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**Buffering the Negative Impacts of Age Diversity on  
Company Performance and Innovation: The Roles of  
Knowledge Transfer and Environmental Uncertainty**

**XU Tiecheng**

SINGAPORE MANAGEMENT UNIVERSITY

2023

**Buffering the Negative Impacts of Age Diversity on Company Performance  
and Innovation: The Roles of Knowledge Transfer and Environmental  
Uncertainty**

**XU Tiecheng**

Submitted to School of Accountancy  
In partial fulfillment of the requirements for the  
Degree of Doctor of Business Administration  
SMU-ZJU DBA (Accounting & Finance)

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December 2023

I hereby declare that this PhD dissertation is my original work  
and it has been written by me in its entirety.

I have duly acknowledged all the sources of information  
which have been used in this dissertation.

This PhD dissertation has also not been submitted for any degree  
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XU Tiecheng

15 December 2023

# **Buffering the Negative Impacts of Age Diversity on Company Performance and Innovation: The Roles of Knowledge Transfer and Environmental Uncertainty**

**XU Tiecheng**

## **Abstract**

The VUCA (Volatility, Uncertainty, Complexity, Ambiguity) era has resulted in significant uncertainty in the global economy, while deglobalization in international politics and economics, and the interweaving of old and new contradictions, have presented substantial challenges to businesses. On the other hand, aging is a crucial issue that China and the world at large are currently facing. It is essential to study the relationship between employee age structure and enterprise performance.

Different researchers have provided empirical analyses of the effects of age diversity on organizational performance and innovation, but the conclusions are not consistent. According to the research in this paper, age diversity has a negative impact on enterprise performance, which means the richer the diversity of age, the hindering knowledge transfer between young and older workers, ultimately weakening the company's overall performance. However, this negative effect can be mitigated in the face of an increasingly complex and competitive market environment that promotes more knowledge transfer between elder and younger employees.

The paper analyzes the relationship between employee age diversity in enterprises and their business performance and innovation. It reveals the critical mediating role

played by knowledge transfer between older and younger employees within organizations in the impact of age diversity on organizational performance and innovation processes. Furthermore, this study examines the moderating effect of environmental uncertainty on the impact of age diversity of employee to the company performance and innovation. This paper enriches the study of the effects of employee age diversity and provides a critical reference for organizations to better help employees cope with the challenges brought by the age structure in a new situation filled with uncertainty.

**Key words:** Age diversity, Company performance, Company innovation, Knowledge transfer between older and younger employees, Environmental uncertainty

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## **1. Introduction**

### **1.1 Background and statement of the research question**

In the VUCA era, the global economy is challenged by significant and uncertain factors, and order has turned into disorder. Black swan and gray rhino events are constantly emerging, while the trend of deglobalization in international politics and economics, and the interweaving of old and new contradictions, have brought enormous challenges to business operations. The domestic and foreign markets that enterprises face are becoming increasingly turbulent and changing. To adapt to the more uncertain normality, cope with various risks in the domestic and foreign markets, seize development opportunities, and enhance their competitiveness, enterprises must strive to build a sound organizational structure, promote the enhancement of their innovation capability, and achieve good performance.

On the other hand, with the trend of population aging in China, the age structure of employees in enterprises is becoming increasingly diverse. With more than 30 years of reform and opening-up policies and family planning policies in China, the aging problem is different from that in developed Western countries. According to the sixth national census, the supply of young labor force in China will continue to decline. It is estimated that by 2020, the proportion of middle-aged and elderly people (aged 45 and above) in the labor force will rise from 30% in 2010 to 39.5%, and may even reach 45.3% by 2050. Furthermore, the proportion of young labor force will drop from 70% in 2010 to less than 60% in 2020, and may even drop to below 55% by 2050. This shift

in the labor force structure not only has a significant impact on China's overall economic and social development, but also poses a considerable challenge to the age structure of employees in enterprises. The policy of delaying retirement age has already been implemented in China, and retirement age is likely to be further postponed in the future. In this context, the age span of employees in enterprises will become more extensive, and enterprise managers must establish a more inclusive human resources strategic management system. Therefore, it is crucial to enhance an organization's innovation capability under the more uncertain environment and study the relationship between employee age structure and enterprise performance.

From the perspective of strategic human resource management, enterprises can improve their creativity and innovation capability, enhance their competitiveness, and improve their company performance by constructing a sound organizational structure. The positive effect of organizational diversity has been widely recognized by scholars and the industry (Jackson, 1992; Triandis, Kurowski, & Gelfand, 1994; Van Knippenberg, De Dreu, & Homan, 2004; Williams & O'Reilly, 1998). Organizational diversity refers to the differences in some attributes perceived by members of an organization (Li & Ge, 2018), which includes both surface demographic diversity and deeper cognitive and attitudinal diversity (Bower, Pharmer, & Salas, 2000; Williams & O'Reilly, 1998). Enterprise managers have gradually realized that in the rapidly changing environment, an organizational structure with single cognition or team members with relatively limited knowledge resources is no longer sufficient to cope with and meet complex and diverse work tasks. Organizational structures and work teams with diversity can obtain more abundant and effective knowledge and resources,

expand the talent pool of enterprises, and provide important help for the growth of enterprise performance and innovation capability (Li & Ge, 2018).

Employees of different age groups have different knowledge, skills, and abilities, and there are also significant differences in values, cultural backgrounds, occupational backgrounds, and work styles. Research on age diversity has led to several theoretical perspectives that explain the diversity effect, including social identity theory, information decision theory, and similarity attraction perspective. These perspectives offer different explanations for the effect of age diversity on group performance, with social identity theory (Turner et al., 1987) suggesting a negative effect and information decision theory (Williams & O'Reilly, 1998) suggesting a positive effect. As a psychological theory, social identity theory proposes the importance that individuals attach to high self-esteem and the behavior of team members making comparisons. Research has shown that maintaining a low level of diversity in the team would be a better choice if one hopes for higher cohesion, better loyalty, and better performance within the team. (Mumighan & Conlon, 1991; O'Reilly et al., 1989; Wagner et al., 1984). Information/decision theory provides a viewpoint that members of a group with different backgrounds are important conditions for the group to acquire more types of knowledge, skills, and cognitive resources. Research has shown that the improvement of team performance is largely influenced by the high level of diversity within the team. (Van Knippenberg & Schippers, 2007). These perspectives have important implications for organizational diversity management and suggest that different strategies may be needed to manage diversity effectively depending on the level and nature of diversity in the group.

In addition, it is also important for enterprises to explore how to promote the overall market performance of the organization and enhance innovation ability through the age diversity of employees at the organizational level. Age diversity means that the organization's talent pool is more abundant. In such a diverse organization, the diversified knowledge based on the rich talent pool can also be exchanged through the social interaction process among employees. The ability and methods of organization members to solve problems can also be greatly improved through the sharing of knowledge and mutual learning processes, which can have a positive impact on the performance and innovation of enterprises. Collins & Clark (2003) also pointed out that the strategic human resource management practices of enterprises can further affect the performance level of the organization by influencing the abilities of organizational employees.

Furthermore, the practical experience of strategic human resource management also suggests that when exploring employee behavior and organizational processes in organizations, contextual factors in the organizational environment, such as environmental uncertainty, need to be considered. These contextual factors have an important moderating effect on the impact of organizational diversity. Environmental uncertainty refers to the existence of unidentifiable and unpredictable information that affects enterprise performance. Environmental uncertainty will have a direct or indirect impact on enterprise management activities, such as knowledge transfer among internal employees of the enterprise.

Ellwart et al.(2013) found a positive correlation between age diversity and knowledge transfer among individuals within a team. Their research cases indicate that

the strengthening of knowledge transfer is caused by the activation of age diversity in cognitive diversity related to knowledge differences. Burmeister et al.(2021) believes that identity-related barriers can hinder knowledge transfer among colleagues of different age groups. To achieve the social cognitive benefits of age diversity, knowledge-oriented age diversity training is needed. Organizational and network characteristics may also be influencing factors for the efficiency of intergenerational knowledge transfer, which is different from knowledge transfer among peers. In addition, the barriers to knowledge transfer vary among different generations (Schmidt & Muehlfeld, 2017). However, Schneid et al.(2016) study showed that there is no correlation between age diversity and team outcomes such as overall performance, financial performance, innovative creativity, effectiveness, and satisfaction, but there is a weak moderating effect on personnel turnover.

For enterprise managers, how to effectively manage the diversity of enterprise human resources, better promote the division of labor and cooperation among employees of different age groups, and promote knowledge transfer and sharing among employees of different age groups to improve the innovation ability and performance of enterprises under environmental uncertainty is becoming an important challenge for enterprises today. Through a deeper understanding of this issue, managers can better deal with and manage the problem of age diversity in enterprise employees, and encourage employees of different age groups to cooperate with each other, give full play to their strengths, and jointly improve enterprise performance.

Overall, the question of how the age diversity of employees in a company affects its performance and innovation, and to what extent and through which mechanisms, is

a topic that deserves further research and attention from business managers. This study aims to explore how age diversity of employee's impact company performance and innovation by facilitating knowledge transfer among employees of different age groups. Additionally, we will investigate how the impact of age diversity on company performance and innovation is moderated by environmental uncertainty.

## **1.2 Significance and innovation of the study**

At present, research on the relationship between age diversity of employees and company performance and innovation is not yet sufficient, and there is no consensus on the extent to which the diversity of employee age will either promote or undermine an organization. Some studies have shown that employee age diversity has a positive effect on corporate performance and innovation, while others have demonstrated negative effects, and some have shown that there is no consistency in the relationship between employee age diversity, business performance, and innovation. Different researchers have provided empirical analyses of the effects of age diversity on organizational performance, but the conclusions are not consistent: some studies have shown a positive and significant effect on company performance (Page, 2007; Backes-Gellner & Tuor, 2010), while others have demonstrated negative effects (Cleveland & Lim, 2007). Some studies have not found evidence of consistency between age diversity and business performance (Leonard & Levine, 2006). Backes-Gellner and Veen (2013) studied the relationship between age diversity and business performance, and created a model that considers the impact of age diversity on business performance. They argue that while an increase in age diversity among employees brings benefits to a company, it also increases costs, and the impact of age diversity on business

performance ultimately depends on the rate of growth of diversity benefits and costs. They argue that an increase in diversity initially has a positive effect on the overall performance of the organization because the increase in benefits exceeds the increase in costs at the beginning. However, after passing a certain critical point, the growth of costs exceeds the growth of benefits as age diversity increases, leading to a gradual decline in company performance. In other words, there is a U-shaped relationship between age diversity and corporate performance. Some scholars have also pointed out that the neglect of certain important moderating variables is the main reason for the differences in research results. The age diversity of employees may have different effects on corporate performance and innovation in different scenarios and under different moderating effects.

This paper considers knowledge transfer as a mediator in exploring how age diversity of employee impacts business performance and innovation. Previous research has focused on using knowledge transfer as an independent variable to investigate its relationship with corporate performance and innovation (e.g. (Hendriks, 1999; Cohen & Bailey, 1997; Liao Bing, 2014)). However, starting from the process of corporate innovation, the existence of age diversity enriches the team's information pool. However, the impact on corporate innovation is weak if there is only information but no transmission, sharing, and exchange. Therefore, this study considers knowledge transfer and examines how age diversity affects corporate innovation and performance through knowledge transfer. Based on this, this study will explore how employee diversity can further enhance the market performance and innovation of enterprises by promoting knowledge transfer among employees of different ages from the perspective



of strategic human resource management, which enriching the study of the effects of employee age diversity.

Furthermore, this study considers incorporating environmental uncertainty as a moderator into the model to investigate how the impact of age diversity changes under different levels of environmental uncertainty. Under high levels of environmental uncertainty, potential biases and stereotypical impressions between different age groups may even be alleviated, and organizations may encourage employees of different age groups to adopt effective coping strategies to deal with external turbulence. Therefore, we believe that under conditions of high environmental uncertainty, the role of age diversity in organizational innovation and performance will be weakened. This also provides important reference for how organizations can better help employees cope with the challenges brought by the age structure in a new situation filled with uncertainty.

## **2. Literature Review**

With the emergence and aggravation of the population aging problem in China, as well as the trend of increasing external environmental changes, enterprises will face the challenge of age diversity in their internal workforce. Understanding the characteristics of age diversity and being able to effectively utilize this diversity is one of the important factors for enterprises to gain competitive advantages.

As an important research direction in organizational behavior, research on age diversity of employees has a history of more than fifty years. Numerous scholars have been studying this topic, based on the fundamental cognitive hypothesis that employee diversity can not only affect individuals' emotions and personal performance, but also impact group effectiveness and team performance. However, there is no consistent conclusion on the mechanism of this impact. Researchers have conducted systematic studies on the definition of diversity, its categories, and its mechanisms of action. Therefore, this paper first reviews the relevant research on employee diversity in enterprises, and then summarizes the research literature on the impact of age diversity among employees on business performance and innovation. Furthermore, the paper reviews the relevant research on knowledge transfer and environmental uncertainty and their roles in the impacts on company performance and innovation.

### **2.1 Diversity of employee**

The central issue in the study of employee diversity is the diversity effect, which refers to how differences among employees can affect their attitudes and subjective experiences, and how these attitudes and experiences can influence their behavior, thus affecting the progress and outcomes of the group they belong to. Previous research on

employee diversity has drawn on various theoretical perspectives from different disciplines, among which **social identity theory** (Turner et al., 1987) and **information decision theory** (Williams & O'Reilly, 1998) have had the most significant impact. These two theories, from the perspectives of social categorization (Brewer, 1979; Tajfel & Turner, 1986; Hogg & Terry, 2000) and information processing (Williams & O'Reilly, 1998; Van Knippenberg, De Drue & Homan, 2004; Van Knippenberg & Schippers, 2007), respectively, have guided research on diversity for several decades. Although they are the foundation of diversity research in organizations, these two theories present opposite conclusions about the effect of diversity on group performance. Information decision theory suggests that diversity has a positive effect on group performance, as a high level of diversity can increase the group's cognitive resources, including knowledge, skills, and abilities. In contrast, social identity theory suggests that diversity has a negative effect on group performance, as diverse groups are more likely to have internal biases that hinder cooperation.

Social identity theory is a psychological theory that suggests that each individual has a need to maintain a high level of self-esteem and intends to compare themselves to others in their group. Individuals first define themselves and then classify themselves and others into different categories based on similarities and differences. This process results in two categories of group members: "in-group members," who have high similarity with the individual, and "out-group members," who have high differences. Individuals tend to evaluate in-group members positively and out-group members negatively, leading to higher levels of trust, preference, and cooperation among members of the same sub-group (Brewer, 1979; Brewer & Brown, 1998). Due to the

process of social categorization, low levels of diversity in the group facilitate smooth cooperation and higher levels of satisfaction among employees. Individuals also tend to hold biases and stereotypes against members of other sub-groups. Research has shown that lower diversity levels in the group lead to higher cohesion, lower turnover rates, and higher performance (Mumighan & Conlon, 1991; O'Reilly et al., 1989; Wagner et al., 1984).

The **similarity attraction perspective** is another theory that supports social identity theory. This theory suggests that similar individuals are attracted to each other because they have shared experiences, interests, and values, which lead to more effective communication and cooperation (Byrne, 1971; Festinger, Schachter, & Back, 1950). Individuals tend to interact more with people who are similar to them and avoid those who are different, leading to homophily in social networks. Therefore, in diverse groups, people may have fewer opportunities to interact with those who are different from them, leading to lower levels of trust and cooperation.

**Information decision theory** posits that individuals within a group have diverse backgrounds that provide the group with a greater variety of knowledge, skills, and abilities, and cognitive resources. Groups approach problems from diverse perspectives, utilizing the full range of knowledge and information available to them. When facing difficult tasks, the group draws on its comprehensive knowledge and information to think about the problem from multiple angles, leading to more comprehensive solutions. Additionally, when employees with different backgrounds collaborate and communicate, they bring different viewpoints and information, increasing the likelihood that the group will fully discuss conflicting views. Through this discussion,

the group can further learn and reflect, increasing the potential for innovative behavior. Research has confirmed that higher levels of diversity within a group promote innovation and enhance team performance (Van Knippenberg & Schippers, 2007).

As organizations face the challenges and opportunities presented by demographic change, age diversity has become an increasingly important topic. To address relevant issue, Burmeister et al. (2021) conducted a study to investigate how age diversity training can be used to overcome challenges and leverage the benefits of an age-diverse workforce. They drew on the two predominant theoretical perspectives in diversity literature - social identity theory and the information and decision-making perspective - to develop two age diversity training programs: identity-oriented training and knowledge-oriented training. The former focuses on emotional reactions and helps organizations to overcome the challenges of age diversity by "speaking to the heart" of age-diverse coworkers, while the latter targets cognitive reactions and aims to realize the benefits of age diversity by "speaking to the mind" of age-diverse coworkers. The researchers tested both training programs in a randomized controlled field experiment with age-diverse coworker dyads and found that the identity-oriented training facilitated contact quality as a socioemotional outcome, reducing stereotype threat and increasing perceived similarity, while the knowledge-oriented training increased knowledge transfer as a sociocognitive outcome, enhancing perceived knowledge utility and transactive memory. The study advances research on the evidence-based management of age diversity and highlights the importance of considering both emotional and cognitive factors in designing effective age diversity training programs.

In subsequent research, scholars have proposed combining two perspectives into a **social categorization-elaboration model**. This model posits that both perspectives must be integrated to better understand the effects of age diversity (Van Knippenberg et al., 2004). The Social Categorization-Elaboration Model emphasizes that each diversity attribute (such as age) provides a basis for both social categorization and information processing mechanisms. As a result, the impact of age diversity on group performance may be positive, negative, or have no effect, depending on the team's performance and the situational factors surrounding the group (Van Knippenberg & Schippers, 2007).

In the operation of diversity, social categorization and information processing mechanisms interact, and one mechanism will moderate the role of the other. When social categorization mechanisms are not activated, information processing mechanisms will operate, and diverse teams can fully utilize the strengths of different types of employees, thereby promoting group performance and innovation. Conversely, when information processing mechanisms are not activated, social categorization processes will be activated, and there will be "sub-groups" within the group that hinder communication, collaboration, and ultimately harm group performance and innovation.

In conclusion, we can see that from the perspective of social identity theory, the higher the level of diversity in a group, the more likely it is for employees to develop negative emotions and cognitive differences, which can drain the group's energy. Subgroups consisting of in-group members may create conflicts and affect the subjective feelings of individuals, thereby negatively impacting both individual and group performance and innovation as well. On the other hand, from the perspective of

information processing theory, diversity brings about stimulation and encouragement to the entire group, as different backgrounds of members enrich the group's knowledge, skills, and abilities. This in turn improves the overall strength and decision-making ability of the group, leading to positive effects on both individual and group performance and innovation.

## **2.2 Age diversity's effect on company performance**

Since the 1950s, Western scholars have conducted theoretical and empirical analyses on the relationship between an employee's age and their job performance. Various disciplines, such as psychology, physiology, economics, and management, have explored this topic. Studies have found that there is a clear relationship between an employee's age and their job performance, which is influenced by the employee's abilities, company incentives, and work environment (Blumberg & Pringle, 1982). The impact of an age diversity of employee on job performance varies in different contexts and under different task environments. Rhodes developed a model of the relationship between an employee's age and their job behavior, whereas employees age, their cognitive and motor abilities tend to decline, which affects their job performance. Schmidt and others found that an employee's work experience is an important factor in predicting their job performance. According to relevant theories and empirical studies, we found that the relationship between an employee's age and their job performance varies based on the nature of the work and the work environment. For manual laborers, there is a inverted U-shaped relationship between age and job performance, while for knowledge workers, the impact of age on job performance is not very significant and the relationship is more complex. For freelancers, age has a positive impact on job

performance, which stabilizes after a certain age. For researchers, the relationship between age and job performance exhibits a saddle-shaped curve. Therefore, there is no unified conclusion on the relationship between an employee's age and their job performance, as it can be positive, negative, or even inverted U-shaped. Thus, when studying this issue, it is necessary to judge the relationship between an employee's age and their job performance based on the nature of their work and the environment they work in.

Tsui and O'Reilly (1989) were the first to propose that an individual's demographic characteristics can affect their attitudes and behaviors, and the theoretical foundation related to individual-level diversity research is mainly based on Social identity theory and similarity-attraction theory (Byrne, 1971). As typical demographic characteristics such as age, gender, race, and education level are easily observable and measurable and can directly reflect the similarity between individuals, many scholars have studied individual-level diversity based on differences in demographic characteristics. For example, Zenger and Lawrence (1989) studied the age and tenure of engineers and found that when these characteristics are more different from those of others, the engineer communicates less. Tusi, Egan, and O'Reilly (1992) studied the relationship between individual characteristics and personal commitment and found that when there are differences in demographic characteristics such as age, gender, and race, it affects an individual's level of commitment. In contrast to the above theories, information decision theory based on information processing perspectives believes that differentiated group employee characteristics can improve the overall cognitive ability of the enterprise and thus improve group performance.



Ellwart et al. (2013) discussed the impact of age diversity on team performance and provide empirical data, showing that individual perceptions of diversity (subjective diversity) and beliefs about the benefit of diversity (diversity beliefs) are heterogeneously observed and evaluated by individual team members. Although their results underline the importance of the subjective view, it is not out of question that objective age diversity is a pre-condition for subjective processes. As the moderating effect of individual diversity beliefs reveals, group level and individual level effects are interdependent and should be addressed in future research.

Currently, there is no consensus on the impact of age diversity of employee on company performance. Suzanne et al. (2013) conducted a meta-analysis of the relationship between demographic diversity variables and team performance and found no significant relationship between age diversity and team performance. Leonard and Levine (2006) collected longitudinal data from 800 similar workplaces to study the relationship between gender, race, and age diversity and employee turnover rates and found no significant relationship between age diversity and employee turnover rates. Backes-Gellner and Veen (2009) collected data from 18,000 German companies with a total of 2 million employees to explore the impact of the aging workforce and changes in age diversity on company performance. The study found that the organization's productivity did not decline as the average age of the company's employees increased, under the premise that the level of age diversity and job type did not change. However, an increase in age diversity can significantly improve a company performance, especially for innovative companies, where this positive effect is more pronounced. Lauring and Selmer (2012) further pointed out that employee diversity in demographic

characteristics (including age) is different from cultural or linguistic diversity. Different researchers have provided empirical analyses of the effects of age diversity on company performance, but the conclusions are inconsistent: some studies show a positive and forward-looking effect between them (Page, 2007; Backes-Gellner and Tuor, 2010), while others show a negative destructive effect (Cleveland and Lim, 2007), and even some studies have not found consistent evidence of the relationship between employee age diversity and corporate performance (Leonard and Levine, 2006).

Backes-Gellner and Veen (2013) conducted a study on age diversity and firm performance and creatively established a model for age diversity and firm operational performance. They believe that the increase in age diversity of employees in a company brings benefits while also increasing the company's costs. The impact of age diversity on firm performance ultimately depends on the growth rate of diversity benefits and diversity costs. They argue that an increase in diversity will first have a positive effect on the overall performance of the organization because the rate of benefit growth is greater than that of cost growth at the beginning stage. However, when a certain critical point is reached, the increase in age diversity leads to a greater increase in costs than in benefits. At this point, as age diversity increases, organizational performance gradually declines. In other words, there is a U-shaped relationship between age diversity and firm performance.

### **2.3 Age diversity's effect on company innovation**

Research on the impact of employee age diversity on company innovation has not reached a consistent conclusion. Hun Whee Lee (2018) et al. discussed the influence of gender differences on team creativity and status conflict within the team. The article

proposed that in teams composed of members of different genders, team members tend to send friendly signals to the opposite sex and try to avoid competitive behavior that could cause conflicts, based on the costly signaling theory and the competitive altruism theory. Østergaard (2011) et al. focused on the impact of employee diversity on innovation outcomes. They analyzed the influence of employee diversity on team creativity from four aspects: gender, age, educational level, and race. Bogers (2018) et al. studied the influence of employee cultural background and work experience on open innovation (acquisition of external knowledge). Taking work experience as a variable is based on the relationship between work experience and a person's external network, which affects the acquisition of external knowledge and thus affects employee creativity. Vas Taras (2019) et al. researched the influence of individual diversity and environmental diversity on team effectiveness (task results and psychological results). Based on social identity theory and the same-sex attraction theory, the article proposed that individual diversity will have a negative impact on innovation.

Watson, Kumar & Michaelsen (1993) proposed that diversity-induced heterogeneity can enhance cognitive processing and process information more efficiently. De Dreu & West (2001) argued that cognitive diversity can bring teams a wide range of unique knowledge, skills, and ideas, thus generating more new choices, plans, and products. At the same time, members with different ways of thinking and value systems can use different perspectives to view the environment and process information, which can help the team analyze problems from different aspects and promote team creativity. According to the diversity value theory, when a team brings together people with diverse backgrounds, ideas, and viewpoints, the team has greater

creativity (Bantel & Jackson, 1989). Williams & O'reilly (1998) believed that cognitive diversity among team members could stimulate team creativity because exposure to different or divergent viewpoints could stimulate team members to generate more innovative ideas.

## **2.4 Age diversity's effect on knowledge transfer**

Knowledge transfer is one of the crucial components of knowledge management processes. Fan et al. (2006) suggested that the subject of knowledge sharing within a team can be classified into three levels: individual sharing, team sharing, and organizational sharing. Wei and Wang (2004) defined knowledge sharing as a process by which team members share their individual knowledge through various forms of communication and exchange, creating a pool of shared knowledge within the team.

The demographic diversity and cognitive differences of team members can affect knowledge transfer within the team. In addition, the impact of age diversity has become an urgent challenge for most organizations. Hence, knowledge about the consequences of age diversity for team outcomes is essential to managers to estimate risks and rewards of age diversity (Schneid et al., 2016). While the importance of knowledge transfer between employees with a large age difference has grown for organizations in the last few years and has been discussed in business publications (e. g. Milligan, 2014), academic research has not kept pace (Burmeister & Deller, 2016). Meanwhile, previous studies on the impact of team diversity on knowledge transfer have not produced consistent results. On the one hand, the greater the similarity among team members, the easier the exchange and transfer of knowledge, while on the other hand, higher

levels of team diversity can hinder knowledge transfer and integration within the team. This suggests that team diversity can either inhibit or promote knowledge sharing.

De Dreu and Weingart (2003) suggested that people tend to prioritize their own understanding of a problem and do not consider other people's views or ideas as equally important. Therefore, they may not be enthusiastic about exchanging different knowledge within the team or integrating it into their own understanding.

Some studies have also indicated that the impact of team diversity on knowledge transfer depends on the type of diversity. Nissen et al. (2014) studied how the collaboration and cooperation of heterogeneous teams in public projects could affect knowledge transfer. Luring and Selmer (2012) found that the impact of diversity on knowledge transfer in international teams was more significant than that of demographic diversity among team members.

In a recent study by Burmeister et al. (2020), the motivational benefits of knowledge transfer for older and younger workers in age-diverse coworker dyads were explored using an actor-partner interdependence model. The results of the study indicated that knowledge transfer can have different motivational benefits for employees of different ages. For older workers, knowledge transfer was found to increase their self-efficacy and organizational commitment, while for younger workers, it increased their task motivation and organizational commitment. Additionally, the study found that knowledge transfer between coworkers who are similar in age was more effective than knowledge transfer between those with greater age differences. These findings suggest that age diversity can play an important role in shaping the motivational outcomes of knowledge transfer in the workplace.

To mitigate the potential loss of critical knowledge resulting from the mass-exodus of retirement-aged employees, the Society of Human Resource Management (SHRM) recommends that organizations focus on knowledge transfer strategies that facilitate the transfer of knowledge from experienced to less experienced employees. SHRM also urges HR professionals and managers to invest in retaining seasoned employees, as they are a valuable source of knowledge and expertise. Failure to prioritize knowledge transfer efforts may result in significant costs, both in terms of financial impact and overall performance (Czaja et al., 2019).

## **2.5 Knowledge transfer's effect on company performance and innovation**

Knowledge transfer among employees in organizations is central to the entire process of knowledge acquisition, sharing, integration, and creation within teams (Hendriks, 1999). Scholars have studied the relationship between knowledge transfer, organizational performance, and innovation from different perspectives. Yameng Zhang et al. (2019) proposed that the ability to absorb knowledge is considered as an important intangible resource for innovation and gaining a competitive advantage in a dynamic environment. Knowledge sharing and collaboration among team members will affect team creativity. Cohen & Bailey (1997) suggested that a team is a widely used micro-organizational form for innovation creation, and the team's creativity and innovation are closely related to the extent of knowledge transfer. Xu Bixiang et al. (2007) argued that the degree of knowledge transfer among team members will significantly impact the learning ability, creativity, and organizational performance of the entire team. Wang Guobao's (2010) research also indicated that knowledge sharing

is particularly important in the process of knowledge transfer and has a positive impact on the team's innovative abilities. Since team creativity depends on individual creativity, knowledge transfer among members may enhance their personal creativity and promote the overall creativity level of the team as a whole and organizational performance. Liao Bing's (2014) research also confirmed this and found that the willingness to share knowledge plays a mediating role in the relationship between the innovation level of scientific research teams and the work emotions of team members.

Some studies have examined knowledge transfer as a mediator in discussions of how knowledge transfer affects organizational performance and innovation. The diversity of team members will directly lead to differences in the content, methods, and processes of knowledge transfer, which will in turn have different effects on the level of team creativity and organizational performance. Therefore, knowledge transfer may be an intermediary through which team diversity affects team creativity. Lyu & Zhang (2015) verified that cognitive diversity and intra-team conflict have a significant impact on the creativity of teams and their members with knowledge heterogeneity. Knowledge transfer plays a mediating role between cognitive diversity and team creativity. Therefore, knowledge transfer is essential for improving the creativity and innovation of teams and ultimately enhancing organizational performance.

## **2.6 Environmental uncertainty**

Making decisions is difficult under uncertain environment, and organizations need to take countless factors into consideration. The more knowledge/ information they

have, the better equipped they are to handle uncertainty and illuminate the factors involved.

Environmental uncertainty is a situational factor that affects people's ability to predict the outcomes of their actions. Milliken (1987) believed that uncertainty is a subjective perception of the individual, referring to the inability of individuals to accurately predict the organizational environment due to a lack of information or an inability to distinguish relevant from irrelevant data. In high uncertainty environments, individuals may feel that they lack the ability to understand the direction of environmental change, are unclear about the impact of environmental change on the organization, or do not know whether a particular action will be successful (Milliken, 1987). Subsequent research has focused on the dynamics of environmental uncertainty, gradually acknowledging the general definition of environmental uncertainty, which refers to the unpredictability that companies face when customer needs or technological developments are rapidly changing (Baron & Tang, 2011; Wiklund & Shepherd, 2005), including unforeseeable changes in competition, customer demand, and technological upgrades (Boyns & Meier, 2009), reflecting the level of uncertainty that companies face when making decisions in a dynamic environment.

Galbraith (1977) defined uncertainty as "the difference between the amount of information required to perform the task and the amount of information already possessed" (p. 37). Simonin (1999) found that as uncertainty increases, knowledge transfer decreases and organizations try to develop their own knowledge. However, Hsu and Wang (2008) assumed that increased perceived environmental uncertainty triggers the implementation of knowledge sharing policies and practices. Availability



of knowledge helps organizations deal with uncertainty (Tsoukas and Vladimirou, 2001).

According to Pfeffer and Salancik (1978), environmental uncertainty is "the degree to which future states of the world cannot be anticipated and accurately predicted" (p. 67). Environmental uncertainty stems from a lack of access to sufficient information during the decision-making process and individuals' inability to anticipate the future. High levels of uncertainty arise when the rationales and experiential bases of knowledge are inadequate (Lee et al., 2011). Environmental uncertainty can be driven by several environmental components, such as clients, suppliers, competitors, wholesalers, jobbers, predictable and unpredictable factors, and technology. Among these factors, technology, markets, and competitors are the best-known sources of environmental uncertainty because of their rapid ongoing changes and developments (Köseoglu et al., 2013; Long et al., 2014).

Okumus et al. (2010) define environmental uncertainty as "the degree of uncertainty and changes in the task and general environments" (p.178). Based on the **confusion theory**, individuals cannot distinguish between the pieces of information presented in an uncertain environment. Consequently, confusion manifests as delayed decision making, dissatisfaction, and reduced commitment to the source of the confusion (Mitchell et al., 2005). Employees who experience confusion in uncertain environments cannot figure out problems or present suitable answers when faced with unpredictable issues. Consistent with the confusion theory, primary studies regarding environmental uncertainty and its relationship with performance outcome reveal these have an inverted relationship.

Environmental uncertainty can have a positive or negative impact on firm performance (Samsami et al., 2015). For example, if the market is stable and can be perfectly predicted, there is little immediate risk to firms. However, changes in environmental conditions pose uncertainty and risk to firms. When managers face high market uncertainty, integrating innovation into strategic decisions becomes difficult (López-Gamero et al., 2011). According to Aragón-Correa and Sharma (2003), low environmental uncertainty helps firms determine their business strategy. Environmental uncertainty may moderate the effect of innovativeness on firm performance (Tsai and Yang, 2013). Market turbulence positively influences the causal link between innovation strategy and firm performance (Atuahene-Gima et al., 2006). Moreover, high market uncertainty leads firms to adopt greater innovativeness and perform better (Hult et al., 2004). Successful firms in constantly changing and uncertain markets develop innovative strategies to satisfy customer demands (Atuahene-Gima et al., 2006) and capture new product-market niches (Lumpkin and Dess, 2001). Innovation is therefore a top priority not only for improving a firm's performance but also for increasing its chances of surviving in periods of ongoing turbulence and great uncertainty (Dervitsiotis, 2012). Specifically, in the current economic turbulence and uncertainty and the global financial crisis, sustainable innovation strategies that offer greater value through better products or processes, or innovation leading to a more effective business model, are crucial (Dervitsiotis, 2010b).

Environmental uncertainty is often driven by intense competition and the unpredictable timing of technological advances. In such an environment, the cycles of technological innovation, such as product and process innovation, are often short,

making technology-related capabilities more desirable and forcing firms to invest more in technological competencies to keep up with the competition (Song et al., 2005; Atuahene-Gima et al., 2006). Moreover, firms struggle to understand changing market trends and come up with renewed products in turbulent markets (Wang et al., 2015). In circumstances of competition, characterized by economies of speed, organizational innovation also plays an important role in achieving and sustaining a competitive edge (Ganter and Hecker, 2013). Organizational innovation helps firms improve their capacity to develop new forms of marketing for products, which must be capable of adapting to new market situations in periods of uncertainty (Ramirez et al., 2018). Marketing innovation can help improve an organization's results, even in times of financial crisis (Medrano and Olarte Pascual, 2016). From the above, it seems that in periods of uncertainty, firms struggle to survive by adopting all dimensions of innovation and in doing so improve their performance.

### 3. Hypotheses and model

#### 3.1 Hypotheses development

A higher level of age diversity within a company means that its employees belong to various age groups. According to social identity theory and the literature on diversity (e.g., Ashforth & Mael, 1989; Harrison & Klein, 2007; Shore et al., 2011; Turner & Tajfel, 1986), increased diversity within organizations tends to create an environment in which people tend to categorize themselves and others into "us" and "them" based on noticeable characteristics, such as age. This categorization process can cause individuals to identify and commit more strongly to their own groups, leading to more coherent intra-group relationships but also the potential for inter-group conflicts (Harrison et al., 2002; Harrison & Klein, 2007; Valls et al., 2021). Therefore, in companies with a more age-diverse employee composition, age differences may be more conspicuous during day-to-day interactions, leading to more obvious age-related differences among employees. This can result in age-group-based identity being more noticeable, and age-group-based subgroups or conflicts may be more likely to arise. As people are more likely to be committed to their own age groups and devalue contributions from other groups, workers in the same age groups may tend to transfer knowledge, such as work experience and market information, to other members of their age group while avoiding proactively exchanging knowledge with other age groups. Therefore, there may be a negative association between age diversity and knowledge transfer between older and younger workers in a company.

**Hypothesis 1:** Age diversity will be negatively associated with knowledge transfer between older and younger workers.

Knowledge transfer among employees serves as a critical operationalized process that promotes company performance and innovation. In companies with higher levels of age diversity, employees tend to categorize each other into different age groups due to the relatively conspicuous age differences and even negative stereotypes to each group, thereby creating barriers for knowledge transfer among different generations. These obstacles in knowledge transfer among older and younger workers in a company will subsequently exert negative impacts on both company performance and company innovation.

On the one hand, the improvements of company performance, or even the maintenance of company performance, requires smooth cooperations among employees. When employees within the same company are reluctant to transfer knowledge (e.g., knowledge about the market preference and about the local policy) with each other, it would be difficult for employee to fully leverage the knowledge reservoir available to improve firm products and services. Additionally, not being able to access important work-related knowledge in time from each other, may even directly impair company performance, due to the lack of capability to respond to the market or the customers quickly, rendering a disadvantage status as compared to other competitors in the same market.

On the other hand, lower levels of knowledge transfer between older and younger workers may also inhibit company innovation. To facilitate innovation, either incremental or radical innovation, requires sufficient information exchange and absorptive capability at the company level (Li et al., 2021; Subramaniam & Youndt, 2005). Lacking knowledge transfer among employees in different groups renders it

difficult for the company to achieve innovation via continuously refining and improving products and services (Collins & Smith, 2006). Further, not being able to absorb and leverage existing knowledge residing in each employee renders it difficult to fully maximize the potential benefits of such knowledge for creating new knowledge at the collective level and/or achieving innovations as breakthroughs (Grand et al., 2016). Taken together, we propose that a higher level of age diversity with the company is likely to lead to less knowledge transfer between older and younger workers, and the lower levels of intergenerational knowledge transfers will ultimately impair company performance and innovation.

Knowledge transfer can mediate the relationship between employee diversity and organizational market performance. The existence of age diversity can promote interaction among organizational members in a more diverse organizational atmosphere, which creates a better communication environment for decision-making. The ability of organizational employees to exchange and integrate knowledge enables organizations to master the ability to create more new knowledge in dynamic market environments. The ability to create new knowledge is an important competitive resource for companies, allowing them to effectively respond to changing environments, gain stronger market competitiveness, and achieve better performance in the market (DeCarolis & Deeds, 1999; Grant, 1996). Through daily interactions, employees can effectively integrate and restructure single ideas and knowledge that were previously not connected, forming new knowledge and ways of thinking (Kogut & Zander, 1992; Nahapiet & Ghoshal, 1998). This new knowledge comes from communication and interaction among organizational members. Inefficient ideas are

screened out, leaving behind efficient and valuable information that is integrated, resulting in new knowledge that is more efficient, more valuable, and more conducive to organizational decision-making, allowing organizations to achieve better performance in the market.

**Hypothesis 2:** Knowledge transfer between older and younger workers will be positively associated with the company' (a) performance and (b) innovation.

Although a higher level of age diversity is likely to reduce knowledge transfer among employees in different age groups, this association is likely to be shaped by the external environment that the company is embedded in. This is because, as mentioned earlier, the negative impacts of age diversity on intergenerational knowledge transfer are likely to be impacted by the extent to which the age-related difference is the key information that employees process. As such, we propose an environmental factor – environmental uncertainty – as the moderator that attenuates the negative effect of age diversity on knowledge transfer between older and younger workers.

Environmental uncertainty captures the extent to which the external environment is dynamic and turbulent (Milliken, 1987). In companies that face a more uncertain external environment, more internal resources are likely to be allocated to monitor and respond to external dynamics, rendering age-related differences among employees a less prominent information for workers to process. Additionally, in companies that need to effectively cope with the relatively dynamic external environment, the importance of maximizing the values of internal knowledge pool becomes more important. In this case, the potential between-age-group bias or even stereotypes could also be alleviated, as companies tend to encourage employees from different age groups

to initiate valuable and effective responses to address external turbulence, rendering more opportunities for employees in different age groups to objectively evaluate each other's contributions. Taken together, we propose:

**Hypothesis 3:** Environmental uncertainty will moderate the association between age diversity and knowledge transfer between older and younger workers, such that the effect of age will be weaker (vs. stronger) when environmental uncertainty is higher (vs. lower).

The mediation hypothesis and moderation hypothesis, together, indicate moderated mediation effects. We propose that a more age-diverse company tend to face higher risks of impaired knowledge transfer between older and younger workers, and such stagnant tend to further inhibit company performance and innovation. However, when environmental uncertainty is higher, the negative impact of age diversity on intergenerational knowledge transfer will be attenuated, rendering weaker indirect impacts of age diversity on company performance and innovation. Taken together, we propose:

**Hypothesis 4:** Environmental uncertainty will moderate the indirect effect of age diversity on the company's (a) performance and (b) innovation via knowledge transfer between older and younger workers, such that the indirect effect of age diversity will be weaker (vs. stronger) when environmental uncertainty is higher (vs. lower).

### **3.2 Hypothesized Model**

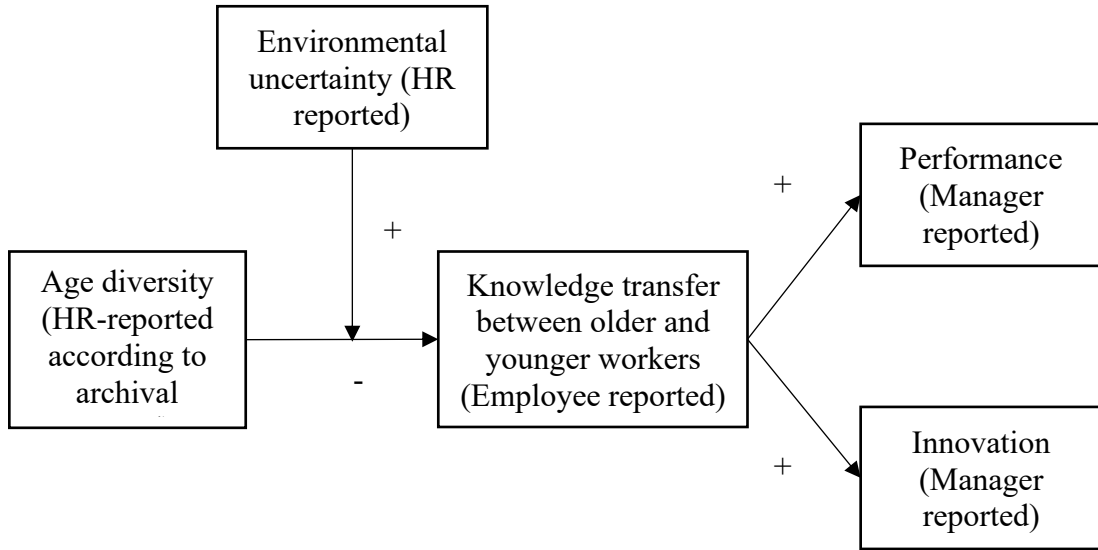
After reviewing the research hypotheses, we propose that environmental uncertainty significantly moderates the indirect effect of age diversity in organizations on knowledge transfer among older and younger employees, and subsequently on firm



performance and innovation. When faced with higher environmental uncertainty, organizations are likely to allocate more internal resources towards monitoring and responding to external dynamics, reducing the salience of age-related differences among employees in processing information. This, in turn, enables organizations to leverage their diversity advantage through employee communication and knowledge transfer, leading to the creation of updated knowledge and more effective problem-solving approaches. The newly created knowledge can effectively help firms to gain a competitive edge over their competitors, improving their competitiveness, and promoting market performance and innovation capability.

In conclusion, we propose that a higher level of age diversity in a company can have negative effects on intergenerational knowledge transfer, which may lead to lower levels of company performance and innovation. However, the negative effect of age diversity can be attenuated by environmental uncertainty, as it makes age-related differences less salient information for employees and highlights the importance of maximizing the value of the internal knowledge pool. By considering the moderating role of environmental uncertainty, companies can effectively manage age diversity and foster knowledge transfer among employees of different age groups, thus enhancing company performance and innovation.

**Figure 1: Hypothesized Model**



## **4. Methodology**

### **4.1 Technical route**

This study proposes five research stages, including the preliminary preparation stage, questionnaire survey stage, data entry stage, data analysis stage, and thesis writing stage. In the preliminary preparation stage, we first determined the research topic, collected and organized literature, completed a literature review related to the topic, and determined the research direction. Then, we designed the research model and questionnaire, identified the companies and samples to be surveyed, and made preparations for the questionnaire survey. The questionnaire survey method is a common data collection method in management research, this study also used this method to collect data.

Specifically, the research questionnaire design follows the following steps: first, the content of the questionnaire survey is determined. In this study, the survey content mainly revolves employee diversity, environmental uncertainty, knowledge transfer between older and younger employees, corporate performance, and innovation. Second, the scales used in the survey research are confirmed. In the process of reading relevant domestic and foreign literature, this study collected and sorted out the scales used in empirical research related to employee age diversity, environmental uncertainty, knowledge transfer between older and younger employees, corporate performance, and innovation. By comparing the content and specific aspects emphasized by the relevant scales, the scales that are similar to the background of this study and have a higher frequency of use in previous studies are selected. Third, the scales are back-translated to ensure that the meaning of the Chinese scales is accurate and the expression is

smooth. Finally, a small-scale pre-survey is conducted after the Chinese survey questionnaire is formed, and the questionnaire is revised according to the pre-survey situation. The formal large-scale questionnaire survey is conducted based on the revised questionnaire.

## **4.2 Sample and Procedure**

The main content of this study is how age diversity of employees affects company performance and innovation through knowledge transfer (between older and younger employees), as well as the moderating effect of environmental uncertainty. Therefore, based on actual conditions, the survey was designed as follows.

In terms of the questionnaire sample source, an online survey was conducted through Joyowo.com\* (the author's company, a well-known Chinese digital human resources service provider that provides integrated digital services for enterprises and has served over 85,000 enterprises in different industries nationwide), which distributed the survey questionnaire to the companies it serves via WeChat, email, and other means. In each company, we requested one senior manager, one HR manager, and 5-10 random employees to participate in our survey.

The survey was divided into three waves of questionnaire surveys. In the first wave, we collected the human resources manager's assessment of environmental uncertainty and controlled variables such as enterprise size, enterprise age, and family-owned nature. Two weeks after the first wave of questionnaire surveys ended, we conducted the second round of questionnaire collection. In the second wave, we collected information on the current status of knowledge transfer between older and younger employees in the organization, and employees participating in the research

evaluated the questionnaire based on the current status of the organization. Two weeks after the second wave of questionnaire surveys ended, we conducted the third wave of questionnaire collection. Senior managers participating in the survey evaluated the questionnaire based on the current status of the organization. In this round, we collected data on the company innovation and market performance. The company innovation level was evaluated by senior manager based on the current status of the organization, and the market performance was subjectively evaluated by the senior managers of each participating company based on the difference between the company and its competitors.

In the above surveys, data was collected from different enterprises across the country. Before conducting the surveys, we sent thank-you letters to all employees who were expected to participate in the surveys through the enterprise's human resources department, clarified the voluntary nature of the survey to the respondents and explained that the survey results were for academic purposes only. We also assured respondents that their answers would not be disclosed to others to alleviate their concerns. We received 338 completed questionnaires, and the response rate was approximately 84.5%, which met the academic requirements.

We reached out to 338 companies to collect data. In each company, we asked a top manager, an HR manager, and randomly 5-10 employees to participate in our survey. In total, we received responses from 338 companies. Among the top managers, they had an average age of 43.19 years ( $SD = 7.05$ ). Among the HR managers, they had an average of 37.72 years ( $SD = 7.24$ ) and an average organizational tenure of 7.5 years. In each company, we received responses from 8.72 responses from employees.

These employees were randomly recommended by their HR managers to participate in our study, they had an average age of 30.61 years ( $SD = 7.52$ ) and an average organizational tenure of 4.09 years ( $SD = 3.83$ ). To retain statistical power and maintain as much data as possible, we follow prior literature and model missing values with full information maximum likelihood estimator (Enders & Bandalos, 2001; Graham, 2009; Li et al., 2021). Notably, in one of our supplemental analyses, we reran our model using listwise deletion, and our results stayed robust (please refer to the supplemental analysis section for details).

### **4.3 Measures**

Based on literature review and reference to excellent scales both domestically and internationally, and considering the specific situation of questionnaire distribution, the scales used in this survey include team member basic information, environmental uncertainty, knowledge transfer between older and younger employees, company performance, and company innovation. The detailed contents of the questionnaire are presented in the appendix.

**Age diversity.** Age diversity was calculated using the archival data reported by HR manager in each company. Following prior literature on workplace age diversity (Li et al., 2021, 2022), each HR manager was instructed to report the proportion of employees in the categories of (1) younger than 30 years old, (2) 30 to 39 years old, (3) 40 to 49 years old, (4) 50 to 59 years old, and (6) older than 60 years old. Furthermore, age diversity in each company was calculated using Blau's index (1977).

**Environmental uncertainty.** Environmental uncertainty was measured using the four items from Jung et al. (2008). HR managers were asked, "How dynamic is the

external environment facing your company in terms of four aspects?” The four aspects were economic, technological, political/regulatory, and social. Participants responded to each item on a 7-point scale, from 1 = *very stable (changing slowly)* to 7 = *very dynamic (changing rapidly)*. The Cronbach’s  $\alpha$  for this scale was .97.

**Knowledge transfer between older and younger workers.** We measure intergenerational knowledge exchange using the 11 items adapted from Becerra et al. (2008) and Zhan et al. (2015). Among them, 6 items captured knowledge from older workers to younger workers (e.g., “In the company, older workers share their accumulated work experiences with younger workers”), and 5 items captured knowledge transfer from younger workers to older workers (e.g., “In my company, younger workers provide older workers with information about current products and services”). Participants responded to each item on a 5-point scale, from 1 = *strongly disagree* to 7 = *strongly agree*. The Cronbach’s  $\alpha$  for this scale was .98. The median rwg(j) scores of knowledge transfer between older and younger workers was .98, suggesting that there was a strong within-company agreement of this measure. Further, the intraclass correlation ICC(1) was .36, indicating that 36% of the variances of this variable were at the company level. Additionally, the reliability of the company-level means ICC(2) was .75, indicating a high reliability of the aggregated measure at the company level.

**Performance.** We measure company performance using the 6 items from Simsek et al. (2005). Specifically, managers of each company were asked “in comparison with that of major competitors in terms of (1) achieving overall performance, (2) growth in sales revenue, (3) net profit after taxes, (4) return to

shareholders, (5) market share growth, and (6) product (or service) quality, how was your company's performance?" Participants responded to each item on a 7-point scale, from 1 = *much worse* to 7 = *much better*. The Cronbach's  $\alpha$  for this scale was .97.

**Innovation.** Innovation was measured using the 6 items from Subrammaniam and Youndt (2005). The scale incorporates 3 items capturing exploitative innovation (e.g., "We launch innovations that reinforce our prevailing product/service lines.") and 3 items capturing exploratory innovation (e.g., "We launch innovations that make our prevailing product/service lines obsolete"). Participants responded to each item on a 5-point scale, from 1 = *strongly disagree* to 7 = *strongly agree*. The Cronbach's  $\alpha$  for this scale was .92.

**Control Variables.** We controlled for the following company characteristics in the analysis. First, we incorporated company age as a control variable, because companies with longer operationalized experience tend to accumulate more resources and expertise that could impact performance and innovation (Li et al., 2018, 2021). Second, company size was controlled in our analysis, because companies with larger size tend to have more resources and better managerial capabilities to achieve better performance (Ployhart & Moliterno, 2011). Third, we also controlled for the family-owned nature in our analysis. Noteworthy, in one of our supplemental analyses, we reran our model with no control variables included, and our results stayed robust (please refer to the supplemental analysis section for details).

#### 4.4 Analytic strategies

Theoretical model was tested in a path model using Mplus Version 8.0 (Muthén & Muthén, 1998). Specifically, effects of all control variables (i.e., company age,



company size, and family-owned nature), the independent variable (i.e., age diversity), and the moderator (i.e., environmental uncertainty) were specified on the three endogenous variables (i.e., knowledge transfer between older and younger workers, performance, and innovation). The effect of mediator (i.e., knowledge transfer between older and younger workers) was also specified on the two dependent variables (i.e., company performance and innovation). To examine the moderating role of environmental uncertainty, an interaction term was created as the production of age diversity and environmental uncertainty. To facilitate the results of interaction terms, control variables, independent variable, and the moderator were centered at their means values across companies (Cohen et al., 2013). The Monte Carlo simulation with 20,000 bootstrap repetitions was used to test the mediation and the moderated mediation effects (Selig & Preacher, 2008).

## 5. Results

### 5.1 Confirmatory Factors Analysis

We conducted confirmatory factor analysis (CFA) to test discriminant validity of our measures. Given that we collected data from different sources (i.e., manager, HR, and employee) and our data had a nested structure (i.e., employees' responses were embedded in each company), we conducted multi-level CFA. Aligned with data structure and the theoretical model, we specified a five-factor model, with knowledge transfer between older and younger workers was specified at both the within and the between levels, whereas company performance, innovation, and environmental uncertainty were specified at the between level. Results showed that this five-factor model fitted the data well,  $\chi^2(362) = 2291.09$ , RMSEA = .05, CFI = .91, TLI = .90, SRMR = .07 at the within level .06 at the between level. We further specified six alternative models by loading items measuring any two factors at the between level onto the same latent factor. Results showed that all these models fitted the data worse than the theoretical five-factor model, with  $\Delta \times 2$  ranging from 484.21 to 1254.99, and  $p < .001$ . Results of CFA are presented in Table 1. Therefore, these results provide support for distinct validity of measures used in our study and these measures captured distinct constructs.

**Table 1 Results of Confirmatory Factor Analysis**

| <b>Model</b>                  | <b>RMSEA</b> | <b>CFI</b> | <b>TLI</b> | <b>SRMR-<br/>within</b> | <b>SRMR-<br/>between</b> | <b><math>\chi^2</math></b> | <b><i>df</i></b> | <b><math>\Delta\chi^2</math></b> | <b><math>\Delta df</math></b> | <b><i>p</i>-<br/>value</b> |
|-------------------------------|--------------|------------|------------|-------------------------|--------------------------|----------------------------|------------------|----------------------------------|-------------------------------|----------------------------|
| Five-<br>factor<br>model      | .05          | .91        | .90        | .07                     | .06                      | 2291.09                    | 352              | --                               | --                            | --                         |
| Four-<br>factor<br>model      | .07          | .86        | .84        | .07                     | .16                      | 3546.08                    | 365              | 1254.99                          | 3                             | <.001                      |
| A<br>Four-<br>factor<br>model | .06          | .88        | .87        | .07                     | .14                      | 2928.64                    | 365              | 637.55                           | 3                             | <.001                      |
| B<br>Four-<br>factor<br>model | .06          | .88        | .87        | .07                     | .12                      | 2917.71                    | 365              | 626.62                           | 3                             | <.001                      |
| C<br>Four-<br>factor<br>model | .06          | .89        | .88        | .07                     | .11                      | 2775.30                    | 365              | 484.21                           | 3                             | <.001                      |
| D<br>Four-<br>factor<br>model | .06          | .89        | .87        | .07                     | .11                      | 2901.43                    | 365              | 610.34                           | 3                             | <.001                      |
| E<br>Four-<br>factor<br>model | .06          | .88        | .87        | .07                     | .12                      | 2907.07                    | 365              | 615.98                           | 3                             | <.001                      |
| F                             |              |            |            |                         |                          |                            |                  |                                  |                               |                            |

*Note.* RMSEA = root-mean-square error of approximation. CFI = comparative fit index. TLI = Tucker-Lewis index. SRMR = standardized root-mean-square residual.

## 5.2 Descriptive statistical analysis

Means, standard deviations, and correlations among studied variables are presented in Table 2. The means of age diversity, environmental uncertainty, knowledge transfer between older and younger worker, company performance and innovation are 0.65, 2.29,3.98,4.52 and 3.67 respectively.

**Table 2 Means, Standard Deviations, Correlations, and Reliabilities**

| Variables   | Mean  | S.D. | 1      | 2      | 3      | 4      | 5     | 6     | 7     | 8     |
|---|-------|------|--------|--------|--------|--------|-------|-------|-------|-------|
| 1. Company age  | 11.95 | 9.97 | --     |        |        |        |       |       |       |       |
| 2. Company size <sup>a</sup>                            | .81   | 2.29 | .39**  | --     |        |        |       |       |       |       |
| 3. Family-owned nature                                  | 1.54  | .63  | -.34** | -.29** | --     |        |       |       |       |       |
| 4. Age diversity  | .65   | .16  | .34**  | .27**  | -.42** | --     |       |       |       |       |
| 5. Environmental uncertainty                            | 2.29  | 1.15 | -.01   | -.02   | .05    | -.09   | (.97) |       |       |       |
| 6. Knowledge transfer between older and younger workers | 3.98  | .70  | -.01   | -.10   | .11    | -.28** | .06   | (.98) |       |       |
| 7. Performance  | 4.52  | 1.24 | .06    | -.06   | -.07   | .07    | .14*  | .41** | (.97) |       |
| 8. Innovation   | 3.67  | .90  | -.19** | -.17** | .24**  | .00    | .08   | .40** | .45** | (.92) |

Note.  $N = 338$ . \*  $p < .05$ , \*\*  $p < .01$ , two-tailed. Cronbach's alphas are presented in parentheses along the diagonal. <sup>a</sup> Measured in 1000 employees.

## 5.3 Hypotheses Tests

Unstandardized coefficients of the path model are presented in Table 3 and Figure 2. As shown in Table 3 and Figure 2, age diversity was negatively associated with knowledge transfer between young and old workers ( $\gamma = -1.34$ ,  $p = .01$ ). Hence, **Hypothesis 1 was supported.**

Further, knowledge transfer between older and younger workers was positively related to company performance ( $\gamma = 1.06$ ,  $p < .001$ ) and innovation ( $\gamma = .84$ ,  $p < .001$ ).

Results of Monte Carlo simulation with 20,000 replications showed that the indirect effect of age diversity on company performance and innovation was -1.427 (95% confidence interval [CI] = [-2.767, -.366]) and -1.128 (95% CI = -2.154, -.286), respectively. As such, **Hypothesis 2 was also supported** by the data.

We also found that environmental uncertainty shaped the impacts of age diversity on knowledge transfer between older and younger workers ( $\gamma = 2.38$ ,  $p < .001$ ). We present the moderating effect of environmental uncertainty in Figure 3. As shown in Figure 3, age diversity was negatively associated with knowledge transfer between older and younger workers when environmental uncertainty was lower (slope = -4.07,  $p < .001$ ). However, the relationship between age diversity and knowledge transfer between older and younger workers was positive but only marginally significant (slope = 1.39,  $p = .07$ ). Hence, **our Hypothesis 3 was supported**.

Results of Monte Carlo simulation showed that the indirect effects of age diversity on company performance and innovation were also shaped by environmental uncertainty. The moderated mediation effects were 2.533 (95% CI = [1.376, 4.515]) on company performance and 2.002 (95% CI = [.859, 3.722]) on innovation. Specifically, the indirect effect of age diversity on performance via knowledge transfer between older and younger workers was negative and significant when environmental uncertainty was lower (conditional indirect effect = -4.332, 95% CI = [-7.472, -2.573]), but was not significant when environmental uncertainty was higher (conditional indirect effect = 1.479, 95% CI = [-.657, 3.789]). The difference between the two conditions was significant (difference = 5.811, 95% CI = [3.155, 10.356]). Similarly, the indirect effect of age diversity on innovation via knowledge transfer between older

and younger workers was negative when environmental uncertainty was lower (conditional indirect effect = -3.424, 95% CI = [-6.353, -1.555]), but was not significant when environmental uncertainty was higher (conditional indirect effect = 1.169, 95% CI = [-.357, 3.105]). The difference between the two conditions was significant (difference = 4.593, 95% CI = [1.970, 8.537]). Therefore, **our Hypothesis 4 was also supported.**

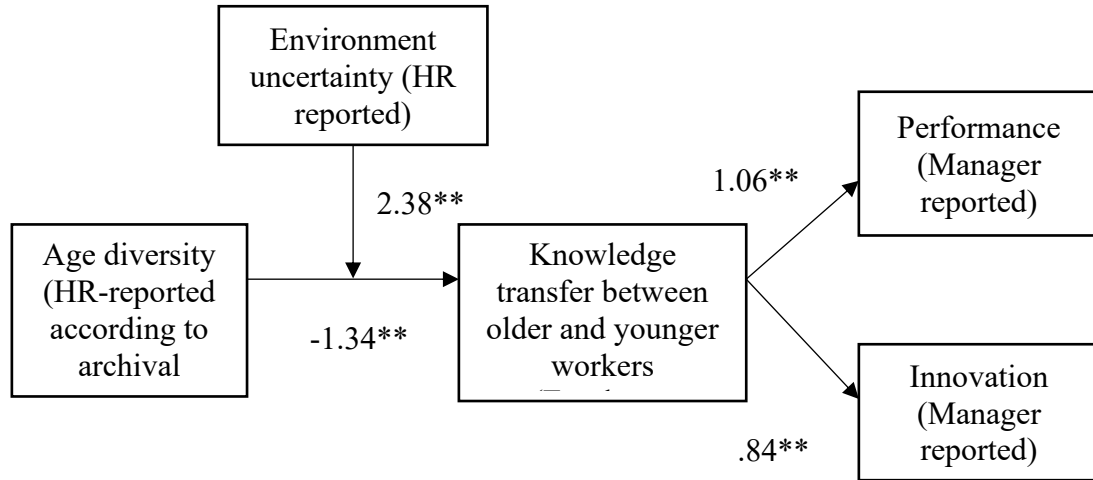
**Table 3 Unstandardized Coefficients of Path Analysis**

| <b>Variables</b>   | Knowledge transfer between older and younger workers |             |                | Performance     |             |                | Innovation      |             |                |
|--|--|-------------|----------------|-----------------|-------------|----------------|-----------------|-------------|----------------|
|  | <i>Estimate</i>                                      | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> |
| Intercept  | 4.06**   | .05         | <.001          | .24             | .81         | .77            | .29             | .71         | .68            |
| <b>Control variables</b>                                   |  |             |                |                 |             |                |                 |             |                |
| Company age  | .00  | .01         | .92            | .01             | .01         | .57            | -.01            | .01         | .09            |
| Company size <sup>a</sup>                                  | .00  | .02         | .91            | -.05            | .03         | .15            | -.03            | .02         | .23            |
| Family-owned nature  | .03  | .07         | .70            | -.23            | .12         | .06            | .23*            | .09         | .01            |
| <b>Predictors</b>  |  |             |                |                 |             |                |                 |             |                |
| Age diversity  | -1.34**  | .50         | .01            | 1.09            | .82         | .18            | 1.28            | .74         | .08            |
| Environmental uncertainty                                  | .07  | .04         | .09            | .10             | .07         | .15            | .01             | .05         | .86            |
| Age diversity ×<br>Environmental uncertainty               | 2.38**   | .32         | <.001          | -1.75*          | .89         | .05            | -1.77*          | .85         | .04            |
| Knowledge transfer<br>between older and younger<br>workers |  |             |                | 1.06**          | .20         | <.001          | .84**           | .17         | <.001          |
| Residual variance  | .26**  | .05         | <.001          | 1.16**          | .11         | <.001          | .57**           | .08         | <.001          |
| <b>R<sup>2</sup></b>                                       |  | 46%         |                |                 | 24%         |                |                 | 31%         |                |

Note.  $N = 338$ . \*  $p < .05$ , \*\*  $p < .01$ , two-tailed. <sup>a</sup> Measured in 1000 employees.

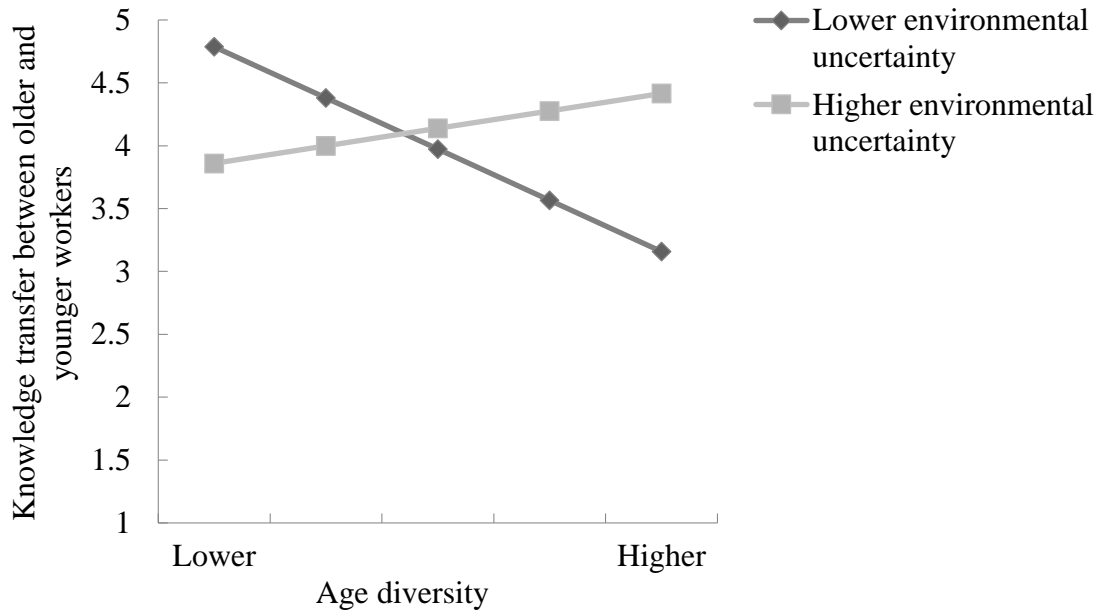
**Figure 2 Unstandardized Coefficients of Path Analysis**

Note.  $N = 338$ . \*  $p < .05$ , \*\*  $p < .01$ , two-tailed.





**Figure 3 The Moderating Role of Environmental Uncertainty on the Relationship Between Age Diversity and Knowledge Transfer Between Older and Younger Workers**



## 5.4 Supplemental Analyses

We conducted two sets of supplemental analyses to test the robustness of our results. First, following recommendations from Becker (2005), Bernerth and Aguinis (2016), we reran our model with no control variables included. We present our results in Table 4. As shown in Table 4, we obtained similar result patterns as we reported in the main analyses. Specifically, age diversity was negatively associated with knowledge transfer between older and younger workers ( $\gamma = -1.39, p < .001$ ), which was further positively associated with company performance ( $\gamma = 1.07, p < .001$ ) and innovation ( $\gamma = .64, p < .001$ ). Further, the negative association between age diversity and knowledge transfer between older and younger workers was attenuated by environmental uncertainty ( $\gamma = 2.45, p < .001$ ).

**Table 4 Unstandardized Coefficients of Path Analysis with No Controls**

| <b>Variables</b>   | Knowledge transfer between older and younger workers |             |                | Performance     |             |                | Innovation      |             |                |
|--|--|-------------|----------------|-----------------|-------------|----------------|-----------------|-------------|----------------|
|  | <i>Estimate</i>                                      | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> |
| Intercept  | 4.03**   | .05         | <.001          | .26             | .85         | .76            | 1.04            | .95         | .27            |
| <b>Predictors</b>  |  |             |                |                 |             |                |                 |             |                |
| Age diversity  | -1.39**  | .35         | <.001          | 1.37*           | .67         | .04            | -.95            | .68         | .16            |
| Environmental uncertainty                                  | .08  | .04         | .07            | .10             | .07         | .14            | -.01            | .05         | .82            |
| Age diversity ×<br>Environmental uncertainty               | 2.45**   | .27         | <.001          | -1.61           | .92         | .08            | -1.39           | 1.15        | .23            |
| Knowledge transfer<br>between older and younger<br>workers |  |             |                | 1.07**          | .21         | <.001          | .64**           | .23         | .01            |
| Residual variance  | .25**  | .05         | <.001          | 1.19**          | .11         | <.001          | .61**           | .07         | <.001          |
| <b>R<sup>2</sup></b>                                       |  | 49%         |                |                 | 23%         |                |                 | 25%         |                |

Note.  $N = 338$ . \*  $p < .05$ , \*\*  $p < .01$ , two-tailed. <sup>a</sup> Measured in 1000 employees.

We reran the other set of supplemental analyses by using listwise deletion in model testing. Our sample size turned to 137 when doing so, and we present our results in Table 5. Similarly, as reported in Table 5, we obtained similar results patterns as reported in the main analyses. Specifically, we also found a negative relationship between age diversity and knowledge transfer between older and younger workers ( $\gamma = -.45, p = .01$ ). Knowledge transfer between older and younger workers was then positively associated with company performance ( $\gamma = 1.24, p < .001$ ) and performance ( $\gamma = .50, p = .01$ ). Further, the negative impact of age diversity on knowledge transfer between older and younger workers was also mitigated by environmental uncertainty ( $\gamma = .86, p < .001$ ).

Overall, the above analyses show that the results are robust.

**Table 5 Unstandardized Coefficients of Path Analysis with Listwise Deletion**

| <b>Variables</b>   | Knowledge transfer between older and younger workers |             |                | Performance     |             |                | Innovation      |             |                |
|--|--|-------------|----------------|-----------------|-------------|----------------|-----------------|-------------|----------------|
|  | <i>Estimate</i>                                      | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> | <i>Estimate</i> | <i>S.E.</i> | <i>p-value</i> |
| Intercept  | 4.08**   | .03         | <.001          | -.26            | 1.39        | .85            | 1.36            | .75         | .07            |
| <b>Control variables</b>                                   |  |             |                |                 |             |                |                 |             |                |
| Company age  | -.01   | .00         | .11            | -.02            | .01         | .22            | -.01            | .01         | .11            |
| Company size <sup>a</sup>                                  | .02  | .01         | .08            | -.04            | .04         | .37            | -.01            | .02         | .67            |
| Family-owned nature  | .11*   | .05         | .02            | -.51**          | .16         | .002           | -.10            | .08         | .21            |
| <b>Predictors</b>  |  |             |                |                 |             |                |                 |             |                |
| Age diversity  | -.45*  | .18         | .01            | .69             | .65         | .29            | .38             | .33         | .24            |
| Environmental uncertainty                                  | -.02   | .03         | .52            | -.01            | .11         | .97            | -.01            | .05         | .90            |
| Age diversity ×<br>Environmental uncertainty               | .86**  | .18         | <.001          | -1.10           | .73         | .13            | -.58            | .37         | .12            |
| Knowledge transfer<br>between older and younger<br>workers |  |             |                | 1.24**          | .34         | <.001          | .50**           | .18         | .01            |
| Residual variance  | .08**  | .01         | <.001          | .87**           | .11         | <.001          | .22**           | .03         | <.001          |
| <b>R<sup>2</sup></b>                                       |  | 29%         |                |                 | 18%         |                |                 | 12%         |                |

Note.  $N = 137$ . \*  $p < .05$ , \*\*  $p < .01$ , two-tailed. <sup>a</sup> Measured in 1000 employees.

## 5.5 Preliminary discussion

In conclusion, our study provides strong support for all of the hypotheses we proposed. Our data revealed that age diversity among employees can have a negative impact on company performance and innovation outcomes when knowledge transfer is limited. Conversely, our data also showed that when knowledge transfer is enhanced among employees of different ages, firms are more likely to experience better performance and innovation outcomes.

Our study also revealed that environmental uncertainty plays a significant moderating role in the relationship between age diversity in organizations and knowledge transfer among employees of different ages. Specifically, we found that when environmental uncertainty is high, the indirect effect of age diversity on knowledge transfer is stronger compared to when environmental uncertainty is low.

Overall, our findings suggest that organizations need to be aware of the moderating role of environmental uncertainty when managing age diversity and promoting knowledge transfer. By creating a more supportive environment for knowledge sharing and collaboration, firms can facilitate better performance and innovation outcomes, particularly in uncertain environments.

## **6. Discussion and conclusion**

### **6.1 Theoretical implications**

This study aims to reveal the important mediating role played by knowledge transfer between older and younger employees within organizations in the impact of age diversity on organizational performance and innovation processes. Previous studies have mainly focused on exploring the relationship between employees' individual age and their job performance, or the impact of age diversity at the group level on individual job performance. However, it is not clear how organizational diversity promotes the exchange and integration of diverse information within the organization and further influences the innovation and market performance of the organization. Therefore, this study addresses the limitations of previous research and elucidates how age diversity in the organizational can effectively impact organizational processes through knowledge transfer between different groups. This explains the "black box" mechanism of the impact of organizational age diversity on organizational processes and provides a reference for a deeper understanding of the effectiveness of diversity in organizations, enriching the research on the heterogeneity of employee age structure in the field of enterprise human resources.

This study also incorporates environmental uncertainty into the research model, considering its role as a boundary condition for moderation. Previous studies on the utility of diversity have mostly focused on the boundary effects of team atmosphere or leadership style (Li & Liang, 2015), with little consideration given to environmental uncertainty. However, environmental uncertainty has an undeniable impact on knowledge transfer among employees within enterprises, as well as on enterprise

performance and innovation. Therefore, this study explores how environmental uncertainty moderates the indirect effect of organizational age diversity on market performance and innovation by promoting knowledge transfer between older and younger employees, providing an environmental perspective for organizational innovation.

In summary, this paper empirically analyzes the relationship between the age diversity of employee in enterprises and their business performance and innovation, revealing the important mediating role played by knowledge transfer between older and younger employees within organizations in the impact of age diversity on organizational performance and innovation processes. Furthermore, this study examines the moderating effect of environmental uncertainty on the impact of age diversity of employee to the company performance and innovation.

## **6.2 Practical implications**

Ageing is a crucial issue that China and the world at large are currently facing. Population ageing has become a significant challenge faced by both developed and developing countries. China's unique ageing characteristics have been shaped by more than 30 years of reform and opening-up and a long-standing family planning policy. Therefore, the age span of employees in enterprises will become more extensive, and enterprise managers must establish a more inclusive human resources strategic management system. In this context, it is crucial to study the relationship between employee age structure and enterprise performance, especially for Chinese companies that emphasize the importance of social status and respect for authority under the Confucian culture. The hierarchical concept could hinder knowledge exchange by



creating a culture of obedience and conformity. This can lead to a lack of critical thinking and innovation, as employees may be hesitant to share their ideas or express their opinions. According to the research in this paper, age diversity has a negative impact on enterprise performance, but this negative effect can be mitigated in the face of an increasingly complex and competitive market environment which promote more knowledge transfer between elder employee and younger employee.

In today's rapidly changing world, environmental uncertainty is increasing, posing significant challenges for businesses. To cope with the challenges of environmental uncertainty, businesses need to adapt to changes and improve their ability to learn and innovate. Internal knowledge exchange plays a critical role in helping businesses to adapt to changes and innovate. Therefore, how to strengthen internal knowledge exchange under high environmental uncertainty is an essential issue for businesses to address. Enterprises should pay more attention to promoting communication and collaboration among employees of different age groups, creating a friendly and harmonious organizational atmosphere, reducing communication barriers among employees of different age groups, and fully tapping into the knowledge, skills, and abilities of different employees.

Under conditions of high environmental uncertainty and age diversity, knowledge exchange becomes crucial for enhancing company performance and innovation. Knowledge exchange involves the sharing of information, skills, and experience among individuals and teams within a company. It can help bridge the gaps between different age groups and promote understanding, respect, and collaboration.

Additionally, it can help overcome the negative impacts of environmental uncertainty by providing the necessary information and resources to adapt to changing conditions.

To strengthen internal knowledge exchange under high environmental uncertainty, businesses can adopt several strategies. Firstly, they can establish a culture of knowledge sharing. To do so, businesses must create a culture that values knowledge sharing and collaboration. This culture should emphasize the importance of sharing knowledge and information, while also providing incentives for individuals and groups to do so. Secondly, businesses can develop knowledge-sharing platforms. These platforms can take various forms such as online forums, wikis, and blogs and can enable individuals and groups to share knowledge and information easily. To ensure effectiveness, these platforms should be user-friendly, easily accessible, and secure. Thirdly, informal mentoring and coaching can be encouraged as an effective way to facilitate knowledge exchange. Businesses can encourage individuals and groups to seek out mentors and coaches to learn from their experiences and perspectives. Managers can also serve as mentors and coaches and provide guidance and support to individuals and groups. Lastly, businesses can establish communities of practice to facilitate knowledge exchange and innovation. Communities of practice are groups of individuals who share a common interest or expertise and who collaborate to share knowledge and information. Establishing communities of practice can help businesses to encourage knowledge sharing and innovation.

In conclusion, the high level of environmental uncertainty and age diversity within a company creates significant challenges for maintaining high levels of company performance and innovation. Knowledge exchange becomes a critical factor in helping

organizations overcome these challenges. Through the adoption of various strategies such as creating a culture of knowledge sharing, developing knowledge-sharing platforms, encouraging informal mentoring and coaching, and establishing communities of practice, businesses can enhance their internal knowledge exchange, improve company performance, and foster innovation.

### **6.3 Limitations and future directions**

In the course of this study, due to sample selection limitations, this paper has certain deficiencies and limitations in the research process, which are manifested as follows:

Firstly, the study has insufficient exploration of employee diversity. Although the individual age of employees reflects to a certain extent their knowledge, skills, abilities, work styles, and values, exploring employee diversity through multiple dimensions would better reveal the relationship between employee heterogeneity and business performance. However, due to the limitation of data collection of knowledge, skills, abilities, work styles, and values etc., this paper uses age structure as the dimension of feature to conduct research.

Secondly, when exploring the relationship between employee age diversity and business performance and innovation, the study only take knowledge transfer between older and younger employees into consideration as a mediator. In fact, there are lots of factors that may affect the relationship between age diversity and business performance and innovation, such as, organizational culture, human resource management practices, team communication frequency, interaction process and team type as well. There are also mediation effects in the mechanism of the effect of age diversity on business

performance, such as team leadership, team conflict, team communication, social integration, and team reflection. Therefore, in exploring the mechanism of the effect of age diversity on business performance, it is necessary not only to enrich the moderator variables but also to explore how diversity can leverage employee diversity through intermediary mechanisms.

Thirdly, our research indicates that age diversity is negatively related to firm performance and innovation, providing support for social categorization theory. One of the reasons behind this phenomenon could be attributed to the influence of Confucian culture on knowledge exchange among employees of different age groups in Chinese companies. One of the core concepts of Confucian culture is the hierarchical order, which emphasizes the importance of social status and respect for authority. This hierarchical concept is deeply ingrained in Chinese society and can hinder knowledge transfer between older and younger workers by creating a culture of obedience and conformity. In Chinese companies, employees may be reluctant to challenge the authority of their seniors or question their decisions, even if they disagree with them. This can lead to a lack of critical thinking and innovation, as employees may be hesitant to share their ideas or express their opinions. Furthermore, younger employees may be hesitant to share their knowledge and ideas with their seniors, as they may fear being seen as disrespectful or insubordinate. This is especially true for Chinese companies that emphasize the importance of social status and respect for authority under the Confucian culture. The hierarchical concept could hinder knowledge exchange by creating a culture of obedience and conformity, resulting in a lack of critical thinking and innovation.

Fourthly, we used questionnaires as the primary method for data collection. To ensure better comparability, we categorized age diversity into five age groups. For measuring environmental uncertainty, participants were asked to rate four items (economic, technological, policy and regulatory, and societal) on a 7-point scale. The measurement of knowledge exchange between older and younger employees was based on an adapted eleven-item scale for intergenerational knowledge exchange. In contrast, firm performance and innovation were measured using six items each. In the future, it would be beneficial to include more objective indicators to measure variables such as environmental uncertainty, performance, and innovation. This would provide further validation for our model and conclusions.

This study clarifies the role of employee age diversity level in company performance and innovation. Based on the research results and limitations mentioned above, the author believes that future research can be further deepened in the following areas:

Firstly, in measuring the level of employee diversity, it is possible to delve into the internal level of the enterprise and measure employee diversity from multiple dimensions, comprehensively exploring the relationship between employee diversity and business performance, rather than just limiting it to age dimensions. As analyzed earlier, the level of employee diversity not only has explicit demographic characteristics (such as age, gender, and race) but also has implicit characteristics, such as occupational backgrounds and values. Therefore, in exploring the mechanism of the effect of diversity, it is possible to increase the measurement dimensions of diversity.

Secondly, when exploring the mechanism of the effect of employee age diversity, it is necessary to consider more mediator, such as individual and organizational cognitive responses, internal conflicts, etc. Therefore, in future research, the relevant mediating effects of the mechanism of age diversity should be enriched.

The third limitation of the study highlights the need for further comparative research to explore the impact of Confucian culture on knowledge exchange within companies compared to those in Western countries. Confucian culture, which emphasizes hierarchy and respect for authority, has been shown to hinder knowledge exchange in Chinese companies. This is because the hierarchical concept can create a culture of obedience and conformity, resulting in a lack of critical thinking and innovation. On the other hand, Western companies generally have a flatter organizational structure and place a greater emphasis on individualism, which may encourage more open and innovative knowledge exchange. Therefore, comparative research between Chinese companies and Western companies could shed light on the factors that promote or hinder knowledge exchange in organizations. Furthermore, future studies could explore the extent to which Confucian values such as hierarchy and respect for authority affect knowledge exchange within organizations, and how these values may be adapted or changed in response to global business practices. Comparative research between Chinese and Western companies have the potential to generate valuable insights into how organizations can promote knowledge exchange and leverage employee diversity for improved business performance and innovation.

Fourthly, to further validate our model and conclusions, it would be beneficial to incorporate additional objective indicators in our study. Many scholars have utilized

various objective indicators to measure variables such as environmental uncertainty, performance, and innovation. For instance, in terms of objectively measuring environmental uncertainty, we could include calculations such as the standard deviation of sales revenue and employee turnover rate. When examining performance, we could explore factors like return on investment, return on equity, return on asset, Tobin's Q, or sales (Schneid et al., 2016). Additionally, we could incorporate more objective indicators for innovation, such as the number of patents, awards received for technological advancements, the R&D expenses, the number of R&D personnel, the percentage of new products into the index system, etc.

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## **Appendix**

### **Measures used**

#### **Age diversity (calculated by employee age composition)**

Please report the percentages of employees in your organization that are in the following age range.

1.  $\leq 29$  \_\_\_\_\_

2. 30-39 \_\_\_\_\_

3. 40-49 \_\_\_\_\_

4. 50-59 \_\_\_\_\_

5.  $\geq 60$  \_\_\_\_\_

#### **Environmental uncertainty**

1. How stable/dynamic is the external environment facing your company in terms of economic aspect?

2. 1. How stable/dynamic is the external environment facing your company in terms of technological aspect?

3. 1. How stable/dynamic is the external environment facing your company in terms of political/regulatory aspect?

4. 1. How stable/dynamic is the external environment facing your company in terms of social aspect?

### **Knowledge transfer between older and younger workers**

1. In the company, older workers initiate knowledge transfer to younger workers
  2. In the company, older workers teach and train younger workers
  3. In the company, older workers share their accumulated work experiences with younger workers
  4. In the company, older workers assist younger workers with problem solving
  5. In the company, older workers are responsive to younger workers' inquiries
  6. In the company, older workers help with the development of younger workers.
- 
1. In my workplace, younger workers provide older workers with information about current products and services.
  2. In my workplace, younger workers exchange ideas and information about industry trends with older workers.
  3. In my workplace, younger workers share activities with older workers that provide learning.
  4. In my workplace, older workers have learned much from younger workers' direct contact with them.
  5. In my workplace, younger workers exchange knowledge about customers, suppliers, and competitors with older workers.

### **Company performance**

1. in comparison with that of major competitors in terms of achieving overall performance, how was your company's performance?

2. in comparison with that of major competitors in terms of growth in sales revenue, how was your company's performance?

3. in comparison with that of major competitors in terms of net profit after taxes, how was your company's performance?

4. in comparison with that of major competitors in terms of return to shareholders, how was your company's performance?

5. in comparison with that of major competitors in terms of market share growth, how was your company's performance?

6. in comparison with that of major competitors in terms of product (or service) quality, how was your company's performance?

### **Company innovation**

1. We launch innovations that reinforce our prevailing product/service lines.

2. We launch innovations that reinforce our existing expertise in prevailing products/services.

3. We launch innovations that reinforce how we currently compete.

1. We launch innovations that make our prevailing product/service lines obsolete.

2. We launch innovations that fundamentally change our prevailing products/services.

3. We launch innovations that make our existing expertise in prevailing products/services obsolete.