# Master Thesis

## The impact of Team diversity and leadership on innovative behavior in R&D teams of Chinese industrial firms


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# Abstract

This research aimed at finding out the both direct and indirect impact of team diversity and leadership on innovative behavior of employees in the Chinese R&D teams of industrial firms. Team climate and team cohesion are regarded as the mediators to assist team diversity and team leadership to make indirect influence on innovative behavior. In this research, team diversity is divided into non-task oriented diversity and task oriented diversity while team leadership is defined as transformational leadership.

An online questionnaire has been used as the research instrument and eventually 84 respondents from 12 R&D teams of 12 different Chinese industrial firms participated in this research. The first finding of this research is that in the Chinese R&D teams, only region diversity positively and directly influences innovative behavior while function diversity has direct and negative effects on innovative behavior. Transformational leadership and other diversity factors doesn’ t be proved that have positive influence on innovative behavior. In addition, team climate and team cohesion both fail to act as the role of mediator. What’ s more, this research finding also filling a gap between transformational leadership and team diversity in the Chinese R&D teams, which shows that tenure diversity can stimulate team leader to be more transformational while function diversity limits the ability of team leader to form transformational leadership.

**Key words:** Team diversity, Transformational leadership, team climate, team cohesion, R&D teams, China

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# 1. Introduction and objective of the research

With the increasing worldwide competition and ever more pressing changes in the commercial environment, organizations' ability to innovate is gradually accepted as a key factor to ensure them to success (Cohen & Levinthal, 1990; Leonard-Barton, 1995; Brown & Eisenhaurdt, 1997; Tsai, 2001). Innovation seems to be vital outcomes to enable organizations to obtain sustainable development, especially in the industrial field. The industrial firms, one of the driving forces to make great contributions to the rapid economic development, have business activities which mainly focus on high tech productivities and innovations, (Griliches & Regev, 1995; Medcof, 1999; Chorev & Anderson, 2006). Innovation brings the financial growth as well as a good reputation to the industrial firms in the end. Thus it follows that the advancement of industrial firms acquires the dependence on innovations.

Zheng et al. (2010) argue that when it comes to arousing competitive development of organizations, research and development (R&D) teams bear more responsibilities for innovation in organizations. R&D teams are deemed to be the most essential teams to bring innovation and sustainable development capacity to firms. They accomplish this through R&D activities and by creating new products (Oakey et al., 1988). Thus, the successful outcomes of a R&D team becomes more and more desirable and the work of R&D teams becomes more and more vital to the long-term success of a firm (Balachandra & Friar, 1997; Sun & Wing, 2005; Nagesh & Thomas, 2015). However, the success on innovation rate of R&D teams is low, which attracts the attention of researchers to find the impact factors to improve the success rate of innovation in R&D teams (Zheng et al., 2010). People's behavior to create, revise and apply the ideas forms the bases of innovation (Scott & Bruce, 1994). Such behavior can be defined as the innovative behavior because innovative behavior is also composed by such behavior. Innovative behavior is a type of multilevel behavior, from developing ideas in the first place to applying ideas finally, which produces innovation for firms to survive in the fierce competition (Yuan, & Woodman, 2010). Thus, it is evident that innovation has a strong connection with innovative behavior, which is also supported by many researchers (eg: Kleysen & Street, 2001; Janssen, 2004; Greve, 2003). In other words, it seems to be vital to find out how to improve the innovative behavior within R&D teams to succeed, since there is a strong link between innovative behavior and innovation.

Scott and Bruce (1994) inform us that R&D teams, normally regarded as the valuable cases, drive the whole firms' innovation and as a result, it seems to be vital to find the determinants for innovative behavior in R&D teams (Scott & Bruce, 1994). Therefore, this paper will follow the research of Scott and Bruce (1994) to make a study on the innovative behavior in R&D teams.

In the past decades, a lot of reforms took place in China. Moreover, the evolution of economy and technology under the Chinese context also progresses at a fastest pace. After such rapid development in the economy and technology, R&D in China produces new products and creates innovation. These outcomes influence the world remarkably (Fischer & Von Zedtwitz, 2004). In order to sustain constant development, China pays close attention to the development of R&D teams. Large amounts of investment have been put into R&D teams. The data shows that in 2001, the cost of R&D in China increased to US$60 billion, which is only behind the USA and Japan (Von Zedtwitz, 2004). In addition, China attracted more and more western firms to invest in Chinese industrial firms. The data indicates that in 2013, China had an investment inflow of US$121 billions from foreign countries (UNCTAD, 2013; Postelnicu & Dabija, 2015). Except the expenditure on R&D teams, Chinese firms also pay more attention to input of human resources in R&D teams. The number of researchers (743,000) who work in the R&D field in 2001 is the second biggest number of researchers in the world, only behind the USA and ahead of Japan (Von Zedtwitz, 2004). In this situation, it is clear that R&D teams play a vital role in the Chinese context. What's more, Fischer and Von Zedtwitz (2004) stated that the development of the Chinese R&D teams in the industrial firms is valuable to forecast. As mentioned before, innovative behavior is a momentous factor for R&D teams to succeed. Leung et al. (2014) indicate that innovative behavior is vital for Chinese firms but it can be easily influenced by relational factors such as cooperation and fear for failure. Thus it is necessary to find out the important factors that can improve employees' innovative behavior (Leung et al., 2014). However, limited researches have focused on innovative behavior of employees in Chinese industrial firms, especially in R&D teams. Therefore, it is meaningful to set the background of the research on innovative behavior in the R&D teams in the Chinese context (in Chinese industrial firms).

In this research, since the innovative behavior is important to R&D teams of Chinese

industrial firms, it is valuable to find out what influences the innovative behavior in R&D teams of the Chinese industrial firms. Based on Horwitz (2005) and Jackson and Joshi (2004)'s research, it was found that team diversity can help the team members produce different opinions and ideas which can easily form a positive brainstorm to improve the creativity in the team (Jackson & Joshi, 2004). But in accordance with the Chinese culture, Chinese teams tend to lack team diversity among the team members. These teams are often composed of members with the same background in order to form the same value and same point of view (Chou et al., 2006). The employees in Chinese working team, the employees who have the same position are almost in the same generation and have a similar educational background. What's more, Chinese are the collectivist and prefer the group-oriented behavior and focus on harmony among the group members (Qian et al., 2013). As it is mentioned before, innovations require an open mind and various ideas, which hardly happen without the team diversity. And according to the recent situation in China, because of the introduction of various educated Chinese talents into firms, the demographic diversity in the firms become significant. In this case, it is interesting to discuss the degree of team diversity in R&D teams and how team diversity directly influences the behavior among the team members. Chou et al. (2006) also supports that it is necessary to be discussed in the Chinese context, although team diversity has been well studied in the western context (Chou et al., 2006).

Due to the fact that diverse team members have different perspectives and cognitions and it is hard for them to cooperate (Halcomb et al., 2007), it is vital for the team leader to guide the whole team members to work together, share knowledge and form a mindset to achieve the same goal (Kearney & Gebert, 2009). Fischer and Von Zedtwitz (2004) supported that it is vital for a Chinese R&D team leader to learn to manage the team and to come up with the flow of good ideas to support innovations (Fischer & Von Zedtwitz, 2004). Additionally, many researches also show that team leadership should be regarded as an important factor to improve team members' performance and make support to manage the R&D team (e.g. Czarnitzki & Kraft, 2004; Howell & Avolio, 1993; Hackman, 2002). Thus, this paper will also discuss the direct effect on innovative behavior which made by the team leadership. As mentioned previously, there is a link between team leadership and team diversity and Jackson et al. (2003) also indicates that the relationship of leadership and team diversity is an unexplored area. Thus, this

paper will discuss the relationship between team leadership and team diversity, especially in the Chinese context as well.

This paper will discuss the direct effect, as well as the indirect effect, that team diversity and team leadership have on innovative behavior. Based on the previous researches and compared to other factors such as team values and team size (Curral et al,. 2001), team climate and team cohesion are mostly mentioned when scholars study how the team characteristics make efforts to the innovative behavior (e.g. Czarnitzki & Kraft,2004; Howell & Avolio,1993; Hackman, 2002; Kratzer et al., 2006). Leung et al. (2014) also indicate that team climate is quite important for Chinese employees to improve innovative behavior. The research of Pirola-Merlo et al (2002) and Hambley et al. (2007) shows that team leadership makes influence on the team climate and team cohesion. At the same time team leadership creates an indirect effect on innovations via team climate and team cohesion. According to Jackson and Joshi (2004), and Isaksen and Lauer, (2002), team diversity makes influence on innovative behavior via team cohesion and team climate. These two team characteristics (team climate and team cohesion) will increase working effectiveness in an innovative working environment. Therefore, besides the direct efforts on the innovative behavior that made by team diversity and team leadership, this paper will introduce two mediators (team climate and team cohesion) and study the indirect influence made by team diversity and team leadership via team climate and team cohesion.

To conclude, this paper aims to discuss the direct impact of team diversity, team leadership on innovative behavior in R&D teams. In addition, this paper will also study the indirect influence made by team diversity and team leadership via team cohesion and team climate. What's more, especially research into R&D teams of industrial firms under the Chinese working environment will be investigated. Finally the relationship between team diversity and team leadership will be taken into account as well. It is worth mentioning that the result of the study on innovative behavior in this paper will focus on the team level. The reason is that all the variables such as team cohesion and team climate are only valuable to discuss in a team context.

## 1.1 Research question

Based on the research we discussed before, there can be seen that there will be some interaction between each factors and the innovative behavior in the R&D team. So some problems would appear:

**Main Research Question:**

To what extent do the team diversity and team leadership directly influence the innovative behavior of employees in R&D teams of Chinese industrial firms and do they make indirect influence on innovative behavior via team climate and team cohesion in R&D teams of the Chinese industrial firms?

**Sub questions:**

- What is the composition of the team diversity?
- Which team leadership style make for improving innovative behavior
- Can the team climate and team cohesion be the mediators to assist both team diversity and team leadership to affect the innovative behavior?
- To what extent does team diversity influence the team leadership?

## 1.2 Purpose of the study

The purpose of this study is to make a clear model for the impact that team diversity and team leadership on the innovative behavior via team cohesion and team climate. Additionally, this model will be tested in Chinese R&D teams in the industrial firms. First of all, the finding of this research will explore to what extent team diversity is in R&D teams and to what extent team diversity and team leadership influence Chinese R&D team members in industrial firms. Secondly, this research will also find out if both team cohesion and team climate can build their mediator role in R&D teams under the Chinese context. Finally, since Jackson et al. (2003) point out that the direct relationship of team diversity and team leadership is required to study in the future. Therefore, this research will also fill in this gap and discover to what extent this relationship is under the Chinese industrial context.

To address research aim, the specific research objectives are presented as follows:

- To make a research on how team diversity and team leadership directly influence the team innovative behavior.
- To test if team cohesion and team climate can let the team leadership and team diversity indirectly influences the team innovative behavior
- To investigate the relationship between the team leadership and team diversity.
- To test the model in the Chinese industrial firms

# 2. Literature review and hypothesis

## 2.1 Research and development team (R&D team)

R&D teams (full name: research and development teams), are teams that focus on research and development activities in firms. At the beginning of R&D projects, the ideas are vague, but creativity and technology will help grow ideas into mature products (Kratzer et al,. 2006). R&D teams are the engine to stimulate firms to create new products and ultimately become more and more competitive (Ciborra & Patriotta, 1998). As Huang (2009) said in his research, the R&D team is a core resource to develop the innovative technology and products, and R&D activities can maintain an organization' s innovation level (Huang, 2009). They can bring forth new ideas and create new products, in order enhance the core competitiveness of an organization. Therefore, innovation behavior of R&D team members can help an organization to achieve success to a great extent (Greve, 2003).

Beer et al (1990b) indicates that research and development activities are teamwork in most firms. Teamwork pertains to a group of people with the same goal that work together on one task (Levi & Slem, 1995) These activities need creativity, and if employees are organized in a team, they will make up for shortcomings between each other so that they can increase the innovations by the collaboration in the team (Zarraga & Bonache, 2003). It is universally acknowledged that R&D teams require creativity in order to innovate. Therefore, team members in R&D teams should be creative, have various fresh ideas and should demonstrate great innovative behavior (Scott & Bruce, 1998). R&D team members are willing to work together, communicate with one another frequently, solve design tasks together, and coordinate their tasks through input from all team members (Kratzer et al., 2006). R&D work is quite different from other types of work in the company. Grinter et al. (1999) indicate that "R&D teams normally have a special life cycle, which consist of requirements, proceeds through design, construction, several stages of testing, and delivery to the customer" (Grinter et al. ,1999).

There are two types of R&D teams. One is a projects-based R&D team and the other is a

cross-functional R&D team (Florida, 1997). In project-based R&D teams, the team is usually composed of scientists and engineers who have various knowledge and technology skills (Keller et al, 1996). The cross-functional R&D team is composed of representatives from various existing teams such as technology, research and manufacturing teams (Florida, 1997). R&D teams in high-tech firms are project-based teams (Kim, 1999) with many professionals who have different technological skills. The main work form of R&D teams is teamwork. The team members in the R&D team also try to improve their team innovative performance, by sharing new ideas and various kinds of knowledge (Huang, 2009). The leader of an R&D team is very important. According to the characteristics of various tasks and projects, they should play different roles such as strategic planner, team builder, gatekeeper, technical expert, and champion in order to manage the team members in an efficient way and to create innovations (Kim, 1999).

## 2.2 Innovative behavior

Innovative behavior is commonly used to measure performance of R&D employees (Wang et al., 2015). If an individual' s innovative behavior improves, the whole team innovative performance will be positively influenced (Scott & Bruce, 1994). Innovative performance is also the embodiment of innovative behavior. Individuals in the team that demonstrate significant innovative behavior will also show a remarkable individual innovative performance.

A team member with innovative behavior introduces fresh ideas, products, and processes in his or her working environment (Yuan & Woodman, 2010). Scott and Bruce (1994) described innovative behavior as a multistage process. The first stage consists of problem recognition and idea generation. The second stage is the searching and selecting of sponsorship and support for innovative ideas. In the final stage, individuals in the team build a model or prototype before the innovation can finally be turned over to production (Scott & Bruce, 1994). Based on the research of Scott and Bruce (1994), Wang et al. (2015) introduces three tasks to define innovative behavior, namely idea generation, idea promotion and idea realization. These three tasks represent a process starting with creating ideas (idea generation), followed by attracting support (idea

promotion) and converting the ideas into the tangible products (idea realization) in the end (Wang et al., 2015). Ren and Zhang (2015) indicate that innovative behavior includes two key stages, which are idea generation and idea implementation. Idea generation involves adjusting the way in which to work or creating new and fresh views on products while the idea implementation is to carry out the ideas or perspectives (Ren & Zhang, 2015; West, 2002). However, De Jong and Den Hartog (2010) have a different point of view on idea generation, which is commonly regarded as the first stage of innovative behavior (e.g. Scott & Bruce, 1994; Kanter, 1988; Madrid et al., 2014). De Jong and Den Hartog (2010) make the argument that before idea generation, exploration of ideas or solutions already took place (De Jong & Den Hartog, 2010). Idea exploration is to improve on current tasks and products or to change the methods to handle them (De Jong & Den Hartog, 2010). Thus, they divide innovative working behavior into four stages, namely idea exploration, idea generation, idea championing and idea implementation (De Jong & Den Hartog, 2010). These four stages show a clearer path for innovation. Similarly, in the research of Wu et al., (2014), employees normally start with defining the problem and then produce or generate ideas and solutions (Wu et al., 2014).

In this research, the classification from De Jong and Den Hartog (2010) will be used as the definition for the innovative behavior. This definition is based on the previous researches and is supplemented with a new understanding of the idea generation part, which seems to be better thought-out and integrated.

In some research, the comprehension of creativity and innovative behavior is confused but the fact is that they are distinct terms (Leung et al., 2014). It is vital to make the distinction between creativity and innovative behavior (Yuan & Woodman, 2010). Creativity means to form useful ideas, which is contained in innovative behavior or can be regarded as a part of innovative behavior (Yuan & Woodman, 2010). The most obvious difference between the creativity and innovative behavior, is that innovative behavior includes the implementation of ideas and goes beyond creativity, while creativity is only composed of idea generation (Park et al., 2014)

## 2.3 Team climate

Nowadays research puts more emphasis on team-level climate, than climate on the organization-level. And this research will also put emphasis on the team climate at the team level. Schneider and Bartlett (1968) indicated that team climate can present the characteristic of the team convectively, which is the expectation of relationship, tasks and communication that are formed by the team members in their daily work. Schneider (1990) gave a definition for working climate and he indicated that working climate, for example the climate in a team, consist of the norms, attitudes, and expectations, which are operated by individuals in a particular social circumstance.

The most well known theory of team climate is the Team Climate Theory, which was pointed out by West (1990). West (1990) identified four dimensions that can influence the team climate: vision, participative safety, support for innovation, and task orientation. Vision enables employees to form an idea or concept of a valuable result including an ambitious goal and a power for motivation (West, 1990). Participative safety, refers to the degree to which team members feel that they are in a trusting and non-threatening environment when they participate in the activities such as decision making (West & Anderson, 1998). Support for innovation describes to what extent the environment stimulates team members to create new ideas and give support to each other, while task orientation is the commitment among the team members to perform well in their tasks so that they can create policies and rules (West & Anderson, 1998). In 1998, the research of West and Anderson (1998) added one more factor: interaction frequency, which describes the frequency of interacting among team members.

In this research, due to the fact that dimension of support for innovation is more closed to innovative behavior and Chinese employees tend to be collective (Qian et al., 2013), we defined team climate as a working atmosphere in which individuals are mutual supportive and communicate with each other frequently to pursue the same goals and to create and apply innovations

**Team climate and innovative behavior**

Team climate has been regarded as a determinate to assist the team members in R&D

teams to make improvements for their innovative performance (Kim & Lee, 1995; Hülsheger et al., 2009). Working climate gives the awareness to employees to understand the ultimate goal of working teams (Herman et al., 2008) and leads them to find out appropriate behavior to reach the goal (Scott & Bruce, 1994). When the team members regard the freedom of expression as a norm in their working climate, their working behavior will be more innovative (Basaglia et al., 2010). When employees speak out their opinion freely to share their ideas and give suggestions to each other, this can be regarded as a kind of resource exchange. Such resource exchange can give support to other working members to find out new methods, which enable them to have more opportunities to innovate (Ibarra, 1993; West & Anderson, 1998). Scott and Bruce (1994) researched the impact of team climate in R&D teams, and treated the work climate as a determinate for innovative behavior (Scott & Bruce, 1994). This research pointed out that a supportive climate can improve the innovative behavior in R&D teams (Scott & Bruce, 1994). A supportive climate does not only consist of the support for idea creation among the team members (West, 1990) but also considers other resources in the work environment, such as equipment and time, which are also vital to the innovative behavior of individuals (Scott & Bruce, 1994). Therefore, when the team climate is supportive for innovation, team members will be more motivated to display innovative behavior (Scott & Bruce, 1994; Yuan & Woodman, 2010; Jung et al., 2003; Gumusluoğlu & Ilsev, 2009)

To sum up, based on the theories mentioned above, especially the research of Scott and Bruce (1994), it can be concluded that it is vital for a team to constitute a good team climate for team members, to improve innovation in R&D teams. Therefore, my hypothesis will be the following:

***Hypothesis 1: Team climate has a positive influence on the innovative behavior of employees in R&D teams.***

## 2.4 Team cohesion

Research shows that teamwork is seen as a main approach towards success for an organization, and many organizations pay more attention on investing in the development of cohesive teams (Katzenbach, 1993). Team performance is a much more

effective way than individual performance to achieve goals (Brewer et al., 1994). A team isn't merely a group of people and it's necessary that team members stick together to achieve the same goal. The tendency for a group of people, to cooperate to work towards a shared goal is called team cohesion (Wellington et al., 2005). Team cohesion is a kind of social interaction process as well, which enables people to unite (Sargent & Sue-Chan, 2001). Magni et al. (2009) defined team cohesion as a kind of relational strength among team members which encourages them to display self-motivated behavior to perform tasks and enables team members to feel supported by the whole team (Magni et al., 2009).

In this research, team cohesion is defined that people in a team are united to be motivated to fulfill the tasks. Unity among team members increases their mutual trust to attain the target and satisfies the emotional needs among each other (Mach et al., 2010).

**Team cohesion and innovative behavior**

R&D teams have to develop group cohesiveness to innovate better (Kim et al., 1999; Huang, 2009). If an R&D team possesses high levels of team cohesion, team members will trust each other more, which removes conflicts in the team (Kim et al., 1999). Huang (2009) researched the impact of sharing knowledge and team cohesion on the performance of R&D team members in Taiwan (Huang, 2009). A positive relationship was found between team cohesiveness and innovation in R&D teams, which indicated that R&D team members should keep a watchful eye on uniting the entire team to improve their performance (Huang, 2009). Therefore, it is clear, that teamwork plays an important role in an organization and team cohesiveness will help a team to get successful in innovating, especially in R&D teams. Kratzer et al. (2006) also pointed out that R&D team members are willing to work together, communicate with one another frequently, solve design tasks together, and coordinate their tasks through input from all team members. Frequent communication and positive cooperation enables innovative ideas to form and to apply these ideas into practice (Eisenbeiss et al., 2008; West, 2002; Hertel et al., 2005). Idea generation and idea implementation are an important part of innovative behavior (Yuan & Woodman, 2010). Thus, team cohesion enables the team members to create ideas, carry out ideas and improve innovative behavior of team members ultimately.

Hence, based on the research of Huang (2009), we find out that team cohesion enables R&D team members to be more innovative and improve their performance. Thus, hypothesis 2 reads as follows:

***Hypothesis 2: Team cohesion has a positive influence on the innovative behavior of employees in R&D teams.***

## 2.5 Team leadership

Team leadership is the capacity of a team leader, to effectively enable team members to form a great commitment in a team. In addition, team leader can manage competing team perspectives so that the team members can achieve the same goal and finally create the innovation (West et al., 2003; Curral et al., 2001; Mumford & Gustafson, 1988; Nemeth & Owens, 1996). Therefore, the team members will be more committed to the tasks or projects and quarrel is reduced when making team decisions.

Leadership style has two well-known styles which are transactional and transformational leadership, which are quite opposite to each other ( Sivasubramaniam et al., 2002). In the former leadership style, the leader focuses on maintaining compliance of followers by using rewards and punishment, based on performance. The latter one puts more emphasis on how to inspire or stimulate followers to accomplish tasks beyond the normal expectations. Transformational leadership will also make employees more enthusiastic about their work and increase their interest in teamwork (Bass & Avolio, 1993; Den Hartog & Koopman , 2001).

Many researches gave the evidence that transformational leadership has a great impact on innovation (e.g. Basu & Green, 1997; Keller, 1992; Basu, 1991), Transformational leadership inspires respect from employees and makes them collaborate better. In addition, transformational leaders always consider the different demands of the employees and discuss the future with them, in a positive light. Finally, transformational leadership enables employees to achieve their goals and to use new methods in their daily work (Bass & Avolio, 1995; Pieterse et al., 2010). Thus, in this research paper, team leadership is defined as transformational leadership, which is more associated with innovation, than transactional leadership.

**Transformational leadership and innovative behavior**

The transformational leadership style gives employees more possibilities in their daily work. It inspires and motivates subordinates to change their mind and manners on dealing with problems so that they can produce more and better innovative ideas.(Gumusluoglu & Ilsev, 2009). Additionally, transformational leadership also considers the subordinate' s voice and meets their real needs (Zhang et al., 2011). Under this kind of leadership style, employees will feel more relaxed and receive more freedom in their work. If subordinates get more authority and freedom, their innovative behavior will be positively influenced (Scott & Bruce, 1994). Shin et al. (2012) emphasized that transformational leadership will enable employees to be open minded and have various perspectives, and lets them make good use of the resources produced by various team members( Shin et al., 2012). Kim et al. (1999) defined the role of a transformational leader in R&D teams as a team builder, who encourages the team members to deal with challenging tasks and to create new perspectives in a more innovative way (Kim et al., 1999). Based on Kim et al. (1999)' s finding, hypothesis 3 is formulated as follows:

***Hypothesis 3: Transformational leadership has a positive influence on the innovative behavior of employees in R&D teams.***

**Transformational leadership and team climate**

A vital role of team leader is to make sure that all the team members can clearly understand the team goal and use their knowledge in the most effective way and he has to make sure a great team climate is formed (West et al,. 2003). In this research, team climate has been characterized as a supportive working atmosphere which inspires team members to communicate with each other and share ideas together to create innovations. Transformational leaders get close to their subordinates, clarify future goals and lead subordinates to understand the importance of mutual support in a team. This enables team members to strengthen communication with each other in order to share new ideas and perspectives (Zohar & Tenne-Gazit, 2008). Pirola-Merlo et al. (2002) pointed out a positive relationship between transformational leadership and team climate (Pirola-Merlo et al., 2002). Similarly, literature showed that transformational leadership greatly contributes to establish a more supportive climate

in R&D teams (Eisenbeiss et al., 2008). Eisenbeiss et al. (2008) connected transformational leadership with the team climate theory (West, 1990) in 33 R&D teams. They found that transformational leadership encourages team members to give more assistance to each other, and simultaneously establishes a promise for innovation in the team (Eisenbeiss et al., 2008). Thus, the results show that transformational leadership reinforces a team climate that supports innovation in R&D teams, which leads to more innovation (Eisenbeiss et al., 2008). Based on this statement, Hypothesis 4 reads as follows:

***Hypothesis 4: Transformational leadership has a positive influence on team climate in R&D teams.***

**Transformational Leadership and team cohesion**

Apart from improving team climate, transformational leadership also plays an important role in increasing team cohesion (Pillai & Williams, 2004). Transformational leaders share their vision and perspective with team members, and foster them to form a common vision, which lets team members cooperate more and increases team cohesion (Jung & Sosik, 2002). Conflicts are inevitable when a group of people keep communication and idea exchange (Markman et al., 1993; Pelled et al., 1999). Transformational leaders reduce the amount of conflicts produced by team members when they discuss the tasks at hand (Zhang et al., 2011). In addition, the intellectual stimulation imposed by transformational leadership will lead team members to reconsider their ideas and to try to find new methods for solving problems, which decreases quarrel and increases team cohesion (Callow et al., 2009). Eisenbeiß and Boerner (2010) studied the relationship between transformational leadership and an R&D teams' innovation level, and they argued that transformational leadership enables team members to consider team interest above self-interest, which forms a sense of collectivity among team members (Eisenbeiß & Boerner, 2010; Bass et al., 2003). And Whetten (1987) argues that high team cohesion signifies that team has collectivity (Whetten, 1987). Based on this statement, Hypothesis 5 is formulated as follows:

***Hypothesis 5: Transformational leadership has a positive influence on team cohesion in R&D teams.***

## 2.6 Team diversity

Team diversity is the different attribution of the individuals in the team such as age, gender, ethnicity, tenure, functional background (Pelled et al., 1999). This team characteristic has been discussed for decade years. On the one hand, the classification of the team diversity has been defined in various ways among the researchers. Pelled (1996) defined two dimensions for the demographic diversity. One is based on the relatedness of the job, and includes variables like organizational or group tenure, education, and functional background. The other dimension is that if it can be directly visible, and refers to attributes such as age, gender, and race (Pelled, 1996). Harrison et al. (1998) utilize the terms surface-level diversity (race, sex, age) and deep-level diversity (attitude, tenure), to classify team diversity (Harrison et al., 1998). Joshi and Roh (2009) divided team diversity into task-oriented and relation-oriented diversity. Task-oriented diversity refers more to work attributes and job-related skills, such as education, function and tenure, while relation-oriented diversity is associated with an individual' s attributes, such as age, gender, and race (Joshi & Roh, 2009). Although different researchers have a different opinion on the classification of team diversity, the content of each classification is quite similar. Age, gender and race are normally seen as a group of attributes while education, functional background and tenure form another. Thus, this research paper will divide team diversity into task-oriented diversity, which relates to work tasks and into non task-oriented diversity, which relates more to demographic distinctions. Task-oriented diversity, in this paper, will be defined as diversity in education, function and tenure. Non task-oriented diversity will refer to differences in age, gender and region.

It is meaningful to mention that race diversity, normally measured in western countries (Hero & Tolbert, 1996; Joppke, 2007; Hooghe et al., 2009), is replaced by region diversity in the Chinese context. The reason is that almost all employees are Chinese in the context of Chinese state-owned firms and private firms. Even in foreign firms in China, the number of foreign employees is rather limited. They, in a manner of speaking, only occupy the top-level management teams. Therefore, it is impractical to measure race diversity in Chinese firms. Race diversity illustrates cultural diversity. In the Chinese context, people from different regions (or provinces) have a distinctive culture and habits. Thus, region diversity refers to the different provinces employees come from.

**Team diversity and innovative behavior**

Refer to the team diversity, Jackson and Joshi (2004) argued that a diverse team can collect various perspectives when solving the problems, especially the gender and race diversity can help the team to get alone with different customers to obtain the solutions (Jackson & Joshi, 2004). In R&D teams, team members need to meet the needs of various customers (Chen et al., 2015). Thus, age diversity and gender diversity have the advantages to generate ideas or solutions when meeting the requirement of different customers. In addition, team diversity can promote the output of innovations in the team due to the diverse solutions which pointed out by the team members (Milliken & Martins, 1996). Van der Vegt and Janssen (2003) gave an argument that demographic diversity in a team is also vital for the employees to increase their innovative behavior because the diverse team members can share, compare and gather various perspectives in order to form the task-related solutions (Van der Vegt & Janssen, 2003). Team members who have different working experiences (Tenure), education level, functional backgrounds are able to share different knowledge and ideas and support for innovations (Daellenbach et al., 1999). Kilduff et al., (2000) made an illustration that age and gender diversity will trigger team members to form different values and manner (Kilduff et al., 2000). Employees who have the disparity in values and attitudes can provide different perspectives on problem-solving (Bantel & Jackson, 1989). These useful and fresh ideas and perspectives can lay the foundation for the whole teams' innovation (Scott & Bruce, 1994). Yueh (2009) and Zhang (1988) indicated that different provinces (Region diversity) in China have distinction in culture (Yueh, 2009; Zhang, 1988). Various regional cultures can stimulate the employees to create new ideas and opinions, which is also positive for them to innovate (Martins & Terblanche, 2003). Simultaneously, Sargent and Sue-Chan (2001) argued in their research result that diverse group has more ability to innovate compared to the homogeneous group because of the various ideas and alternative choices (Sargent & Sue-Chan, 2001).

Although the specific researches of team diversity in R&D teams are limited, there are still massive literature supporting a positive relationship between team diversity and the behavior of employees to innovate in R&D teams (as mentioned above). Therefore, we formulate the Hypotheses as followed:

***Hypothesis 6a: Task oriented diversity (education, tenure and function) has positive influence on innovative behavior of employees in R&D teams.***

***Hypothesis 6b: Non-task oriented diversity (age, gender and region) has positive influence on innovative behavior of employees in R&D teams.***

**Team diversity and team climate**

What' s more, team diversity also plays an important role on building an innovative team climate. Diverse team members own different opinions and ideas which can increase the interaction among them (Isaksen & Lauer, 2002). And frequent interaction can increase the team climate (West & Anderson, 1998). Individuals with different education background, function and tenure own various task-related skills or knowledge, which can be shared among the team members (Pelled, 1996). Then, it will build a supportive environment for the whole team and improve the team climate.

People from the same gender or race, easier form a similar vision than more diverse groups of people (Pelled, 1996). In other words, with people who are diverse in gender, age or region it is harder to form a shared vision, and this influences team climate in a negative way, because it is important for team members to clarify the team vision or goal in order to create a great climate (West & Anderson, 1998). In addition, if individuals experience a wide age gap, it will be more difficult for team members to communicate with each other (Der Foo et al, 2005), which will decrease a good team climate.

Similar to the literature of team diversity and innovative behavior, the connection between team diversity and team climate is also limited studied under R&D context. However based on the literatures we mentioned above, they can build the hypotheses as followed:

***Hypothesis 7a: Task oriented diversity (Education, tenure and function) has positive influence on team climate in R&D teams.***

***Hypothesis 7b:Non-task oriented diversity (age, gender and region) has negative influence on team climate in R&D teams.***

**Team diversity and team cohesion**

Individuals with task-related diversity (e.g. education, function, tenure) can share specific skills and knowledge which are related to their tasks or their daily work (Pelled, 1996). Communication of knowledge and other information forms knowledge exchange (Patrucco, 2003). In daily work, the exchange of information or knowledge that relates to work or work tasks can establish a network among team members (Fritsch & Kauffeld-Monz, 2010). Such a network or sharing of knowledge can make people more united (Lawler & Yoon, 1996). In other words, shared knowledge related to work tasks can improve team cohesion.

The cost of team diversity also brings some problems to the team cohesion. Team diversity will also enable the team members to form bias and favoritism in the team, which will easily produce the conflict, then affect the efficiency of the team (Jackson & Joshi, 2004). Especially, Chinese has strong regional bias (Gao, 2004). They are willing to communication the people from same province which will be easy for them to understand each other. According to the Social categorization theory (e.g. Park & Rothbart, 1982; Pelled et al., 1999; Webber & Donahue, 2001), individuals in the team will build categories based on different attribution, such as male or female. People from different social categories do not easily come to an agreement in a group and they will display bias towards people in other categories, so relational or emotional conflicts will appear (Pelled et al., 1999). In addition, this kind of categorization alienates team members from each other and makes them lose trust. This gradually affects team cohesion in a negative way (Horwitz & Horwitz, 2007). Jackson et al. (2003) also confirmed in their research that having different genders in a team (sex diversity) , has a notably negative effect on team cohesion.

Although the specific research in R&D teams that discuss the relationship of team diversity and team cohesion are limited, it still can draw clear forecast the following hypotheses based on the literature above.

***Hypothesis 8a: Task oriented diversity (Education, tenure and function) has positive influence on team cohesion in R&D teams.***

***Hypothesis 8b: Non-task oriented diversity (age, gender and region) has negative influence on team cohesion in R&D teams.***

**Team diversity and transformational leadership**

According to the characteristic of transformational leadership, transformational leadership describes that the leader is open minded and willing to accept others' opinion to re-examine his or her assumptions. Team leader with the transformational leadership also inspires the followers to use new ways and methods to finish the tasks (Bass & Avolio, 1995; Callow et al., 2009).

Turning to the team diversity, team members have different background will have different opinions or visions (Jackson & Joshi, 2004), which can help the leader to make good choice for solving the problems. Because the team diversity can generate the knowledge flow and the subordinates can give various suggestions to the leader (Jackson, 2003).

The direct relationship of leadership and team diversity is an unexplored area in the recent studies (Jackson, 2003). Thus there are limited literatures discussing how team diversity influence transformational leadership in R&D teams. However, based on the literature mentioned above, we can speculate that team diversity have positive influence on transformational leadership in R&D teams because team diversity and transformational leadership usually exist in R&D teams. So hypotheses are formulated as follows:

***Hypothesis 9a: Task oriented diversity (Education, tenure and function) has positive influence on transformational leadership in R&D teams.***

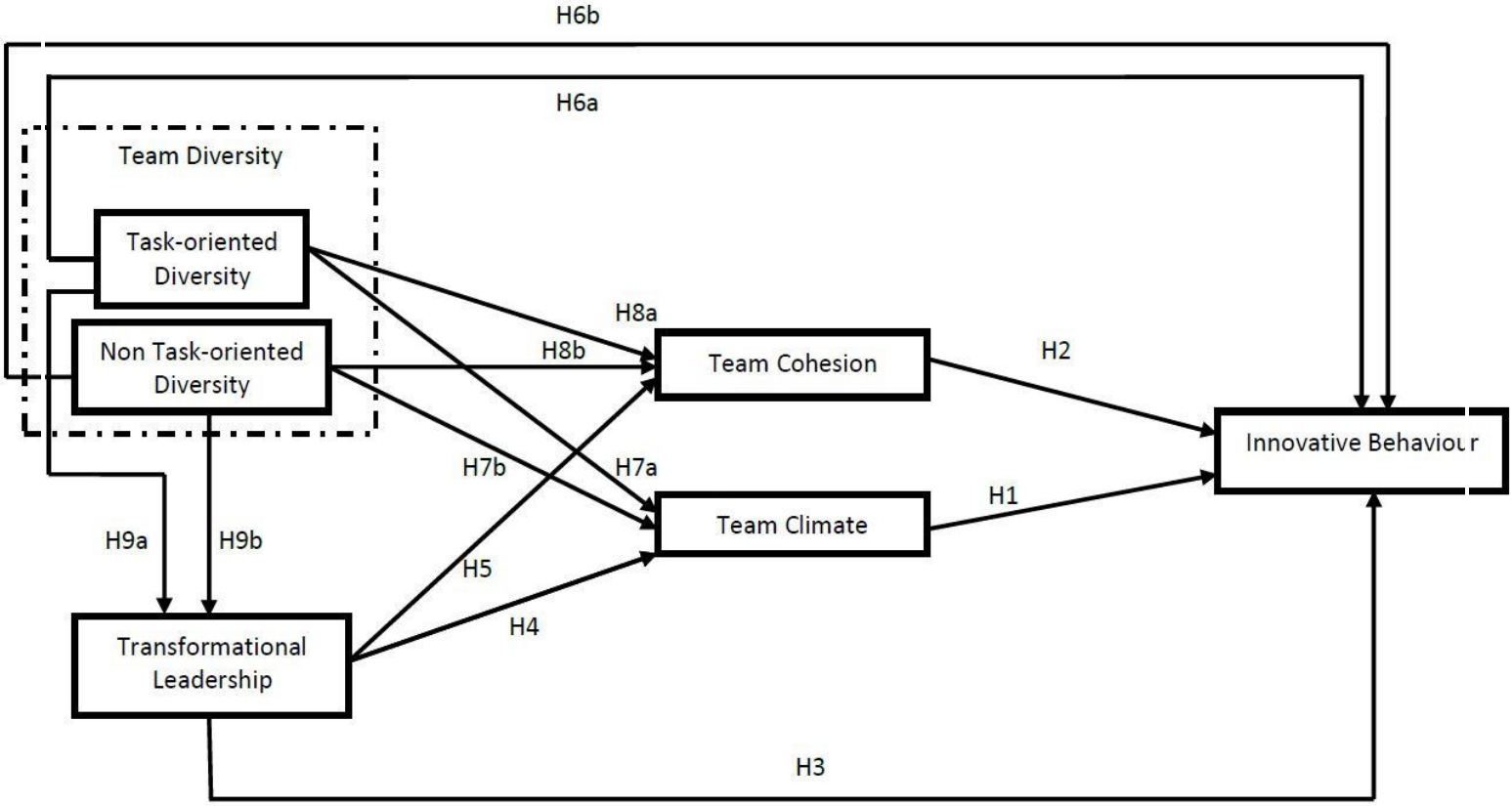
***Hypothesis 9b: Non-task oriented diversity (age, gender and region) has positive influence on transformational leadership in R&D teams.***

## 2.7 Summary of hypothesis

- ***Hypothesis 1: Team climate has positive influence on the innovative behavior of employee in R&D teams.***
- ***Hypothesis 2: Team cohesion has positive influence on the innovative behavior of employee in R&D teams.***
- ***Hypothesis 3: Transformational leadership has positive influence on innovative behavior of employee in R&D teams.***
- ***Hypothesis 4: Transformational leadership has positive influence on team climate in R&D teams.***
- ***Hypothesis 5: Transformational leadership has positive influence on team cohesion in R&D teams.***
- ***Hypothesis 6a: Task oriented diversity (Education, tenure and function) has positive influence on innovative behavior of employee in R&D teams.***
- ***Hypothesis 6b: Non-task oriented diversity (age, gender and region) has positive influence on innovative behavior of employee in R&D teams.***
- ***Hypothesis 7a: Task oriented diversity (Education, tenure and function) has positive influence on team climate in R&D teams.***
- ***Hypothesis 7b:Non-task oriented diversity (age, gender and region) has negative influence on team climate in R&D teams.***
- ***Hypothesis 8a: Task oriented diversity (Education, tenure and function) has positive influence on team cohesion in R&D teams.***
- ***Hypothesis 8b: Non-task oriented diversity (age, gender and region) has negative influence on team cohesion in R&D teams.***
- ***Hypothesis 9a: Task oriented diversity (Education, tenure and function) has positive influence on transformational leadership in R&D teams.***
- ***Hypothesis 9b: Non-task oriented diversity (age, gender and region) has positive influence on transformational leadership in R&D teams.***

## 2.8 Model

If the hypothesizes can be confirmed by Empirical validation, a model for the R&D team will be established as followed:



# 3. Methodology

## 3.1 Research design and procedures

In order to discover the influence of team diversity and leadership on the innovative behavior of the R&D teams in Chinese industrial firms, and verify the hypothesis and the research model, an empirical research method is then taken into consideration. The empirical research is usually done by qualitative method, quantitative method or both of them (Johnson & Onwuegbuzie, 2004). Due to the research object , which is focused on Chinese industrial firms, and the obstacles of jet lag and distance, the quantitative method will be used in resource collection The online questionnaire is a quantitative approach to demonstrate the above hypothesis and research model.

Teams of the R&D department from the Chinese industrial firms will be asked to fill in the questionnaires via Internet. The questionnaires will be sent and collected by email. After the data collection, information will be filtered and excluded. Software SPSS will be used for the statistical analysis. Specifically, the questionnaires will be modified and translated into Chinese, which could avoid misunderstandings and guarantee the accuracy of target answers. The English questionnaires are attached in the Appendix as a reference.

Additionally, when doing the data analysis, it should be focused on the team level, which means that each team will only have a score in each variable.

## 3.2 Sampling and respondents

In this research, a non-probability sampling is utilized to select the sample, which is a nonrandom way to choose the sample (Schreuder et al., 2001). When selecting the non-probability sampling approach to obtain the sample data, it means that the sample needed has the certain particularity (Stehman, 1999).

The research also possesses two aspects of particularity which requires the non-probability sampling. On the one hand, the diverse attributions of the respondents

should be appeared in the sample firms, especially in the teams that are asked to fill in the questionnaires. On the other hand, since the research is based on the R&D team and not all the industrial firms have a R&D team or department, therefore, those firms which do no meet the requirements would not be considered as the sample firms. As a result, the non-probability sampling will be used to find the sample firms in this research due to the above reasons.

The samples of the research will be focused on the R&D team of Chinese industrial firms. In order to seek the appropriate samples, I enquired HR about the conditions of the relevant company before I made the final decision. For example, questions were asked as "Does your firm have the R&D team or R&D department?" ; "Are your employees in the R&D team diversified?" and etc. They played an important role as a reference standard in determining the appropriateness of the samples.

Eventually, after serious selection, there are 12 firms which have take part in this research. They consist of foreign firms and private ones. All of the sample firms have the R&D team or the R&D department and present a sense of diversity among the team members. 10 team members (1 team leader and 9 subordinates) from the R&D team in every sample firm are invited to take part in this research, which means that 12 teams will participate in answering the questionnaires.

**Invalid Sample**

120 questionnaires were sent out, 102 questionnaires were collected, and the collection rate is 85%. Two principles were applied for sample filtering. On the one hand, the questionnaires had one missing value. It is normal that missing values happen in the accomplishment of the questionnaires and it is vital to deal with the miss values before the data being analyzed (Field, 2013). On the other hand, the answers appeared an obvious regularity, for instance, all the answers in one scale were the same. And thus such kind of questionnaires was excluded. According to statistical analysis, the effective collection rate is 70%, and 84 questionnaires were estimated as valid information which could be taken as samples after filtering and excluding. Table 1 shows the details of the sample firms and the respondents.

| Table 1 Sample firms and respondents | | | | |
|---|---|---|---|---|
| Company | Main business of the company: | Size of the company (number of employees): | Numbers of respondents (expected) | Numbers of respondents (after filtering) |
| A | Automation | 500 | 10 | 5 |
| B | Automated laundry | 300-400 | 10 | 8 |
| C | Communications technology | 1000 | 10 | 6 |
| D | Motor | 200-300 | 10 | 8 |
| E | Iron and steel | 700-750 | 10 | 6 |
| F | Automotive | 400 | 10 | 5 |
| G | Thermal technology | 200 | 10 | 9 |
| H | Lighting | 150-200 | 10 | 6 |
| I | Robot | 500 | 10 | 9 |
| J | Protection accessories | 700 | 10 | 5 |
| K | Software | 400-450 | 10 | 9 |
| L | Mobile | 300 | 10 | 8 |

## 3.3 Operationalization

In the following part, the team diversity, team leadership, team climate, team cohesion and innovative behavior will be operationalized by several elements. The questionnaires will be composed of basic information of the employees and 4 different scales from the previous research, which could increase the reliability and validity because these previous scales have been well tested in many researches.

The electronic questionnaires will be the main tool in this research. There are five variables which should be tested in this research. 20 minutes will be allowed to finish the questionnaires.

The questionnaires will apply the Likert scale. In the transformational leadership scale, innovative team climate scale and the team cohesion scale, the score" 5" means "strongly agree" while the score" 4" means "agree". The score "3" means "average" while the score" 2" and the score" 1" mean "disagree" and "strongly disagree" respectively. However, the innovative behavior scale, the score" 5" means "always" while the score" 4" means "usually". The score "3" means "average" while the score" 2" and the score" 1" mean "seldom" and "never" respectively. Because this scale is focus on the frequency of the behaviors happened.

### 3.3.1 Innovative behavior

Innovative behavior is the intentional introduction of new ideas, products, and processes in his or her working environment which including both idea generation and idea implementation (Yuan & Woodman, 2010). This paper will focus on the innovative behavior of R&D team members.

To measure the innovative behavior, this research will use the innovative working behavior (IWB) questionnaire which was designed by De Jong and Den Hartog (2010). One reason for employing this questionnaire is that the IWB questionnaire is more comprehensive and concentrate on the individual level, which is based on Scott and Bruce (1994)' s research and Kanter (1988) to modify the dimensions. Kanter (1988)

classified the innovative behavior into idea generation, coalition building and implementation (Kanter, 1988). De Jong and Den Hartog (2010) indicated that before idea generation, there should be idea exploration. Thus, they built four dimensions for the innovative behavior, that is idea exploration, idea generation, idea championing and idea implementation (De Jong & Den Hartog, 2010). Another reason to employ this questionnaire is that the IWB is more effective compared to other research.

There are 9 items used to measure innovative behavior. Four dimensions, namely idea exploration, idea generation, idea championing and idea implementation are included in these 9 questions altogether. And this scale is concentrated on the frequency of the employees' innovative behavior happened.

### 3.3.2 Team diversity

Team diversity is the differences of age, gender, individual characteristics, values, cognition among the team members (Jackson et al., 1991). Some are related to the working tasks, such as education, function and tenure. Others have strong relationship with the employees' demographic characteristic, such as age, gender and race (Joshi & Roh, 2009).

Most of the researchers use coefficient of variation (Allison, 1978) and the formula: H= $(1 - \sum p_i^2)$ (Blau, 1977) when they measure the team diversity (e.g. Jackson & Joshi , 2004; Joshi & Roh, 2009; Pelled et al., 1999; Reagans & Zuckerman, 2001).

Some of the indicators of team diversity can be measured by numbers such as age and tenure. Since these indicators can be assessed by numbers, coefficient of variation (C.V) can be used to calculate. The formula is: standard deviation/ mean. The greater the value is, the greater the differences of the indicators are (Allison, 1978). Allison (1978) compared this C.V to standard deviation and mean, and he found the value of C.V is more stable than deviation and mean (Allison, 1978).

Referring to the indicators that cannot be measured by numbers such as gender, race, education and functional background, researchers use the formula: H= $(1 - \sum p_i^2)$. P is the proportion of team members in each category. And I refer to the number of

category. Finally the greater the H is, the greater the diversity of the indicators is (Blau, 1977). Due to the research background in China, the race diversity changes to region diversity which focuses on the different provinces that the team members come from.

### 3.3.3 Team leadership

Team leadership in this research paper will focus on how the team leaders manage the team members and team diversity in the R&D teams so that the team members can accordingly improve their innovative behavior and increase the team climate and team cohesion. According to the Chapter 2, transformational leadership is more related to innovation in the working team. Therefore, this paper will focus on the measurement of transformational leadership. Transformational leadership describes that the leadership is more concentrated on how to motivate or inspire the employees to accomplish the tasks (Bass & Avolio, 1993; Den Hartog & Koopman, 2001).

Based on Zhang et al. (2011), they carried out the research centered on the leadership in Chinese organizations and employed the MLQ-5x questionnaires which were designed by Bass and Avolio (1995) to measure the leadership. Since the research background of this paper will focus on the Chinese firms, the Multifactor leadership questionnaire (MLQ-5x) will be used to measure the transformational type of team leadership. The MLQ-5x contains several types of leadership such as transformational leadership, transactional leadership (Schriesheim et al., 2009). And this paper will make use of the 20 items for the transformational leadership subscale. In the transformational part, MLQ employ four dimensions to measure the transformational leadership which are individualized, consideration, intellectual stimulation, attributed and behavioral idealized influence, and inspirational motivation (Schriesheim et al., 2009).

Individualized consideration put emphasis on the individual- level’ s need. The leader should consider the subordinates’ need and development (Pieterse et al., 2010). Inspirational motivation is that the leader should help the subordinates to change their perspectives on the daily work and the manner of working, which is important for the innovation (Schriesheim et al., 2009). Attributed and behavioral idealized influences are the attributed and behavioral charisma of the leader such as the leader’ s confidence

and value, which can influence the subordinates' behavior (Schriesheim et al., 2009). Inspirational motivation is that the leader gives the inspiration and motivation to the subordinates in order to enable them to reach the goal, especially the individual goal (Schriesheim et al., 2009).

### 3.3.4 Team cohesion

Team cohesion can be regarded as that the team members are willing to work together, share the knowledge and achieve the same goal (Kratzer et al., 2006).

According to the previous researches (e.g. Carless & De Paola, 2000; Callow et al, 2009; Chang & Bordia, 2001), the Group Environment Questionnaire (GEQ) (Widmeyer, 1985) can be used as the measurement in the cooperating teams. The questionnaires are reliable and valid, which ahs been well tested in many researches. However, the content of the GEQ is more centered on the sport environment. When applying the GEQ into the working environment, it should be modified. Carless and De Paola (2000) revised the GEQ into a work-adapted vision and eliminated some items that didn't fit the team working environment (Carless & De Paola, 2000).

In this research, the team cohesion is discussed under the working environment, which has the same measurement background with the study of Carless and De Paola (2000). Thus, in this research, the Work-adapted vision of GEQ (10 items) will be used to measure the team cohesion.

### 3.3.5 Team climate

Team climate is the norms, attitudes, and expectations which are operated by the team members in the team (Schneider, 1990).

The most well-known scale to measure the team climate is the Team Climate Inventory (TCI) which is used in many researches to measure the team climate (Loo & Loewen, 2002; Goldberg, 1999; Parker et al, 2003). Compared to the previous research, such as West and Farr (1990); West, (1990); Anderson and King (1993), discussed a four- factors scales including: vision, participative safety, support for innovation, task orientation.

However, the TCI has over 60 items to test the innovative climate of the working team. It is quite lengthy so that the respondents won't have enough patience to accomplish well, which will seriously influence the effectiveness of research result. Therefore, in order to decrease the length of the questionnaire, the subscale "support for innovation" (8 items) will be used to measure the team innovative climate. The reasons are as follows. On the one hand, the innovative behavior is mainly focused on the case of the research, which contains the process from idea generation to idea implementation (De Jong & Den Hartog, 2010). In support of innovation, subscales contain the questions about creating new idea or methods and implement ideas or new answers. On the other hand, the questions in other subscales of vision, participative safety, task orientation and interaction frequency have no question about the implementation of ideas, which is less related to innovative behavior.

## 3.4 Data analysis

In this research, SPSS will be used to analysis the data. The data on each valued questionnaire will be input into the SPSS. After the data entry, a series of statistic analysis techniques will be taken into account, such as descriptive analysis, reliability analysis, correlation analysis and regression analysis which will assess the relationship between the independent and dependent variables.

**Descriptive analysis**

Descriptive analysis is an approach to describe the basic characteristics of the data. In this research, mean and standard deviation will be utilized to illustrate the condition of the data, which also indicates the degree of dispersion of the data. In addition, Frequency will also be made use of to state the distribution of the data.

**Reliability analysis**

Reliability shows that the result under the same situation is consistent. If the instrument isn't reliable, the data collected by the instrument is also invalid (Field, 2013). In this research, the online questionnaire will be regarded as the instrument to measure the

variables. Therefore, it is vital to confirm if this online questionnaire is reliable.

The most common method to measure the reliability of the questionnaire is the Cronbach’ s alpha, which is normally ranged from 0 to 1(Gliem & Gliem, 2003). If the Cronbach’ s alpha is lower than 0.7, it means that the reliability of this scale is questionable. If the Cronbach’ s alpha is lower than 0.6, it shows that the reliability of this scale is poor. On the contrary, if the Cronbach’ s alpha is higher than 0.7, it indicates that this scale has a good reliability (George & Mallery, 2003).

If the Cronbach’ s alpha is quite low, it is important to assess the Cronbach’ s alpha of each item in the scale and remove the items that have low Cronbach’ s alpha. After these steps, the Cronbach’ s alpha of the whole scale will be improved in the end (Field, 2013).

**Correlation coefficient**

Correlation coefficient is the method to test if there exists correlation between the variables. Pearson’ s correlation coefficient and Spearman’ s correlation coefficient are widely utilized to analyze the correlation between the variables (Field, 2013).

Pearson’ s correlation coefficient is a parametric method which is focused on the interval scales, while the Spearman’ s correlation coefficient is a non parametric method which is used for the ordinal scales (Field, 2013). In this research, the Likert scale is applied for the questionnaire, which belongs to the ordinal scales. Therefore, the Spearman’ s correlation coefficient seems to be more suitable for the analysis. In addition, the Spearman’ s correlation coefficient is also be commonly used when the data is not normally distributed (Field, 2013). The data of the variables are not the standard normal distribution. Thus, combining the above two situations, the Spearman’ s correlation coefficient will be applied to accomplish the analysis in the Correlation coefficient part.

When implementing the Correlation coefficient, there are two alternatives, namely the one- tailed test and the two-tailed test. Precisely, One-tail test is applied when the

hypothesis is directional and the two-tailed test is used when the hypothesis does not show the direction (Field, 2013). During this research, one- tailed test will be used because the entire hypotheses pointed out have the direction.

**Regression analysis**

Regression analysis is another statistical analysis method that is able to assess the relationship between the variables. However, regression analysis has deeper explanation about the relationship compared to the correlation coefficient, which can explicitly clarify the independent variables and the dependent variables.

In this research, the simple and multiple linear regression analysis will be applied for testing the linear relationship between the variables. In addition, the multiple linear regression analysis will also be used to test the mediation effect.

# 4. Results

## 4.1 Descriptive Analysis

### 4.1.1Characteristics of team and all the respondents

In the research, as mentioned before, the questionnaires were sent via e-mail, the research objects are industry enterprises. As a result, the sample firms are located in east costal area, mainly around Shanghai as the center, including Shanghai, Jiangsu and Zhejiang, the most developed region in China.

Subjects of the investigation are 12 R&D teams from 12 companies. Before the filtering, the team size is average 10 persons per team. After eliminating the invalid questionnaires, the team size is from 5 up to 9 persons per team, which has the average of 7 members per team. Additionally, the total numbers of valid respondents are 84 (N=84)

In the 84 respondents, the ratio of male and female is 3:2, which means that 57.1% of the respondents are male while 42.9% of the respondents are female. It can be clearly seen that male plays an important role in the R&D team

Turning to the age distribution with the average of 30 years old, 88% respondents are under 35 years old, which means young people in the R&D teams are majority. But there are still 22% respondents are over 35 years old. Especially, the oldest respondent is 53 years old. Based on this phenomenon, it can be conclude that the R&D team still remains a certain number of employees who have plenty of experience and knowledge instead of composing the team with all young passionate employees.

84 respondents are born in different provinces from all over the China. But almost half of the respondents are from east provinces of China which are Shanghai, Zhejiang and Jiangsu (48.7%). Others are from south of China, north of China and west of China. Respondents fro this three areas are distributed similarly.

Tenure is the time that the employees work in their current R&D team. From the result of these 84 respondents, they have the average of 5 years tenure. 75% employees working in theirs position in the current team within maximum 6 years. But the longest tenure among the employees is 28 year.

The education among the 84 respondents is similar. The result indicates that about 70.2% people hold a Bachelor' s degree while the 25% people own the Master' s degree. Only 4.8% people have the other degree such as PHD, HBO and MBO.

The function of the 84 respondents is quite different. The results showed that around 23% people are occupied in software function while 19.4% people are engaged in the hardware development function. 30.5% people are responsible for the supportive work while people who have the duty for technique and maintenance are 27.1%.

### 4.1.2 Mean and standard deviation

Another descriptive analysis is to measure variables' mean and standard deviation.

**Table 2 Mean and Standard Deviation**

| Variables | N | Mean | Std. Deviation |
|---|---|---|---|
| ***Non- task oriented diversity*** | | | |
| $Age^H$ | 12 | .13225 | .067799 |
| $Gender^H$ | 12 | .35233 | .154616 |
| $Region^H$ | 12 | **.63908** | .244800 |
| ***task oriented diversity*** | | | |
| $Tenure^H$ | 12 | **.61167** | .332059 |
| $Education^H$ | 12 | .34558 | .211244 |
| $Function^H$ | 12 | **.72208** | .139839 |
| ***Innovative behavior*** | 12 | 3.587350 | .291376 |
| ***Transformational leadership*** | 12 | 3.756042 | .278467 |
| ***Team climate*** | 12 | 3.849600 | .363278 |
| ***Team cohesion*** | 12 | 3.867175 | .2954315 |

** H is the logogram of the Heterogeneity which is the index of diversity*

In this research, in order to measure the team diversity, the heterogeneity of team diversity was taken into account. Heterogeneity is an index that illustrates the degree the team diversity is. For example, $Age^H$ means how is the degree of the diversity of the team members' age.

The measurement of heterogeneity varies based on characteristics of variables. Totally there are six dimensions as variables under scope of team diversity as which have already been demonstrated: age, gender, region, tenure, education and function. To use formulas to make the calculation of the team diversity, they were divided into two groups based on their own characteristics. Age, tenure will be put into one group due to the fact that they are the continuous variables while the gender, region, education and function will be classified into one group because they belongs to the qualitative variables. Variables in each group which have the same characteristics were applied the same formula to calculate the heterogeneities.

Blau coefficient was commonly used to measure the heterogeneity of antecedent variables. It represents possibility that the $i^{th}$ randomly selected item is not the same sample. In this research, variables: gender, region, function and education were calculated via Blau coefficient:

$$H=(1-\sum p_i^2)$$

Normally, the heterogeneity is ranged from 0 to 1, within a team which different characteristics are evenly distributed the heterogeneity will always approach to 1 which means a high diversity, oppositely, a team with equal characteristic will result in heterogeneity=0, which means there is almost no diversity existing in this team.

Coefficient of variation, abbreviated as CV, it represents the ratio of the standard deviation and the mean from a sample. Normally it is used to measure continuous variables, such as age and tenure in this case. The formula is:

$$CV=S/M$$

The greater of the value of CV, the higher of the heterogeneity it will be, which is directly linked to team diversity.

From the table 2, it can be seen that the heterogeneity of region (.63908), tenure

(.61167) and function (.72208) got rather high score on mean compared to other diversity variables: age, gender and education, which shows these three characteristics are highly diverse in the surveyed 12 R&D teams. The result also classifies that the 12 R&D teams gathers the various culture from different regions in China and the team members in the R&D team own diverse working experience and possess qualified working skills and duties from different functions.

However, heterogeneity of Age (.13225) is rather low, which states that the age gap among the team members in each team is rather narrow. The heterogeneity of gender (.35233) and education (.34558) also got low scores but they are a bit higher than heterogeneity of age, which account for that the team members in the R&D teams are inclined to single gender and their educational background are closed to each other. According to the characteristics of the respondents in 4.1.1, it can be concluded that the majority of a R&D team are composed by young males who have bachelor' s or master' s degree. In total, the score on task-oriented diversity is significantly higher than non task-oriented diversity, I can draw the conclusion that individual' s task-oriented characteristics such as tenure and function can be vital and impact more than non task-oriented characteristics during establish a R&D team.

The mean of innovative behavior is almost 3.6, which shows that the employees in the R&D teams own a good innovative behavior. The mean of transformational leadership, team climate and team cohesion are all near 4, which illustrates that the leadership style in the R&D teams tends to be more transformational and the team members own good sense of team work while their working atmosphere is more supportive for innovation. Therefore, to sum up, the R&D teams have a good transformational leader to lead the team to create more innovations and new ideas and the R&D team also have good team climate and team cohesion to enable the team members to cooperate with each other under a comfortable and supportive working environment

## 4.2 Reliability Analysis

In order to verify stability and reliability of the collected data from the questionnaires, Cronbach' s alpha was applied to do the reliability analysis, as it is commonly used to estimate the reliability of the surveyed samples. The overall Cronbach' s alpha was calculated for four variables, as for each variable the sum of all the results together were taken into account from the questionnaire.

The calculated Cronbach' s alpha is showing in the following table:

**Table 3 Cronbach' s alpha**

| Variables | Number of items | Cronbach's Alpha |
|---|---|---|
| Innovative behavior | 9 | .850 |
| Transformational leadership | 20 | .911 |
| Team climate | 8 | .842 |
| Team cohesion | 10 | .820 |

It is commonly accepted that Cronbach' s alpha' s from different scales are indicating how reliable of the test results, the higher of the correlations among the test items, the higher of Cronbach' s alpha it will be. Normally, values below than 0.6 indicates that the reliability of this scale is poor. Some item from this scale shall be eliminated from the results. Values in a scale from 0.7 to 0.8 are considered as acceptable, values greater than 0.8 are highly reliable (Field, 2013).

From the table, all calculated Cronbach' s alpha' s for four variables are all with positive values, and greater than 0.8, which indicates a good correlation among the test items, and reflect a high reliability of the test results.

Team diversity is excluded from the reliability statistics, as it is not in the form of MCQ (Multiple Choice Question), declarative information input was implemented for it in this

questionnaire, the result is apparently objective and accurate,. Thus it is not applicable to do the reliability analysis for team diversity.

## 4.3 Correlation Analysis

The correlation coefficient is commonly used to analyze the relational strength between items. It is ranged from -1 to 1, so when the value is scaled from $-1<x<0$, there is a negative correlation, in contrast, it is positively correlated with outcomes ranging from $0<x<1$. When the coefficient equals zero, there is no relation among items. The strength of the relationship between items, is reflected by the absolute value of the correlation coefficient, obviously, the greater $|x|$, the stronger the correlation between items.

From table 4, region diversity, which is the only variable that belongs to non-task oriented diversity, has a significant and positive connection with innovative behavior ($r=.560$, $p<0.05$, 1-tailed). Although age diversity and gender diversity don't have a significant connection with innovative behavior, age diversity($r=.028$, 1-tailed) and gender diversity ($r=.173$, 1-tailed) give the indication that they might have a positive relationship with innovative behavior.

Task oriented diversity, specifically tenure diversity ($r=.182$, 1-tailed) and education diversity ($r=.098$, 1-tailed) don't have a significant relationship with innovative behavior, but these results show signs that there might be a positive correlation between tenure diversity and innovative behavior and a positive connection between education diversity and innovative behavior as well. Otherwise, function diversity ($r=-.502$ $p<0.05$, 1-tailed) shows a significant and negative correlation with innovative behavior.

These results lead us to the conclusion that region diversity has a strong and positive relationship with innovative behavior, which means that team members who have various regional cultures will stimulate each other's innovative behavior in R&D teams. Similarly, age diversity, education diversity, tenure diversity and gender diversity show a possible positive relationship with innovative behavior, but these results are not

significant. It is interesting to see that only function diversity has a negative relationship with innovative behavior, which means that if an R&D team is composed of team members with diverse functions, innovative behavior of team members may be reduced. Additionally, the negative influence function diversity has can affect the innovative behavior greatly due to the high and significant r.

In addition, transformational leadership (r= .070, 1-tailed), team climate (r= .091, 1-tailed) and team cohesion (r= .147, 1-tailed) also illustrate a positive but not significant relationship with innovative behavior. However, these results only manifest a possible trend to show the positive connection but cannot be proved. We can only conclude that transformational leadership, team climate and team cohesion might have a small positive influence on innovative behavior in R&D teams but that also cannot be testified.

To sum up, it is surprising to see that only region diversity and function diversity have significant correlation with innovative behavior. Additionally, the function diversity has the strong and negative relationship with innovative behavior. Other team diversity variables (age, gender, tenure and education) have no significant connection with innovative behavior.

Turning to the correlation of team diversity, transformational leadership, team climate and team cohesion, it is clear that function diversity has a significant negative connection with both team climate (r=-.593, $p<0.05$, 1-tailed) and team cohesion (r=-.537, $p<0.05$, 1-tailed), which is opposed to the hypothesis. On the contrary, tenure diversity (r=.657 $p<0.05$, 1-tailed) has a positive and significant relationship with team climate. Similarly, it also has a positive, significant connection with team cohesion (r= .720 $p<0.01$, 1-tailed). Additionally, transformational leadership has a strong significant relationship with both team climate (r= .888 $p<0.01$, 1-tailed) and team cohesion (r= .874 $p<0.01$, 1-tailed). Finally, it is interesting to find that the age diversity almost has no influence on both team climate and team cohesion because the r is nearly zero. Above results indicate, that task oriented diversity and transformational leadership play an important role in team climate and team cohesion, compared to the effect non- task oriented diversity has.

Finally, considering the correlation between team diversity and transformational leadership, it is clear that the result is similar to the result of the correlation between team climate and team cohesion. From the dimension of task-oriented diversity, tenure diversity ($r = .531$ $p<0.05$, 1-tailed) has a positive and strong connection with transformational leadership while function diversity ($r = -.502$ $p<0.05$, 1-tailed) has a significant and negative relationship with transformational leadership, which conflicts with the hypothesis.

**Table 4 Correlation coefficient (N=12 )**

| | Age diversity | Gender diversity | Region diversity | Tenure diversity | Education diversity | Function diversity | Innovative Behavior | Transformational Leadership | Team climate | Team Cohesion |
|---|---|---|---|---|---|---|---|---|---|---|
| Age diversity | | | | | | | | | | |
| Gender diversity | .011 | | | | | | | | | |
| Region diversity | .014 | -.204 | | | | | | | | |
| Tenure diversity | .413 | -.463 | -.137 | | | | | | | |
| Education diversity | .105 | .389 | -.242 | .105 | | | | | | |
| Function diversity | -.316 | .301 | .596 | -.582 | -.025 | | | | | |
| Innovative Behavior | .028 | .173 | **.560*** | .182 | .098 | **-.502*** | | | | |
| Transformational Leadership | .266 | -.247 | -.112 | **.531*** | .067 | **-.502*** | .070 | | | |
| Team climate | .000 | -.261 | -.231 | **.657*** | .039 | **-.593*** | .091 | **.888**** | | |
| Team Cohesion | .007 | -.276 | -.158 | **.720**** | .042 | **-.537*** | .147 | **.874**** | **.923**** | |

*. Correlation is significant at the 0.05 level (1-tailed). **. Correlation is significant at the 0.01 level (1-tailed).

## 4.4 Regression analysis

The analysis of the correlation among variables, illustrates if relationships exist. Furthermore, the nature of the relationship (positive or negative) can be explained by regression analysis, and the causality among variables can be indicated by it. Therefore, the next analysis I did was a regression analysis based on 12 R&D teams.

The regression analysis consists of two parts. Firstly, I analyzed only two factors to build a basic linear regression equation, one independent variable and one dependent variable. The results will be regarded as the foundation for the mediator test in 4.4.2. Secondly, team cohesion and team climate could be functioning as mediators, they may transfer influence from team diversity and team leadership to innovative behavior. Therefore, in 4.4.2 we test the mediator effect of team climate and team cohesion. The way to filter the qualified variables to test the mediator effect will also be discussed in 4.4.2.

### 4.4.1 Simple linear regression analysis

The first 29 relationships, which represent the entire hypothesis, were analyzed with a regression equation to verify significance and causality. From each relationship, only a single path leads from independent variable to dependent variable. As can be seen from table 5, there are 4 dependent variables in total (innovative behavior, team climate, team cohesion and transformational leadership). They are influenced by the independent variables.

We can see the result from the following table:

| Table 5 Simple linear regression (N=12) | | |
|---|---|---|
| Relationship | Beta | R square |
| Age diversity → Innovative behavior | 0.018 | 0.000 |
| Gender diversity → Innovative behavior | 0.169 | 0.028 |
| Region diversity → Innovative behavior | 0.785** | 0.616 |
| Tenure diversity → Innovative behavior | -0.017 | 0.000 |
| Education diversity → Innovative behavior | 0.327 | 0.107 |
| Function diversity → Innovative behavior | 0.396 | 0.156 |
| Transformational leadership → Innovative behavior | -0.160 | 0.026 |
| Team climate → Innovative behavior | -0.130 | 0.017 |
| Team cohesion → Innovative behavior | -0.140 | 0.019 |
| Age diversity → Team cohesion | 0.089 | 0.008 |
| Gender diversity → Team cohesion | -0.235 | 0.055 |
| Region diversity → Team cohesion | -0.453 | 0.205 |
| Tenure diversity → Team cohesion | 0.503 | 0.253 |
| Education diversity → Team cohesion | 0.075 | 0.006 |
| Function diversity → Team cohesion | -0.354 | 0.125 |
| Age diversity → Team climate | 0.184 | 0.034 |
| Gender diversity → Team climate | -0.369 | 0.136 |
| Region diversity → Team climate | -0.406 | 0.165 |
| Tenure diversity → Team climate | 0.538 | 0.290 |
| Education diversity → Team climate | 0.100 | 0.010 |
| Function diversity → Team climate | -0.396 | 0.157 |
| Transformational leadership → Team cohesion | 0.933** | 0.870 |
| transformational leadership → Team climate | 0.954** | 0.910 |
| Age diversity → Transformational leadership | -0.014 | 0.000 |
| Gender diversity → Transformational leadership | -0.376 | 0.141 |
| Region diversity → Transformational leadership | -0.422 | 0.178 |
| Tenure diversity → Transformational leadership | 0.466 | 0.217 |
| Education diversity → Transformational leadership | 0.009 | 0.000 |
| Function diversity → Transformational leadership | -0.344 | 0.119 |

From table 5, it is clear that only 3 equations can be established. First of all, region diversity positively affects innovative behavior at 0.785** ($p<0.01$

). Additionally the $R^2$ of region diversity is 0.616 (it is high), which means that the positive influence made by region diversity on innovative behavior is great. Secondly, transformational leadership influences team cohesion in a positive way ($R^2$ =.870, Beta=.933**, p<0.01). It indicates that transformational leadership improves team cohesion to a great degree. Finally, team climate is strongly and positively affected by transformational leadership ($R^2$ =.910, Beta=.954**, p<0.01), which is similar to team cohesion. This result indicates that transformational leadership plays an important role in a team to enhance team cohesion. However, except for these three equations, all other equations are insignificant.

Although simple linear regression didn' t substantially help with verifying the relationship between variables due to the limited N (N=12), we cannot conclude that these variables have absolutely no relationship. Thus, in the discussion part we will go back to the correlation analysis to analyze the results and simple linear regression will be regarded as an additional support.

### 4.4.2 Multiple linear regression analysis

In this research, multiple linear regression analysis focuses on illustrating if team diversity and transformational leadership indirectly influence innovative behavior via team climate and team cohesion. In order to get results, I will test the mediator effect of team climate and team cohesion to confirm if team diversity and transformational leadership have an indirect effect on innovative behavior through these two mediators.

Before making the regression analysis, three rules should be taken into account to ascertain if these variables form a true mediation relationship. According to the research of Baron and Kenny (1986), three regression equations should be established when using the mediation model. Firstly, the independent variables should affect the mediator (Rule1). Secondly, the independent variable should influence the dependent variable (Rule2). Thirdly, the dependent variable should be affected by the mediator (Rule3) (Baron & Kenny, 1986).

Based on these three rules and the simple linear regression results in the table 5, I weed out the variables that don't comply, which means the variables eliminated do not fit the mediation model. Firstly, team cohesion doesn't have a significant linear relationship with innovative behavior, which doesn't match the regression equation 3 (Rule 3). Thus, team cohesion cannot be regarded as a mediator. Similarly, team climate doesn't show a significant relationship with innovative behavior, which indicates an inconformity with the regression equation 3(Rule 3).

In conclusion, both team cohesion and team climate have an insignificant relationship with innovative behavior and results are inconsistent with Rule 3(the mediator should have an effect on the dependent variable) (Baron & Kenny, 1986). Therefore, we can conclude that team cohesion and team climate cannot be used as mediators, when trying to measure the relationship between team diversity and transformational leadership and innovative behavior.

# 5. Discussion and Conclusion

## 5.1 Summary of findings

In this research, the first part of the research question is "To what extent do team diversity and transformational leadership influence innovative behavior in R&D teams of Chinese industrial firms? Team diversity in this research is divided into non-task oriented diversity and task oriented diversity.

Non-task oriented diversity includes age diversity, gender diversity and region diversity. According to the results, region diversity has a rather strong impact on innovative behavior, which is supported by both correlation analysis and simple linear regression analysis. It is interesting to see that in Chinese industrial firms, R&D team members who come from different provinces are able share their regional culture instead of being biased towards each other. Also, the various ideas that are produced by the exchange of different regional cultures, give opportunities to the Chinese R&D team members to improve their innovative behavior. However, age diversity and gender diversity only show an indication that they might have positive but insignificant influence on innovative behavior of the Chinese team members in R&D teams. According to this research paper these two relationships could not be sufficiently proven. Such results can be explained by the low diversity of age and gender, which are 0.13225 and 0.35233 respectively. It shows that in Chinese R&D teams, the age gap between team members is rather small while the gender of team members tends to be similar. So it might be the situation, that age and gender diversity have no obvious impact on the innovative behavior of team members in the context of Chinese R&D teams.

We now turn to task- oriented diversity. Education diversity, tenure diversity and function diversity are involved in task- oriented diversity in this research. From the result, the education diversity and tenure diversity also just show a sign that they might positively add innovative behavior of team members in the Chinese R&D teams but the impact is not significant. From the educational diversity data, we can see that the educational background of team members in the context of Chinese R&D teams is very similar, which is only 0.34558. Thus, we can conclude that low education diversity

doesn’ t produce a significant contribution to improving the innovative behavior of team members in Chinese R&D teams. Tenure diversity in Chinese R&D Teams is high, however, the impact of tenure diversity on innovative behavior is not significant and cannot be proven in this research paper. What’ s more, it is surprising to see that function diversity has a significant negative effect on innovative behavior, which indicates that people from different positions that form an R&D team in the Chinese context will restrain their ability to innovate.

In addition, transformational leadership, team climate and team cohesion also cannot be proved that they have a significant influence on innovative behavior in this research, but the indication show that they might have a positive influence on innovative behavior of the employees in the Chinese R&D teams.

To make a compare among these nine factors, we can see that the region diversity and function diversity play the most important role to influence the innovative behavior while other variables cannot be proved that they have significant influence on innovative behavior of R&D team members under the Chinese context. Therefore, team diversity seems to be more important than transformational leadership, team climate and team cohesion when inspiring innovative behavior in R&D teams in Chinese industrial firms.

The second part of the research question is to discuss if the team diversity and team transformational leadership make the indirect influence on the innovative behavior via team climate and team cohesion, or they only make the direct influence on the innovative behavior in the R&D team under the Chinese condition. From the results, both team climate and team cohesion fail to play the mediator roles. But it is still worthwhile to point out that transformational leadership improves both team climate and team cohesion. These results indicate that transformational leadership encourages the team members to build up a more supportive working climate in the Chinese R&D teams and transformational leadership inspires team members to add group consciousness. In the contrary, functional diversity negatively makes efforts on both team cohesion and team climate, which explains that under the Chinese context, R&D

team members who have various functions cannot understand each other’ s work and may form conflicts in their daily work by misunderstanding of each other’ s tasks.

The last part of the research is about that how team diversity influences the transformational leadership. Based on the result, only tenure diversity will strongly and positively influence the transformational leadership while the function diversity will make significant and negative effect on transformational leadership. This result indicated that people who have the different working experience will give enough ideas and suggestions to the team leader so that the leader can be more acceptable to make the decisions. However, if the leader are faced with people with different functions, the leader will feel hard to consider all the requirements for the different positions, especially the position with high skilled.

## 5.2 Research findings and existing literatures

First of all, this research paper ascertained only region diversity and function diversity are determinants of innovative behavior of team members in Chinese R&D teams in industrial firms.

Region diversity positively influences innovative behavior, which indicates team members in Chinese R&D teams are used to diversity in regional culture and this helps to engender a bigger variety of ideas (Gong et al., 2011). This finding does not resemble results from the study of Luong et al. (2013). They argued that people from different provinces in China have barriers to communicate well with each other, which results in a low productivity (Luong et al., 2013). Our finding is opposite to Luong et al. (2013) because employees in Chinese R&D teams overcome communication barriers to make use of the advantages of region diversity.

Another determinant of innovative behavior is function diversity. According to the research results, function diversity has a surprisingly strong and negative influence on innovative diversity, which doesn’ t fit the argument of Daellenbach et al. (1999) who indicated that functional diversity leads to a more varied amount of knowledge to solve problems (Daellenbach et al., 1999). The reason is that the function diversity in Chinese R&D teams is rather high and it is hard for team members to understand entire

functions in the whole team.

Secondly, our research findings fail to prove that team cohesion and team climate act as the role of mediator under the context of Chinese R&D teams. The main reason is that both team cohesion and team climate lost evidence to prove a positive and strong influence on innovative behavior. What' s more, in this research, team climate is defined as a supportive working atmosphere, which put more emphasis on mutual support among team members. An excess of support among the group members will restrict their behavior to innovate because an excess of support will increase mutual dependence among group members. Similarly, research also shows that high team cohesion will also limit the ability of employees to innovate (Sethi et al., 2001). As we all known, Chinese tend to be more collective so there might be high team cohesion and enough support among the team members. The data in our research give evidence that the average score of team cohesion and team climate is high, which are both close to 4. That high score might explain why the relationship of team climate and innovative behavior and the relationship of team cohesion and innovative behavior are insignificant.

Finally, there are limited research studying the direct relationship between team diversity and transformational leadership and it is necessary for further studies to explore this relationship (Jackson, 2003; Dionne et al., 2004). This research findings show evidence that there happens the direct relationship between team diversity and transformational leadership under the Chinese R&D teams' context which fills in the gap between team diversity and transformational leadership. What' s more, tenure diversity makes positive influence on transformational diversity while function diversity negatively affects transformational leadership.

## 5.3 Summery of support of hypotheses

Based on the Result chapter, it can be seen clearly that not all the result match all the hypotheses mentioned before.

Table 10 Summery of support of hypotheses

| | Hypothesis | support |
|---|---|---|
| 1 | ***Hypothesis 1: Team climate has positive influence on the innovative behavior.*** | No |
| 2 | ***Hypothesis 2: Team cohesion has positive influence on the innovative behavior.*** | No |
| 3 | ***Hypothesis 3: Transformational leadership has positive influence on innovative behavior*** | No |
| 4 | ***Hypothesis 4: Transformational leadership has positive influence on team climate*** | Yes |
| 5 | ***Hypothesis 5: Transformational leadership has positive influence on team cohesion*** | Yes |
| 6 | ***Hypothesis 6a: Task oriented diversity (Education, tenure and function) has positive influence on innovative behavior*** | No |
| 7 | ***Hypothesis 6b: Non-task oriented diversity (age, gender and region) has positive influence on innovative behavior*** | Partly support |
| 8 | ***Hypothesis 7a: Task oriented diversity (Education, tenure and function)has positive influence on team climate*** | No |
| 9 | ***Hypothesis 7b:Non-task oriented diversity (age, gender and region) has negative influence on team climate*** | No |
| 10 | ***Hypothesis 8a: Task oriented diversity (Education, tenure and function) has positive influence on team cohesion*** | No |
| 11 | ***Hypothesis 8b: Non-task oriented diversity (age, gender and region) has negative influence on team cohesion*** | No |
| 12 | ***Hypothesis 9a: Task oriented diversity (Education, tenure and function) has positive influence on transformational leadership*** | No |
| 13 | ***Hypothesis 9b: Non-task oriented diversity (age, gender and region) has positive influence on transformational leadership*** | No |

According to this table, it clearly states that only Hypothesis 4 and Hypothesis 5 are evidently supported because transformational leadership positively makes strong effects on team climate and team cohesion. In addition, Hypothesis 7 is partly supported and the reason is that only region diversity can significantly have positive influence on innovative behavior. Age diversity and gender diversity only show an indication to positively influence innovative behavior, which cannot be proved in this research. Therefore Hypothesis 7 is only partly supported. What' s more, the rest of hypotheses aren' t supported in this research.

## 5.4 Conclusion

This research finds out the impact of team diversity and team leadership on innovative behavior of employees in R&D team of Chinese industrial firms. First of all, result shows that only region diversity can positively make direct influence on innovative behavior while function diversity makes direct and negative impact on innovative behavior. Secondly, team cohesion and team climate fail to be proved that they have in the mediator roles under the Chinese R&D team context. Although this research doesn' t make great contribution on explain " to what extent do team diversity and team leadership make influence on innovative behavior of employees in R&D teams of Chinese industrial firms" , it still find that team diversity is an important factor to influence innovative behavior of Chinese R&D team members and the relationship of team diversity and innovative behavior still needs more attention to find out the black box between them under the Chinese context. Another contribution of this research is that we find tenure diversity can make positive influence on transformational leadership while function diversity has negative effect. This result fills in the gap between team diversity and transformational leadership and discovers that there is a direct relationship between team diversity and transformational leadership under the Chinese R&D context.

## 5.5 Limitation

This research is a master thesis, which had to be accomplished in a limited time. Therefore, there are some limitations to this study. First of all, this research used the non-probability sampling method due to the fact that the research has some

particularities. Although this sampling method assisted me to get sample firms, it did reduce the representativeness of this study, which means that this study cannot represent the condition of the overall population (Schreuder et al., 2001). Secondly, the number of teams is rather low, with only 12 R&D teams. Lack of enough sample teams affects the results of this research and makes it more difficult to analyze the data. Thirdly, some diversity scores are rather low, such as education diversity, which will make the results lack persuasion. Finally yet importantly, in this research, the team diversity discussed all falls under demographic diversity without a more deep-level diversity such as the value. This condition makes it hard to test interaction between transformational leadership and team diversity because transformational leadership does not have the ability to change a person's demographic variable such as gender or age.

## 5.6 Further study

Due to the limitations of this research, some suggestions will be given for further study. First of all, further study could find a more effective sampling method to get sample firms than non- probability sampling, which also guarantees a high team diversity and makes the results more typical for all Chinese industrial firms . Secondly, deep-level team diversity should be considered in further study. It will be interesting to see how these deep-level variables influence the innovative behavior in R&D teams. Meanwhile, the interaction between deep-level team diversity and transformational leadership would also be an interesting point to study because transformational leadership can change a team members' values and ideas, and this could have an effect on transformational leadership as well.

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# 7. Appendix

## 7.1 Questionnaire

### Questionnaire for the impact of team diversity and leadership on innovative behavior

## 1. Introduction

Dear Sir/Madam:

Good Day! I am a master student from business administration in University of Twente. My master thesis is to study the effects of team characteristics (like team climate and team cohesion) and leadership on innovative behavior of employees. . Your answer is very helpful for the research result and your answers will stay anonymously and will only be used for the survey purpose. If you have any question about the survey, you can contact with me. My email address is 1.huang-1@student.utwente.nl. Thank you for your time and help.

## 2. Questionnaire

**Directions: Please fill in the following blanks with your answer**

| | |
|---|---|
| Age: | _____ Years old |
| Gender: | Male/ Female |
| Region: | _____ Province |
| Team Tenure | _____ years |
| Function | _____ |
| Education | _____ |

**Directions: Please indicate your level of agreement or disagreement with each of these statements. Place an "X" mark in the box of your answer.**

| | **Strongly disagree** | **Disagree** | **Average** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| I always notice the tasks that not in my daily work | | | | | |
| I am always willing to know how the tasks can be improved | | | | | |
| I always find out new methods, technology or instruments | | | | | |
| I always form the original solutions for the problems | | | | | |
| I always find new methods for implementing the tasks | | | | | |
| I always enable the important organizational members to arouse interest for the innovative ideas | | | | | |
| I always try to convince people to support an innovative idea | | | | | |
| I always introduce the innovative idea into practices systematically at the | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| working environment | | | | | |
| I always make contribution to implementation of the innovative ideas | | | | | |

**Directions: Please indicate your level of agreement or disagreement with each of these statements. Place an "X" mark in the box of your answer.**

| | **Strongly disagree** | **Disagree** | **Average** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| My leader always examines the critical assumptions again to question if they are suitable | | | | | |
| My leader always shares the values and beliefs with me. | | | | | |
| My leader always searches different perspectives when he/ she deals with the problems | | | | | |
| My leader always discusses the team future with me optimistically | | | | | |
| My leader always instills the pride for being associated with me | | | | | |
| My leader always talks passionately to me about the things that need to be finished | | | | | |
| My leader always specify that it is important to have a strong sense of purpose | | | | | |
| My leader always takes time to teach and coach me | | | | | |
| My leader always treats me as an individuals rather than just as a team member | | | | | |
| My leader always acts in the proper ways to get the respect from me | | | | | |
| My leader always consider the moral and ethical influence of decision | | | | | |
| My leader always gives a sense of power and confidence to me | | | | | |
| My leader always articulates the compelling vision of the future in the team to me | | | | | |
| My leader always considers the different needs, abilities and aspirations of me and other colleagues. | | | | | |
| My leader always helps me to develop my strengthens | | | | | |
| My leader always suggests new methods to me when completing the assignments | | | | | |
| My leader always focuses on the importance of having a collective sense of mission | | | | | |
| My leader always expresses the confidence to me that our goal will be achieved | | | | | |
| My leader always suggests me to look at | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| the problems from different angles | | | | | |
| My leader always goes beyond self-interest for the good of our team | | | | | |

**Directions: Please indicate your level of agreement or disagreement with each of these statements. Place an "X" mark in the box of your answer.**

| | **Strongly disagree** | **Disagree** | **Average** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| Our team is consistently seeking for the new answers for development | | | | | |
| Assistance is available in developing new ideas in our team | | | | | |
| Our team is open and responsive to change | | | | | |
| People in our team are always finding fresh, new ways of looking at problems | | | | | |
| Necessary time will be given to develop new ideas in our team | | | | | |
| People get associated in our team in order to help with developing and applying new answers | | | | | |
| Resources are shared by members in our team to help in the application of new ideas | | | | | |
| People in our team provide practical support for new ideas and their application | | | | | |

**Directions: Please indicate your level of agreement or disagreement with each of these statements. Place an "X" mark in the box of your answer.**

| | **Strongly disagree** | **Disagree** | **Average** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| Team members in our team are united in trying to achieve its goals for performance | | | | | |
| I am glad to our team's level of commitment to the task | | | | | |
| Our team members don't have conflicting aspirations for the team's performance | | | | | |
| Our team provides enough chances for me to improve my personal performance | | | | | |
| Our team would like to take time together outside of work hours | | | | | |
| Our team members stick to each other outside of work time | | | | | |
| Our team members always have parties together | | | | | |
| Our team members would rather gather together as a team rather than go out on their own | | | | | |
| Our team is the most important social groups for me to which I belong | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| I have some of my best friends in the team | | | | | |

**Thank you so much for your time!**