovative behavior than hierarchy culture does.	Not supported
Hypothesis 3 (H3): In hierarchy culture and clan culture, organizational identification mediates the relationship of organizational culture with employee innovative behavior.	Supported
Hypothesis 4 (H4): In hierarchy culture other than clan culture, transformational leadership moderates the positive relationship between organizational culture and employee innovative behavior such that with a higher level of transformational leadership, the positive relationship between hierarchy culture and employee innovative behavior is stronger, and vice versa.	Supported
Hypothesis 5 (H5): In hierarchy culture rather than clan culture, the traditionality of employees moderates the positive relationship between organizational culture and organizational identification such that with stronger traditionality, the relationship between hierarchy culture and organizational identification is stronger, and vice versa.	Supported

1) From the descriptive statistics of the questionnaire, it can be found that in the state-owned technology enterprise, hierarchy culture and clan culture are more dominant than

adhocracy culture and market culture. In the questionnaire survey, 293 respondents considered their organizational culture a hierarchy culture, and 149 considered it a clan culture. These two cultures represented nearly 75% of the total sample, being significantly more prominent than adhocracy culture and market culture.

2) Through the survey, it was found that both hierarchy culture and clan culture had a positive effect on employee innovative behavior. However, clan culture had a stronger positive relationship with employee innovative behavior than hierarchy culture. The clan culture emphasizes shared values and goals of the organization, teamwork, mutual learning, and open communication. It encourages employees to participate in decision-making and put forward innovative ideas and solutions, paying more attention to the process and employees' development. Such an environment enables employees to freely share knowledge, try new ideas, and take the risk of failure, which is conducive to innovative behavior. The hierarchy culture emphasizes clear role definition, strict rules and procedures, centralized decision-making, and the pursuit of stability and efficiency. Although this culture helps to ensure the consistency and accuracy of work and reduce errors and risks, it may, to some extent, affect employees' enthusiasm for innovation as innovation usually requires challenging existing rules, trying new methods, and taking certain risks.

3) This study explored the mediation effect of organizational identification on organizational culture and employee innovative behavior through regression analysis. It was found that organizational identification played a mediating role between organizational culture and employee innovative behavior in hierarchy and clan organizational cultures, and the mediation effect was a partial mediation. It shows that the extent to which members identify with organizational culture is an important factor in explaining the impact of organizational culture on employee innovative behavior.

4) We examined the moderation effect of transformational leadership on employee innovative behavior in different types of organizational culture through regression analysis. The results showed that in the hierarchy culture, transformational leadership could accentuate the positive effect of organizational culture on employee innovative behavior. It may be because while hierarchy culture emphasizes the norms and hierarchical structure within the organization, transformational leadership tends to encourage employees' innovation and change, thus making employees face contradictions between organizational culture and leadership style. However, in the clan culture, as shown by the results, transformational leadership had no moderation effect. This may be because the clan culture emphasizes cooperation and team spirit, making

transformational leadership ineffective in asserting an influence on employee innovative behavior. Moreover, the clan culture itself is a positive factor that helps to stimulate employees' innovation ability.

5) Through regression analysis, the moderation effect of traditionality on employee innovative behavior in different organizational cultures was also explored. The results showed that in hierarchy culture, employees' traditionality could accentuate the positive effect of organizational culture on organizational identification, that is, traditionality showed a moderation effect. This can be explained by that employees with stronger traditionality tend to accept and abide by the norms and hierarchical structure of the organization, thereby showing higher organizational identification. The results showed that in the clan culture, traditionality did not have such a moderation effect, which may be due to the clan culture's emphasis on the autonomy and innovation of employees. Employees with higher traditionality find it more difficult to adapt to such a cultural atmosphere, which will eventually negatively impact their organizational identification. These results have some implications for organization managers and leaders: in different organization cultures, different management strategies should be formulated according to employees' traditionality, so as to promote members' organizational identification and innovation ability.

In summary, according to the results of the empirical analysis, among the five hypotheses put forward in this thesis, one was not supported (H2), and the remaining four were supported. Through the regression analysis, the influence mechanism of organizational culture, employee innovative behavior, organizational identification, transformational leadership, and traditionality in organizations with hierarchy culture and clan cultural was revealed. The following chapter will provide a detailed and in-depth discussion of the results found in the empirical analysis.

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Chapter 5 : Discussion and Conclusions

China's national conditions determine that state-owned technology enterprises should undertake the national mission and assume the responsability in scientific and technological innovation. However, previous studies mainly focused on the institutional and policy aspects of Chinese state-owned enterprises' innovation capability, and very few studies addressed how organizational characteristics and leadership style affect the innovation of scientific and technological personnel in state-owned enterprises. As technology talents are the main actors of the enterprise's scientific and technological innovation, their innovative behavior is crucial to the survival and development of the organization. Therefore, how to mobilize technology talents' innovation enthusiasm and improve their innovation ability is one of the relevant topics that need to be studied in depth.

The purpose of this study is to explore the impact of organizational culture, organizational identification, transformational leadership, and traditionality on employee innovative behavior in state-owned technology enterprises. Based on a literature review of relevant studies, we put forward five hypotheses. Using the literature as a reference, this study selected the questionnaire survey as the empirical research method and collected 595 valid questionnaires for analysis.

5.1 Descriptive analysis of the sample

1) At the beginning of this thesis, the first research question we raised was: RQ1 "What are the dominant organizational culture types in China's state-owned technology enterprises?". From the descriptive statistics of 595 valid questionnaires, it was found that in state-owned technology enterprises, hierarchy culture and clan culture are more dominant than adhocracy culture and market culture, which is consistent with the proposed research hypothesis H1. The respondents who considered the culture of their organization a hierarchy culture had the highest number ($n = 293$), accounting for 49% of all respondents; those who considered it a clan culture accounted for 32% ($n = 193$). Therefore, responses of these two cultures totaled 81% of the total sample, significantly higher than that of the other two types of organizational culture. However, this finding is different from some previous studies. Tsui et al. (2006) found that Chinese state-owned enterprises did not show any single organizational culture; instead, the sample organization in their study showed a uniform distribution of four different

organizational cultures (their classification of organizational cultures is not the same as in this study). However, according to our study, the organizational culture of state-owned technology enterprises in China is clearly dominated by hierarchy and clan cultures. In addition, Tsui et al. (2006) considered enterprises' years of establishment an important factor in determining the type of organizational culture: younger enterprises tend to have younger employees, and their organizational culture tends to be more market-oriented. However, based on the ANOVA results of our study, the samples of different organizational culture types showed consistency for the other factors, including age, gender, and organizational tenure as there was no significant difference. That means in the sample of this study, these were not important factors in affecting employees' perception of organizational culture types in state-owned technology enterprises.

The different results between our study and previous studies may be due to the political influence specific to China's state-owned enterprises, as the culture of state-owned enterprises may indeed change with time, policy, market, and social environment. In fact, during its gradual formation and development, the culture of any organization will be affected by internal and external factors. There may be some "turbulence periods" during which enterprises attempt to adjust their culture to adapt to changes in the environment. China's state-owned enterprises, especially since China's reform and opening up, have undergone a series of reforms and changes, shifting from a planned economy to a market economy, from a state-owned monopoly to a hybrid ownership, which may bring about changes in enterprise culture. For example, early state-owned enterprises emphasized collectivism and stability; in the period of rapid opening-up and reform, state-owned enterprises tended to pay more attention to market competition and innovation; with the deepening of the reform of state-owned enterprises and the change in the political environment, the culture of state-owned enterprises has gradually regained its original characteristics, such as the emphasis on stability and order and the respect for authority and hierarchy. That may be related to the nature and mission of state-owned enterprises, as well as China's cultural and social environment.

Therefore, at present, China's state-owned enterprises mainly manifest a hierarchy culture valuing order and stability and a clan culture celebrating teamwork and shared values. According to the Competing Values Framework, these two cultures belong to the dimension of internal focus and integration, which reflects the common characteristics of state-owned technology enterprises that emphasize internal integration and control.

2) From the demographic statistics of the respondents, it was found that China's state-owned technology enterprises manifested the following characteristics: a) in terms of gender,

the employees were dominantly male, accounting for nearly 60%; b) the overall educational level and knowledge level were relatively high, with more than 50% holding a master's degree or above, and more than 50% having middle-level or senior technical titles. In addition, the employees' average age was 37, and the average organizational tenure was 9 years, showing a relatively stable workforce.

Descriptive statistics of the variables showed that the mean values of employee innovative behavior, organizational culture, organizational identification, and transformational leadership were all in the range of 4-5 points, reflecting employees' relatively positive perception of these factors, but there is still room for improvement (they reached the first level of positive evaluation but did not reach the second level). Moreover, the mean value of employees' traditionality was close to 4, and its variance was the highest among the five variables, indicating that the employees of state-owned technology enterprises still had a certain traditionality; but relatively speaking, they showed higher distribution differences, which is consistent with the general impression of state-owned technology enterprises in China.

5.2 ANOVA results

The results of analysis of variance (ANOVA) (see Table 4.5) showed that employees with different educational levels, working for different types of departments, having different job positions or different rankings showed significant differences in their perceived organizational culture, organizational identification, and traditionality.

For organizational culture, the mean score in the groups "doctor or above", "research" departments, and "research" positions was significantly higher than that in other groups of the same category. It shows that in general, scientific researchers with high educational level (doctor or above) tend to have a higher perception of organizational culture, which has two possible explanations: a) The organizational culture for highly educated researchers has already been effectively developed in state-owned research institutions, and researchers holding a doctoral degree, as the senior talents in the organization, tend to participate in more organizational tasks and are more likely to be exposed to the core culture of the organization (Borrego & Newswander, 2010). b) Highly educated researchers tend to have a greater ability to perceive organizational culture and thus, are more likely to be aware of the existing organizational culture and abide by it. As indicated by Louis (1980) and Chatman and O'Reilly (2016), when new employees enter the organization, their cultural background and education level may affect their interpretation and adaptation of organizational culture, and higher

education level may prompt employees to interpret and adapt to the new organizational culture faster. According to the ANOVA results of our study, in state-owned technology enterprises, the education level threshold is the doctoral degree.

For employee innovative behavior, the mean score in the groups "doctor or above", "senior" technical titles, "research" departments, and "research" positions was significantly higher than that in other groups of the same category. Overall, the results showed that highly educated researchers could form more innovative behaviors, which is consistent with common sense and previous studies (Shalley et al., 2004). Researchers with high educational levels and senior technical titles often have higher innovation literacy and innovation experience and thus, are more likely to generate innovative ideas and implement them. Another explanation is related to the hypothesis of this study that organizational culture can promote employee innovative behavior. Since the mean score of organizational culture was significantly higher among employees with high educational levels, their mean score of employee innovative behavior naturally was also higher. However, it is worth noting that the mean score of employee innovative behavior in the master's group was not significantly higher than that in the undergraduate or other groups. Since the training period for the doctoral degree is usually longer than that of the master's, doctoral candidates have more time to immerse themselves in academic research to generate and test their innovative ideas. In comparison, master's candidates may enter the job market sooner and have limited research time, making them less advantageous in innovation.

For organizational identification, the mean score in the groups "doctor or above", "senior" technical titles, "research" departments, and "research" positions was significantly higher than that in other groups of the same category (except for that the score of employees in research positions was not significantly higher than in other positions). Overall, it means that highly educated researchers tend to have a higher degree of organizational identification, which can be explained in two folds. The first is related to the hypothesis in this study that organizational culture can promote the formation of organizational identification. As the mean score of organizational culture was higher among highly educated employees, their mean score of organizational identification was naturally also higher. Second, compared with ordinary employees, highly educated researchers are more likely to be valued by state-owned technology enterprises and thus are given more benefits and resource support (Borrego & Newswander, 2010), making them more inclined to undertake the core work of the organization, thereby forming organizational identification.

For transformational leadership, the mean score in the groups "doctor or above", "senior" technical titles, "research" departments, and "research" positions was significantly higher than that in other groups of the same category. Overall, the results showed that highly educated researchers tend to have a higher perception of transformational leadership. That may be because the team of highly educated researchers usually works in a highly specialized, complex, and rapidly changing environment as they undertake the core task of scientific research, and therefore, the team usually needs a leadership style that can drive innovation, adaptability, and learning (Zacher et al., 2011). Hence, the leadership in their team tends to be less bureaucratic but more transformational and innovative than in other administrative or functional departments. Den Hartog et al. (1999) discussed the recognition of transformational and charismatic leadership in different cultures and organizational departments and showed that the research and technical departments might be more inclined to support transformational leadership.

For traditionality, the mean score in the groups "doctor or above", "senior" technical titles, "research" departments, and "research" positions was significantly higher than that in other groups of the same category.

The results of traditionality were similar, showing the overall trend that the mean score of highly educated research talents was significantly higher than that of other groups. In terms of educational level, the mean score of traditionality in the group "doctor or above" was significantly higher than that in the "master's" and "undergraduate" groups, but not significantly higher than that in the "college or below" group. In terms of technical titles, the mean score of the "senior" group was significantly higher than that of other groups. In terms of department type, the mean score of traditionality in "research" departments was significantly higher than that in "technical" and "administrative" departments, but not significantly higher than that in "other" departments. This may be due to two reasons: a) On the one hand, individuals with a doctorate degree usually have a wide range of employment options. However, as China's state-owned enterprises provide more job stability than private enterprises (Warner, 2000), they opt for working in state-owned enterprises to seek stability. b) On the other hand, it usually requires years of study and practical experience to obtain a doctoral degree or a senior technical title. Therefore, these personnel tend to be older than those who only have a bachelor's or master's degree. With the growth of age and the establishment of families and careers, people's attitudes and views tend to be stable and are more resistant to change. As Arnett (2000) pointed out, in early adulthood (about 20 to 30 years old), many people usually experience the exploration of values and beliefs; later, with more maturity and the establishment of families, this exploration may reduce, and people may become more stable and traditional.

According to the ANOVA results, for the five variables, namely, organizational culture, employee innovative behavior, organizational identification, transformational leadership, and traditionality, the mean score among highly educated (doctor or above) researchers was significantly higher than that in other groups. In addition, this thesis put forward hypotheses that higher organizational culture and traditionality are conducive to higher employee innovative behavior and organizational identification, and that transformational leadership can accentuate the effect of organizational culture on employee innovative behavior. As the mean scores of organizational culture, transformational leadership, and traditionality were significantly higher among highly educated talents than those in other groups, if the above-mentioned hypotheses are confirmed, these talents' average scores in employee innovative behavior and organizational identification should also be significantly higher than those of other groups. That means, the core scientific researchers of state-owned technology enterprises are currently in a relatively benign cycle. With respect to other groups, however, the mean score of organizational identification and employee innovative behavior in the master's group was not significantly higher than that in the undergraduate group, and the mean score of organizational identification and transformational leadership in the "technical" department group was not significantly higher than that in "administrative" or "other" departments. It shows that for master's holders and those working in technical departments, there is still room for improvement in their innovative behavior, especially given that they are also part of the main actors of innovation in state-owned enterprises.

5.3 Hypothesis testing results

5.3.1 Effect of organizational culture on employee innovative behavior

1) In state-owned technology enterprises, hierarchy culture and clan culture are more dominant than adhocracy culture and market culture. At the same time, regardless of the sample being dominated by hierarchy culture or clan culture, organizational culture had a significant positive effect on employee innovative behavior.

Among the 595 valid questionnaires, 49% of the respondents considered their organization's culture a hierarchy culture and 32% considered it as a clan culture, altogether accounting for 81% of the total sample. This shows that hierarchy culture and clan culture are more dominant than adhocracy culture and market culture, and thus Hypothesis 1 (H1) was confirmed. According to the Competing Values Framework (Cameron et al., 2010), the result

also means that China's state-owned technology enterprises have the characteristic of internal focus, which is related to the state-owned nature, government regulation, cultural values, and the emphasis on long-term stability (X.-P. Chen et al., 2014; Hofstede, 2001). These factors jointly shape the organizational culture of these enterprises, making them more inclined to the pursuit of internal management and internal goals. Therefore, internal focus is one of the common features of China's state-owned enterprises. As a type of state-owned enterprises, state-owned technology enterprises retain this characteristic to a large extent, and thus, their organizational culture may prefer the cultural type with internal focus, i.e., clan culture or hierarchy culture. In addition, this finding is a bit different from the results in Tsui et al. (2006), which found that Chinese state-owned enterprises did not clearly show a single organizational culture; instead, the sample enterprise in their study showed characteristics of all four kinds of organizational culture. In their study, organizational culture was classified as hierarchy culture, market oriented culture, moderately integrative culture, and highly integrative culture. However, the results of our study show that hierarchy culture and clan culture are more dominant than adhocracy culture and market culture in state-owned technology enterprises. That may be due to the change of times and the long-term evolution of these enterprises' culture, which eventually led to an internal-focused culture.

In terms of the effect outcome, hierarchy culture and clan culture both had a positive effect on employee innovative behavior. Hierarchy culture can promote the innovation ability of technology talents, probably because it emphasizes authority and norms, which facilitates conveying innovative ideas to employees and providing them with the support and resources needed for innovation (Axtell et al., 2000; Janssen, 2005; Oldham & Cummings, 1996). However, clan culture pays more attention to cooperation, communication, and sharing, which helps to improve employees' innovation ability and quality. It also values attachment, affiliation, membership, and support (Cameron & Quinn, 2001; Hartnell et al., 2011). In such a culture, employees may be more willing to share information and knowledge as they think they are part of a team and believe that sharing can help the whole team (Jaskyte, 2011). Information sharing is an important source of innovation because new ideas often come from new understanding and new combinations of existing information. Leaders of clan culture usually play the role of teachers or mentors, which enables employees to acquire new knowledge and skills, thus further promoting innovation. In addition, in the clan culture, employees tend to feel more secure and are more willing to try new ideas, even if they may fail (Sarros et al., 2008).

2) The regression analysis results showed that hierarchy culture and clan culture both had a positive effect on employee innovative behavior, but no statistically significant difference was detected.

This finding can also be further explained using the Competing Values Framework. Both hierarchy culture and clan culture are internally focused. Internally focused culture usually is related to these two cultures. It emphasizes internal harmony and stability within the organization and pays attention to internal processes and employees' welfare, which helps to reduce employees' psychological pressure and create an atmosphere supporting them to innovate. The difference between the two cultures lies in the organizational structure: hierarchy culture emphasizes the control of the organization, while the clan culture values organizational flexibility. With a flexible organizational structure, employees usually have greater freedom to try new ideas and methods without being bound by strict regulations and penalties, and such experimental and exploratory behavior is an essential driving force of innovation. Moreover, a flexible organizational structure facilitates cross-departmental and cross-functional cooperation, which is conducive to integrating interdisciplinary and cross-sectoral knowledge and skills to create new products or solutions.

At the same time, however, the results of this study also showed that the positive effect of hierarchy culture (which emphasizes organizational control) on employee innovative behavior was not significantly weaker than the effect of clan culture (which emphasizes organizational flexibility). This may be because, in the context of China's state-owned enterprises, innovation is mostly carried out "top-down", thus giving play to the advantages of the hierarchy culture. Hierarchy culture usually has a clear organizational structure and role definition, which helps employees to clearly understand their duties and responsibilities (Oldham & Cummings, 1996), thus enabling them to better coordinate and cooperate to achieve innovation goals. Employees know where to seek support and resources, which reduces the uncertainty in the innovation process. In addition, state-owned enterprises with a hierarchy culture usually pursue long-term stability and sustainability, which can provide a favorable environment for innovation as it enables organizations to invest in R&D and innovation activities in the long term without worrying about short-term risks and instability. In addition, state-owned enterprises usually have more resources, which can be used to support innovation projects. Moreover, hierarchy culture is usually inclined to establish institutionalized processes and procedures, which can also be used to promote innovation. They include the R&D process, project management, and decision-making process, which can ensure that innovation activities are properly managed and

monitored, so as to improve the efficiency and quality of innovation. At the same time, while the hierarchy culture emphasizes control, it is conducive to better risk management, which is one of the key components of the innovation process because innovation may be accompanied by uncertainty and investment risk. By emphasizing control and regulations, a hierarchy culture can help organizations better manage and mitigate these risks, thus encouraging employees to carry out innovation in a more controllable manner. Therefore, while some previous studies highlighted the hindering effect of hierarchy culture on innovation (Jansen et al., 2006; Sitkin & Pablo, 1992), we have found that in the Chinese context, "top-down" innovation may enable the hierarchy culture to give play to its promoting role in innovation.

In a word, the internally-focused hierarchy culture and clan culture both can positively impact employee innovative behavior. Whether the culture emphasizes organizational flexibility or organizational control, it has a positive effect on employee innovative behavior. This can provide managers of China's state-owned technology enterprises with inspirations in management ideas and methods so as to improve the enterprises' innovation ability and competitiveness.

5.3.2 Mediation effect of organizational identification

This study also explored the mediating role of organizational identification between organizational culture and employee innovative behavior. Through regression analysis, it was found that organizational identification had a partial mediation effect between organizational culture and employee innovative behavior in hierarchy and clan cultures. It shows that the extent to which members identify with organizational culture is an important factor in explaining the impact of organizational culture on employee innovative behavior. This finding revealed an important mechanism: in hierarchy and clan cultures, organizational identification may act as a catalyst fostering the establishment of a connection between organizational culture and employee innovative behavior. This may be because employees' strong identification with their organization makes them more willing to accept and follow the organization's culture, which will further affect their behavior, including innovative behavior. Therefore, regardless of the type of organizational culture, it is imperative to pay attention to and improve employees' organizational identification. Only when employees recognize and identify with their organization, can they actively participate in innovation activities. Besides, it also means that for organizations, in addition to selecting and creating appropriate organizational culture, it is equally important to consider how to enhance employees' organizational identification so as to realize culture's positive effect.

In addition, the effect size of organizational identification's mediation was about 24.721% in hierarchy culture and about 24.466% in clan culture, which were very close. It shows that the mediation effect of organizational identification had almost the same strength in hierarchy and clan cultures, which may imply that the mechanism of organizational identification influencing the effect of organizational culture on employee innovative behavior is similar in different organizational cultures. In other words, the mechanism of organizational identification's influence on organizational culture is not much related to the culture type. From the perspective of the Competing Values Framework, both hierarchy culture and clan culture are internally focused. Therefore, the internal focus feature may be one of the essential factors affecting organizational identification, while the different organizational structures of the two cultures have less influence. Moreover, in the context of China's state-owned organizations, the results of our study did not show that high organizational identification might hinder innovation, inconsistent with the findings of some previous studies (Bouchikhi & Kimberly, 2003; Pierce & Aguinis, 2013; Tangirala & Ramanujam, 2008). This may also be explained by the "top-down" innovation pattern in China's state-owned enterprises, which helps to prevent such negative effects.

5.3.3 Moderation effect of transformational leadership

In this study, the moderation effect of transformational leadership on employee innovative behavior was also explored in different types of organizational culture. It was found that in hierarchy culture, transformational leadership could accenntuate the positive effect of organizational culture on employee innovative behavior.

First, that may be because transformational leadership pays more attention to encouraging employees' innovation and change. Transformational leadership exerts a direct influence on the organizational culture and individual employees (Radi Afsouran et al., 2022; Tucker & Russell, 2004), thereby stimulating employees' enthusiasm and creativity, prompting them to overlook their individual interests so as to achieve the goals of the organization. Transformational leaders encourage employees to actively put forward innovative ideas and support them to persist in innovation in the face of difficulties. This can help to mitigate the hindering effect of hierarchy culture on innovative thinking and motivate employees to perform innovative behavior (Bass, 1999; Gumusluoglu & Ilsev, 2009).

Second, transformational leadership can support employees' innovation through management mechanisms. Transformational leaders encourage the sharing of information and

resources across departments/functions, which helps to tackle the problem of information islands and difficulty in resource sharing caused by hierarchy culture, creating favorable conditions for employee innovative behavior (Bass & Avolio, 1994b).

Third, transformational leaders pay attention to the development of individual employees, which helps to stimulate their innovation motivation and mitigate the possible hindering effect of excessive control on innovative behavior in a hierarchy culture.

Fourth, transformational leaders understand that failures may occur in the process of innovation and encourage employees to try and take risks, which can enhance employees' willingness to innovate in the hierarchy culture, reduce their fear of the negative consequences brought by risks and failures, and improve their psychological security (Detert & Burris, 2007; Edmondson, 1999). In such an environment, employees are more willing to put forward new ideas and try new methods in the hierarchy culture.

It is worth noting that the above-mentioned positive effects of transformational leadership are similar to the advantages of a clan culture's flexible organizational structure (according to the Competing Values Framework). However, in the clan culture, transformational leadership did not show a moderation effect. This may be because the clan culture emphasizes cooperation and team spirit, and employees are more likely to accept and adapt to the style of transformational leadership. In this case, the leadership style does not impose any additional impact on employee innovative behavior. Besides, the clan culture itself is a positive factor that can stimulate the innovation ability of employees.

This finding can also be further explained based on the Competing Values Framework. Clan culture emphasizes organizational flexibility, while hierarchy culture emphasizes organizational control. According to the findings presented earlier, among different organizational cultures, the control-oriented organizational structure may not be as effective as the flexible organizational structure in promoting innovation. However, the introduction of transformational leadership, in essence, will change the Structure and Means-Ends of the hierarchy culture. In terms of organizational structure, it will reduce its control and increase its flexibility, thereby improving the organization's innovation ability. In addition, under transformational leadership, employees usually have greater freedom to try new ideas and methods without worrying about strict regulations and penalties, and such experimental and exploratory behavior is a critical driving force for innovation. Moreover, a flexible organizational structure facilitates cross-departmental and cross-functional cooperation, which is conducive to combining knowledge and skills in different fields to create new products or solutions. Furthermore, leaders in a clan culture usually play the role of teachers or mentors

(X.-P. Chen et al., 2014), which enables employees to acquire new knowledge and skills, thus further promoting innovation; transformational leaders also show such a feature. That means, the intervention of transformational leadership may further enhance the positive effect of organizational culture on employee innovative behavior by shifting the organizational culture from a hierarchy culture toward a clan culture.

5.3.4 Moderation effect of traditionality

This study explored the moderation effect of employees' traditionality on the relationship between organizational culture and organizational identification in different types of organizational culture. As stated in the foregoing research findings on organizational identification, the extent to which employees identify with their organization explains, to some extent, why organizational culture can affect employee innovative behavior and largely explains why a specific organizational culture can affect employee innovative behavior. The regression analysis results of traditionality showed that in hierarchy culture, employees' traditionality could accentuate the positive effect of organizational culture on organizational identification, that is, traditionality had a moderation effect. Hierarchy culture, as an organizational culture that emphasizes rules, procedures, and structures (Fiordelisi & Ricci, 2014), is compatible with the traditionality of employees. This type of organizational culture advocates achieving organizational goals through rules and regulations and a clear division of responsibilities, which is very consistent with employees' traditionality (e.g., respecting authority, abiding by rules, and being conservative and prudent). For example, Song (2022) found that when employees have a high level of traditionality, they may be more inclined to accept and follow the norms and values in the organizational culture. Therefore, in a hierarchy culture, employees' traditionality may enhance the positive effect of organizational culture on organizational identification. The traditionality may make them more willing to accept and adapt to the hierarchy culture, thus enhancing their identification with the organization.

However, in the clan culture, traditionality did not show such a moderation effect. Based on the Competing Values Framework, traditionality is more compatible with hierarchy culture's feature of organizational control, while being contrary to the organizational flexibility that clan culture emphasizes. This may be able to explain why in a hierarchy culture, employees' traditionality could accentuate the positive effect of organizational culture on organizational identification, but there was no such a moderation effect in a clan culture.

The theoretical analysis shows that employees' personal characteristics, such as traditionality, may play different roles in different types of organizational culture. This further highlights the necessity to consider the compatibility between organizational culture and employees' personal characteristics in organizational culture research and management. Compatible personal characteristics can support and further strengthen the organizational culture; however, inappropriate personal characteristics may weaken or even resolve the influence of organizational culture.

5.4 Managerial implications and contributions

5.4.1 Managerial implications

1) In the context of China's state-owned technology enterprises, organizational culture remains an important factor in promoting employee innovative behavior. Through the empirical analysis, we can see that both hierarchy culture and clan culture can effectively promote employee innovation. In previous studies, it was believed that a hierarchy culture would limit employees' innovation and autonomy; however, in some cases, it can indeed foster innovation. For example, some state-owned technology enterprises have strong R&D teams and technical experts. It is necessary to join their efforts for efficient collaboration so as to transform innovation into actual products. In this case, the hierarchy culture can provide a clear division of responsibilities, a clear management structure, and an efficient decision-making mechanism, which can help the R&D team better achieve innovation goals. In addition, in a complex environment with various policies, regulations, and government supervision, state-owned technology enterprises need to carry out strict control and management of risks. Hierarchy culture enables a clear definition of rules, regulations, and standards to ensure the stability and safety of enterprise operation, which, at the same time, can help to protect enterprises' innovation achievements and intellectual property rights. In short, the organizational culture of state-owned technology enterprises should be customized according to their industry and market environment, combining the advantages of hierarchy and clan cultures to foster innovation and improve competitiveness.

However, China's state-owned technology enterprises show some weaknesses in the construction of the organizational culture (X. Wang & Yang, 2007; Xin et al., 2002): a) Insufficient understanding of organizational culture. The leaders and employees of some state-owned technology enterprises are not aware of the importance of organizational culture and believe that organizational culture has nothing to do with daily business. This leads to the

neglect of organizational culture development in enterprises. b) No systematic construction of organizational culture. In some state-owned technology enterprises, the construction of organizational culture lacks systematic planning and implementation. Cultural values and concepts are not incorporated throughout the enterprise, resulting in a non-comprehensive cultural construction. c) Rigid management mode. The management of some state-owned technology enterprises is too conservative and rigid to meet the needs of the market economy. This constraints the innovation and development of organizational culture, leading to slow progress in the construction of organizational culture. d) Low employee participation. The construction of organizational culture requires the participation of all employees, but in some state-owned technology enterprises, employees do not actively participate in culture construction activities, making the development of organizational culture lag behind. e) Insufficient integration of organizational culture with internationalization. With the advancement of globalization, state-owned technology enterprises need to better integrate into the international market. However, some state-owned technology enterprises lack international vision and are lagging behind in the construction of organizational culture. Therefore, in order to improve their competitiveness and innovation ability, state-owned technology enterprises need to strengthen organizational culture construction and improve employees' organizational identification and participation, so as to meet the needs of the market economy.

2) As the leader of reform and transformation, transformational leadership can further strengthen the positive effect of organizational culture on employee innovative behavior. Therefore, organizations need to pay attention to the interactive relationship between leadership style and organizational culture. For state-owned technology enterprises dominated by a hierarchy culture, transformational leadership can promote technology talents' innovative behavior. This is similar to the finding in S. Zhang et al. (2021) on authoritarian leadership promoting employee innovative behavior. They found that in Chinese organizational culture, authoritarian leadership had a positive effect on employee innovative behavior within a certain range, although this is counterintuitive. In addition, perceived insider status had a high explanatory power on employee innovative behavior and could mediate the relationship between authoritarian leadership and employee innovative behavior. Moreover, a proactive personality could also moderate the positive influence of authoritarian leadership on perceived insider status. Similar to authoritarian leadership, transformational leadership also tends to have a higher perceived insider status and a stronger proactive personality. At the same time, leadership style can change and maintain organizational culture by shaping and transmitting

organizational beliefs, values, and norms. In addition, transformational leadership also has an interactive relationship and organizational culture.

Hence, organization managers should be aware of the relationship between leadership style and organizational culture and actively guide and shape this interaction, so as to promote employee innovative behavior. Furthermore, change and reform, as well as confrontation and symbiosis with authoritarianism and hierarchy culture, have long been a unique phenomenon in China. On the one hand, China's state-owned enterprises have always been more hierarchical and authoritarian; on the other hand, state-owned enterprises are also closely linked with reform and transformation. Since China's reform and opening up, state-owned enterprises have been a critical component of China's economic system. In order to adapt to the development of the market economy and the trend of globalization, state-owned enterprises must carry out reform and transformation to improve their competitiveness and efficiency. Within the Chinese system, the reform of state-owned enterprises requires continuous efforts. With the development of China's economy and changes in the international environment, state-owned enterprises need to constantly carry out reform and transformation to adapt to new challenges and opportunities (Leutert, 2016; Lou, 2022).

Since the reform and opening-up in 1978, China has carried out a series of reform measures for state-owned enterprises, such as introducing market mechanisms, improving enterprise management, and mixed ownership reform, to enhance these enterprises' competitiveness and efficiency. In order to adapt to the market economy and globalization, state-owned enterprises need to carry out reform and transformation so as to break the monopoly and improve competitiveness. The measures include reducing excess capacity, optimizing resource allocation, and lowering market access barriers (Naughton, 1995). Through mixed ownership reform, state-owned enterprises have introduced private capital and foreign capital, optimized the corporate governance structure, and improved their competitiveness. The mixed ownership reform enables state-owned enterprises to use the market mechanism to allocate resources more effectively (Lardy, 2019). Through a series of reforms, such as the implementation of a modern enterprise system and the improvement of management structure and incentive mechanism, the efficiency and profitability of China's state-owned enterprises have been continuously improving (K. J. Lin et al., 2020; Ding, 2021). With the advancement of globalization, state-owned enterprises continue to reform to adapt to the international market, by strengthening international cooperation, actively participating in the global value chain, and improving the international competitiveness of their products and services.

However, in promoting reform, transformational leaders may encounter conflicts with the existing organizational culture. For example, the existing organizational culture may resist change because employees are used to the existing working mode and environment and worry about the uncertainty and loss of comfort zone caused by the change. The concept and values of transformational leadership may not be compatible with the existing organizational culture, which may result in employees' questioning and dissatisfaction with the leader's decisions. Therefore, transformational leaders need to strengthen their communication with employees and explain the necessity, objectives, and expected effects of the change. They should encourage employees to participate in the change and reform, turn them into the promoters and beneficiaries of the change, and enhance their identification with and enthusiasm for change.

In addition, the decisions and actions of transformational leaders may have an impact on the existing power structure and cause resistance within the organization; resources may need to be reallocated in the process of change, which may lead to dissatisfaction among some employees with resource allocation. Therefore, transformational leaders need to establish trust relationships with other management and key stakeholders and seek cooperation and support. They should show sincerity and transparency, enabling them to understand the purpose and vision of the change to work together to achieve organizational goals. Hence, transformational leadership should respect the existing organizational culture and on this basis, introduce new values and concepts. They must work with employees to co-build a new organizational culture that not only meets the long-term development of the organization, but also the needs and expectations of employees. Resource allocation should be fair and transparent, ensuring that the interests of all departments/functions and employees are protected.

Innovation management should be customized according to the specific organizational cultural background. We hold that in Chinese organizational culture, the relationship between authoritarian leadership and employee innovative behavior may be different from that in the West. This study has constructed a unique research model and put forward new insights on when and how employee innovative behavior is affected by authoritarian leadership.

Therefore, how to cultivate leaders who can effectively carry out change and reform in the Chinese context is one of the key areas that state-owned enterprises need to focus on in the future. When selecting and promoting leaders, state-owned enterprises should consider their transformational leadership. The selection criteria can include factors such as strategic thinking, innovation consciousness, and change-driving ability. In addition, enterprises should establish an effective promotion mechanism to incentivize employees with transformational leadership.

Besides, in order to stimulate the potential of transformational leadership, state-owned enterprises should establish appropriate incentive mechanisms, such as compensation, promotion, and recognition, which will help to stimulate leaders' enthusiasm and innovative spirit. Enterprises can also set up project teams, special task forces, and other forms of groups to empower potential transformational leaders to participate in critical organizational change and decision-making processes. Through practical cases, they can accumulate experience and improve their ability. Enterprises can also carry out talent exchanges with other enterprises, industries, or international organizations, providing potential transformational leaders with the opportunity to learn about different cultures and management models. This will help expand their horizons and improve their transformational leadership.

3) Traditionality is usually considered as one of the factors hindering innovation because it emphasizes inheritance and conservation, rather than creation and innovation. However, this study found that traditionality could promote employee innovative behavior by strengthening organizational identification.

This study selected the dimension of "obedience to authority" in the Chinese Traditionality Scale (CTS) developed by K.-S. Yang et al. (1991) to measure the traditionality of employees. The CTS scale was specially designed to measure traditionality in the context of Chinese culture. It has high cultural sensitivity and is highly applicable to Chinese people. It can fully reflect the core values of Chinese traditional culture, thus enabling a comprehensive evaluation of individuals' traditionality in different aspects. This study found that in different types of organizational culture, employees' traditionality had different moderation effects on employee innovative behavior. In hierarchy culture, employees' traditionality could accentuate the positive impact of organizational culture on organizational identification, that is, traditionality had a moderation effect. This demonstrates that traditional culture is the spiritual tie of the Chinese nation and thus has a significant impact on employees' values and behavior. By respecting and carrying forward the traditional culture, such as filial piety, loyalty, unity, and cooperation, enterprises can enhance employees' identification with the enterprise (C.-C. Chen & Lee, 2008) Similarly, interpersonal relationships and the "face" culture also play an important role in organizations; by maintaining employees' "face" and paying attention to their interpersonal relationships, enterprises can improve their organizational identification (Hwang, 1987). Harmony and stability are also among the core values of Chinese traditional culture; enterprises can improve employees' organizational identification by creating a harmonious and stable working environment (Bond, 2010). Moreover, authority and leadership also play an important role in Chinese organizations; establishing authoritarian leadership and improving

leaders' prestige and trust are conducive to enhancing the organizational identification of employees (X.-P. Chen et al., 2012). Therefore, individuals with strong traditionality tend to identify with organizations with a clear hierarchical structure and standardized workflow, which are conducive to employees' understanding of the organization's goals and values and compliance with the rules and standards.

In general, it is interesting to note that in Chinese state-owned technology enterprises, especially in hierarchy-type organizations, various seemingly contradictory features can bring synergies and jointly produce positive effects. For example, Chinese hierarchy culture is often considered conservative but can promote "top-down" innovation; employees with higher traditionality are more likely to identify with the organizational culture, which, to a certain extent, can drive employees' innovation since organizational identification is the mediator between organizational culture and employee innovative behavior; hierarchy-type state-owned SOEs tend to be stable and lag behind change, but transformational leadership may leverage the strengths of hierarchy culture to give play to its moderating role in driving change, thus influencing organizational innovation. As can be seen, when multiple seemingly contradictory things converge, the mechanism of action is instead favorable.

5.4.2 Contributions

The main contributions of this study are as follows:

1) It determined the current dominant culture of China's state-owned enterprises. Currently, China's state-owned enterprises mainly show a hierarchy culture characterized by order and stability and a clan culture valuing teamwork and shared values. Early state-owned enterprises might have put more emphasis on collectivism and stability; during China's rapid opening-up and reform, state-owned enterprises might have paid more attention to market competition and innovation. However, with the deepening of the reform and the change of the political environment, the culture of state-owned enterprises started showing earlier characteristics, such as the emphasis on stability and order and the respect for authority and hierarchy. This may be related to the nature and mission of state-owned enterprises, as well as China's cultural and social environment.

2) It explored the impact of different types of organizational culture on employee innovative behavior. Previous studies have shown that organizational culture has a positive effect on employee innovation. This study further expanded the research by exploring organizational

culture's impact on employee innovative behavior in hierarchy and clan cultures, which can help provide more targeted suggestions for organizations.

3) Transformational leadership as a moderating variable. Taking transformational leadership as a moderator, this study explored how it enhances/weakens the impact of different types of organizational culture on employee innovative behavior. It helps to reveal the role of transformational leadership in promoting innovation in hierarchy culture, thus enriching the research on the relationship between leadership style and innovative behavior. For state-owned enterprises, there are some contradictions between transformational leadership and the typical organizational culture of these enterprises. To begin with, state-owned enterprises are usually conservative, bureaucratic, and standardized. Transformational leadership pays more attention to employees' autonomy and innovation, contradicting the characteristics of the organizational culture. In this case, transformational leadership will drive the transformation of the organizational culture from a hierarchy culture to a clan culture, so as to enhance employee innovative behavior.

4) Organizational identification as a mediating variable. This study included organizational identification in the analysis and discusses its mediating role between organizational culture and employee innovative behavior, which helps to reveal how organizational culture further affects innovative behavior by influencing employees' organizational identification, thus providing a new perspective for understanding the internal relationship between organizational culture and employee innovation.

5) It considered the influence of employees' traditionality in the relationship between organizational culture and organizational identification. This study also considered employee traditionality as a moderating variable and explored its effect on the relationship between organizational culture and organizational identification. By doing this, we revealed the role of personal cultural values in the relationship between organizational culture and organizational identification, providing new insights into how employees' traits affect the relationship between organizational culture and innovative behavior.

In summary, based on the Competing Values Framework, this study constructed a more comprehensive and detailed theoretical framework by considering multiple variables (e.g., hierarchy culture, transformational leadership, organizational identification, and employees' traditionality), so as to reveal the complex relationship between organizational culture, organizational identification, transformational leadership, and employee innovative behavior. This study not only expanded research on related topics but also provided targeted suggestions

on how organizational characteristics and leadership behavior affect scientific and technological personnel in the context of Chinese state-owned enterprises.

5.5 Limitations and future prospects

Although this study has its significance in exploring the impact of organizational culture, organizational identification, transformational leadership, and traditionality on employee innovative behavior in state-owned technology enterprises, it is not without limitations. Future research is needed to further explore these topics to gain a better understanding of the influence mechanism of various factors on employees' innovative behavior.

1) The research methods used in this study only include literature research and a questionnaire survey, which helped to reveal the relationship of organizational culture, organizational identification, transformational leadership, and traditionality with employee innovative behavior through statistics. However, to investigate a more in-depth influence mechanism, other research methods, such as case studies and in-depth interviews, are needed to obtain more empirical data.

2) This study only discussed the impact of organizational culture, organizational identification, transformational leadership, and traditionality on innovation from the perspective of employees. Other factors, such as organizational structure, system, and environment, which may also have a significant impact on employee innovative behavior, were not considered. Therefore, future research is needed to to consider more factors in order to comprehensively understand the influence mechanism of organizational innovative behavior.

3) Another limitation is the sample size. Due to the limited sample size, this study focused on analyzing and comparing the samples of hierarchy culture and clan culture, while the characteristics of other organizational cultures were not fully studied. This may lead to the incompleteness and limitations of the research conclusion, because different types of organizational culture may have different effects on employee innovative behavior. Therefore, future research is needed to explore the effect of other types of organizational culture on employee innovative behavior. In addition, the sample size can be increased to improve the reliability and generalizability of the results.

4) Through a questionnaire survey, this study collected a large number of empirical data for analysis, but it did not carry out in-depth statistical analysis and data mining. Future research can use more advanced data analysis techniques, such as structural equation modeling and

cluster analysis, to better analyze and interpret the data and further explore the impact of organizational culture, organizational identification, transformational leadership, and traditionality on employee innovative behavior.

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Annex A: Variable Measurement Scales

Table A.1 Organizational culture scale

Item	What is your opinion on the following description of your organization?
A1	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.
A2	The organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.
A3	The organization is very results-oriented. A major concern is with getting the job done. People are very competitive and achievement-oriented.
A4	The organization is a very controlled and structured place. Formal procedures generally govern what people do.
A5	The management style in the organization is characterized by teamwork, consensus, and participation.
A6	The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.
A7	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.
A8	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.
A9	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.
A10	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.
A11	The glue that holds the organization together is the emphasis on achievement and goal accomplishment.
A12	The glue that holds the organization together is formal rules and policies. Maintaining a smoothrunning organization is important.
A13	The organization emphasizes human development. High trust, openness, and participation persist.
A14	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.
A15	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.
A16	The organization emphasizes permanence and stability. Efficiency, control, and smooth operations are important.
A17	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.
A18	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.
A19	The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.
A20	The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling, and low-cost production are critical.

Table A.2 Employee innovative behavior scale

Item	What is your opinion on the following description of you at work?
B1	I am able to suggest new ways to achieve goals or objectives.
B2	I often have a fresh approach to problems.
B3	I am willing to search out new technologies, processes, techniques, and/or product ideas.
B4	I often have new and innovative ideas.
B5	I am a good source of creative ideas.
B6	I am not afraid to take risks.
B7	I develop adequate plans for the implementation of new ideas.
B8	I am willing to exhibit creativity on the job when given the opportunity to.
B9	I develop adequate plans and schedules for the implementation of new ideas.
B10	I can come up with creative solutions to problems.
B11	I am able to suggest new ways of performing work tasks.
B12	I can come up with new and practical ideas to improve performance.
B13	I am able to suggest new ways to increase quality.

Table A.3 Organizational identification scale

Item	What is your opinion on the following statements regarding your organization?
E1	When someone compliments my organization, it feels like a personal compliment.
E2	I am very interested in what others think of my organization.
E3	It feels like a personal insult when someone criticizes my organization.
E4	When I talk about my organization, I usually say "we" rather than "them".
E5	The success of my organization is my success.
E6	I would feel embarrassed if media coverage criticized my organization.

Table A.4 Transformational leadership scale

Item	What is your opinion on the following statements about your direct supervisor?
C1	He/she is honest and is serving the public instead of seeking personal benefits.
C2	He/she prioritizes work over personal enjoyment.
C3	He/she does not spare efforts at work and does not care about personal gains and losses.
C4	He/she can sacrifice personal interests for the benefit of the department/unit.
C5	He/she can put personal interests behind the interests of the collective and others.
C6	He/she can make employees understand the development prospects of the unit/department.
C7	He/she can make employees understand the unit's business philosophy and development goals.
C8	He/she explains to employees the long-term significance of their work.
C9	He/she describes a promising future to others.
C10	When dealing with employees, he/she considers their personal conditions.
C11	He/she is willing to help employees solve life- and family-related problems.
C12	He/she frequently communicates with employees to understand their work, life, and family situation.
C13	He/she patiently mentors employees and answers their questions.
C14	He/she possesses excellent professional ability.
C15	He/she is open-minded and has a strong sense of innovation.
C16	He/she loves his/her job and has strong ambition and enterprising spirit.
C17	He/she is committed to work and maintains high enthusiasm.

Table A.5 Traditionality scale

Item	What is your opinion on the following statements?
D1	The leader of an organization is like the parent of a family, and employees should obey all his/her decisions on organizational issues.
D2	Children should respect those whom their parents respect.
D3	Respect for authority and elders are virtues that one must possess.

D4	Strong leadership is more important than a sound legal system.
D5	The best way to avoid making mistakes is to follow the instructions of the elders.
D6	When a dispute arises, decisions should be made by the person with the most seniority.

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Annex B: Post-hoc Multiple Comparisons

Table B.1 Post-hoc multiple comparisons

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
Educational level	Organizational culture	College or below	Underguaduate	4.66	4.78	-0.11	0.6	-0.16
		College or below	Master	4.66	4.95	-0.29	0.18	-0.42
		College or below	Doctor or above	4.66	5.48	-0.82	0.00***	-1.2
		Underguaduate	Master	4.78	4.95	-0.17	0.01***	-0.26
		Underguaduate	Doctor or above	4.78	5.48	-0.71	0.00***	-1.04
		Master	Doctor or above	4.95	5.48	-0.53	0.00***	-0.78
	Employee innovative behavior	College or below	Underguaduate	4.94	4.62	0.33	0.13	0.47
		College or below	Master	4.94	4.81	0.13	0.54	0.19
		College or below	Doctor or above	4.94	5.43	-0.48	0.03**	-0.69
		Underguaduate	Master	4.62	4.81	-0.19	0.00***	-0.28
		Underguaduate	Doctor or above	4.62	5.43	-0.81	0.00***	-1.16
		Master	Doctor or above	4.81	5.43	-0.62	0.00***	-0.88
	Organizational identification	College or below	Underguaduate	4.42	4.36	0.06	0.82	0.07
		College or below	Master	4.42	4.48	-0.06	0.8	-0.08
		College or below	Doctor or above	4.42	5.3	-0.88	0.00***	-1.08
		Underguaduate	Master	4.36	4.48	-0.12	0.11	-0.15
		Underguaduate	Doctor or above	4.36	5.3	-0.94	0.00***	-1.15
		Master	Doctor or above	4.48	5.3	-0.82	0.00***	-1.01
	Transformational leadership	College or below	Underguaduate	4.49	4.81	-0.33	0.13	-0.46
		College or below	Master	4.49	4.98	-0.5	0.02**	-0.7
		College or below	Doctor or above	4.49	5.45	-0.96	0.00***	-1.36
		Underguaduate	Master	4.81	4.98	-0.17	0.01***	-0.24
		Underguaduate	Doctor or above	4.81	5.45	-0.63	0.00***	-0.9
		Master	Doctor or above	4.98	5.45	-0.46	0.00***	-0.66
	Traditionality	College or below	Underguaduate	4.29	3.97	0.32	0.29	0.33
		College or below	Master	4.29	3.85	0.44	0.15	0.45

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
		College or below	Doctor or above	4.29	4.64	-0.35	0.26	-0.36
		Underguaduate	Master	3.97	3.85	0.12	0.19	0.12
		Underguaduate	Doctor or above	3.97	4.64	-0.67	0.00***	-0.68
		Master	Doctor or above	3.85	4.64	-0.79	0.00***	-0.8
Technical title	Organizational culture	Junior	Middle-level	4.95	4.99	-0.05	0.53	-0.06
		Junior	Senior	4.95	5	-0.05	0.52	-0.08
		Junior	Others	4.95	4.84	0.11	0.28	0.15
		Middle-level	Senior	4.99	5	-0.01	0.92	-0.01
		Middle-level	Others	4.99	4.84	0.15	0.11	0.21
		Senior	Others	5	4.84	0.16	0.12	0.22
	Employee innovative behavior	Junior	Middle-level	4.71	4.92	-0.22	0.00***	-0.3
		Junior	Senior	4.71	5.18	-0.47	0.00***	-0.66
		Junior	Others	4.71	4.38	0.33	0.00***	0.46
		Middle-level	Senior	4.92	5.18	-0.25	0.00***	-0.36
		Middle-level	Others	4.92	4.38	0.55	0.00***	0.76
		Senior	Others	5.18	4.38	0.8	0.00***	1.12
	Organizational identification	Junior	Middle-level	4.29	4.68	-0.39	0.00***	-0.46
		Junior	Senior	4.29	4.9	-0.61	0.00***	-0.72
		Junior	Others	4.29	4.38	-0.08	0.46	-0.1
		Middle-level	Senior	4.68	4.9	-0.22	0.02**	-0.26
		Middle-level	Others	4.68	4.38	0.31	0.01***	0.36
		Senior	Others	4.9	4.38	0.53	0.00***	0.62
	Transformational leadership	Junior	Middle-level	4.9	5.03	-0.13	0.08*	-0.18
		Junior	Senior	4.9	5.26	-0.36	0.00***	-0.5
		Junior	Others	4.9	4.6	0.3	0.00***	0.42
		Middle-level	Senior	5.03	5.26	-0.23	0.01***	-0.32
		Middle-level	Others	5.03	4.6	0.43	0.00***	0.6
		Senior	Others	5.26	4.6	0.66	0.00***	0.92
	Traditionality	Junior	Middle-level	3.81	4.07	-0.26	0.01**	-0.26
		Junior	Senior	3.81	4.4	-0.59	0.00***	-0.59
		Junior	Others	3.81	3.95	-0.14	0.3	-0.14
		Middle-level	Senior	4.07	4.4	-0.33	0.00***	-0.33
		Middle-level	Others	4.07	3.95	0.12	0.36	0.12
		Senior	Others	4.4	3.95	0.45	0.00***	0.45

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
Department	Organizational culture	Research	Technical	5.16	4.89	0.27	0.00***	0.38
		Research	Administrative	5.16	4.75	0.4	0.00***	0.57
		Research	Others	5.16	4.57	0.59	0.00***	0.84
		Technical	Administrative	4.89	4.75	0.14	0.09*	0.19
		Technical	Others	4.89	4.57	0.32	0.03**	0.46
		Administrative	Others	4.75	4.57	0.19	0.22	0.27
	Employee innovative behavior	Research	Technical	5.07	4.77	0.29	0.00***	0.41
		Research	Administrative	5.07	4.58	0.49	0.00***	0.68
		Research	Others	5.07	4.28	0.79	0.00***	1.09
		Technical	Administrative	4.77	4.58	0.19	0.02**	0.27
		Technical	Others	4.77	4.28	0.49	0.00***	0.68
		Administrative	Others	4.58	4.28	0.3	0.06*	0.41
	Organizational identification	Research	Technical	4.81	4.43	0.38	0.00***	0.44
		Research	Administrative	4.81	4.34	0.47	0.00***	0.55
		Research	Others	4.81	4.34	0.47	0.01***	0.54
		Technical	Administrative	4.43	4.34	0.1	0.32	0.11
		Technical	Others	4.43	4.34	0.09	0.62	0.11
		Administrative	Others	4.34	4.34	-0.01	0.97	-0.01
	Transformational leadership	Research	Technical	5.19	4.92	0.27	0.00***	0.38
		Research	Administrative	5.19	4.77	0.42	0.00***	0.59
		Research	Others	5.19	4.49	0.69	0.00***	0.97
		Technical	Administrative	4.92	4.77	0.15	0.07*	0.21
		Technical	Others	4.92	4.49	0.42	0.01***	0.59
		Administrative	Others	4.77	4.49	0.27	0.08*	0.38
	Traditionality	Research	Technical	4.17	3.91	0.26	0.01***	0.25
		Research	Administrative	4.17	3.99	0.18	0.09*	0.18
		Research	Others	4.17	4.1	0.06	0.76	0.06
		Technical	Administrative	3.91	3.99	-0.08	0.52	-0.07
		Technical	Others	3.91	4.1	-0.19	0.38	-0.19
		Administrative	Others	3.99	4.1	-0.12	0.6	-0.12
Job position	Organizational culture	Research	Logistics	5.11	4.92	0.19	0.07*	0.28
		Research	Administration	5.11	4.68	0.44	0.00***	0.62
		Research	Management	5.11	4.71	0.4	0.00***	0.57
		Research	Others	5.11	4.78	0.33	0.03**	0.48

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
		Logistics	Administration	4.92	4.68	0.24	0.05*	0.34
		Logistics	Management	4.92	4.71	0.21	0.11	0.3
		Logistics	Others	4.92	4.78	0.14	0.44	0.2
		Administration	Management	4.68	4.71	-0.03	0.76	-0.05
		Administration	Others	4.68	4.78	-0.1	0.54	-0.14
		Management	Others	4.71	4.78	-0.07	0.69	-0.1
	Employee innovative behavior	Research	Logistics	4.99	4.54	0.46	0.00***	0.63
		Research	Administration	4.99	4.56	0.43	0.00***	0.59
		Research	Management	4.99	4.72	0.27	0.00***	0.37
		Research	Others	4.99	4.6	0.39	0.02**	0.54
		Logistics	Administration	4.54	4.56	-0.03	0.82	-0.04
		Logistics	Management	4.54	4.72	-0.18	0.17	-0.25
		Logistics	Others	4.54	4.6	-0.07	0.72	-0.09
		Administration	Management	4.56	4.72	-0.16	0.16	-0.21
		Administration	Others	4.56	4.6	-0.04	0.83	-0.05
		Management	Others	4.72	4.6	0.12	0.5	0.16
	Organizational identification	Research	Logistics	4.69	4.46	0.23	0.08*	0.27
		Research	Administration	4.69	4.32	0.37	0.00***	0.42
		Research	Management	4.69	4.39	0.3	0.01***	0.35
		Research	Others	4.69	4.55	0.15	0.44	0.17
		Logistics	Administration	4.46	4.32	0.14	0.37	0.16
		Logistics	Management	4.46	4.39	0.07	0.66	0.08
		Logistics	Others	4.46	4.55	-0.08	0.71	-0.1
		Administration	Management	4.32	4.39	-0.07	0.61	-0.08
		Administration	Others	4.32	4.55	-0.22	0.28	-0.26
		Management	Others	4.39	4.55	-0.15	0.47	-0.18
	Transformational leadership	Research	Logistics	5.11	4.83	0.27	0.01**	0.37
		Research	Administration	5.11	4.74	0.37	0.00***	0.5
		Research	Management	5.11	4.93	0.18	0.05*	0.25
		Research	Others	5.11	4.59	0.51	0.00***	0.7
		Logistics	Administration	4.83	4.74	0.1	0.45	0.13
		Logistics	Management	4.83	4.93	-0.09	0.49	-0.13
		Logistics	Others	4.83	4.59	0.24	0.2	0.33
		Administration	Management	4.74	4.93	-0.19	0.09*	-0.26

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
		Administration	Others	4.74	4.59	0.15	0.4	0.2
		Management	Others	4.93	4.59	0.33	0.06*	0.46
	Traditionality	Research	Logistics	4.13	3.61	0.52	0.00***	0.51
		Research	Administration	4.13	3.93	0.2	0.08*	0.2
		Research	Management	4.13	4.02	0.11	0.39	0.11
		Research	Others	4.13	4.27	-0.14	0.53	-0.14
		Logistics	Administration	3.61	3.93	-0.32	0.07*	-0.31
		Logistics	Management	3.61	4.02	-0.41	0.03**	-0.4
		Logistics	Others	3.61	4.27	-0.66	0.01**	-0.65
		Administration	Management	3.93	4.02	-0.09	0.56	-0.09
		Administration	Others	3.93	4.27	-0.34	0.15	-0.34
		Management	Others	4.02	4.27	-0.25	0.31	-0.25
Ranking	Organizational culture	Senior managers	Middle-level managers	5.07	5.04	0.03	0.8	0.03
		Senior managers	Ordinary employees	5.07	4.87	0.19	0.05*	0.27
		Senior managers	Others	5.07	4.8	0.27	0.17	0.37
		Middle-level managers	Ordinary employees	5.04	4.87	0.17	0.01***	0.23
		Middle-level managers	Others	5.04	4.8	0.25	0.18	0.34
		Ordinary employees	Others	4.87	4.8	0.08	0.67	0.11
	Employee innovative behavior	Senior managers	Middle-level managers	5.24	5.06	0.18	0.07*	0.25
		Senior managers	Ordinary employees	5.24	4.59	0.65	0.00***	0.93
		Senior managers	Others	5.24	4.34	0.89	0.00***	1.27
		Middle-level managers	Ordinary employees	5.06	4.59	0.47	0.00***	0.67
		Middle-level managers	Others	5.06	4.34	0.72	0.00***	1.02
		Ordinary employees	Others	4.59	4.34	0.24	0.17	0.34
	Organizational identification	Senior managers	Middle-level managers	5.01	4.81	0.21	0.08*	0.25

Characteristics	Variable	Group (a)	Group (b)	Mean (a)	Mean (b)	Difference (a-b)	p	Cohen's d
		Senior managers	Ordinary employees	5.01	4.29	0.72	0.00***	0.87
		Senior managers	Others	5.01	4.15	0.86	0.00***	1.03
		Middle-level managers	Ordinary employees	4.81	4.29	0.52	0.00***	0.62
		Middle-level managers	Others	4.81	4.15	0.65	0.00***	0.79
		Ordinary employees	Others	4.29	4.15	0.14	0.51	0.17
	Transformational leadership	Senior managers	Middle-level managers	5.26	5.16	0.1	0.3	0.15
		Senior managers	Ordinary employees	5.26	4.81	0.45	0.00***	0.63
		Senior managers	Others	5.26	4.22	1.04	0.00***	1.46
		Middle-level managers	Ordinary employees	5.16	4.81	0.34	0.00***	0.48
		Middle-level managers	Others	5.16	4.22	0.93	0.00***	1.31
		Ordinary employees	Others	4.81	4.22	0.59	0.00***	0.83
	Traditionality	Senior managers	Middle-level managers	4.52	4.16	0.36	0.01**	0.36
		Senior managers	Ordinary employees	4.52	3.84	0.69	0.00***	0.69
		Senior managers	Others	4.52	4.09	0.43	0.11	0.43
		Middle-level managers	Ordinary employees	4.16	3.84	0.32	0.00***	0.32
		Middle-level managers	Others	4.16	4.09	0.07	0.78	0.07
		Ordinary employees	Others	3.84	4.09	-0.26	0.31	-0.26