Relationship between Team Diversity and Innovation: The Moderating Effect of Team Leaders' Innovative Characteristics

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Abstract--**Innovation is an essential condition for enterprises to maintain their competitive advantage. Therefore, many enterprises attempt to find the factors which could achieve innovation. Prior studies have found that team diversity, which include relation-oriented diversity, task-oriented diversity, and deep-level diversity, plays an important role in team innovation, but the results are inconsistent. Furthermore, we find that team leaders' innovative characteristic has a great impact on team innovation. However, few studies have investigated the moderating effect of team leaders' innovative characteristic in the relationship between team diversity and innovation. Therefore, we regard team leaders' innovative characteristic as the moderator to explore the relationship between team diversity and innovation. In this study, we draw on data from 24 teams in manufacturing, and service industries. Finally, the empirical results find that relations-oriented diversity has positive effect on team innovation, and deep-level diversity has negative effect on team innovation. Moreover, this finding also shows that team leaders' innovative characteristic has partly positive moderating effect in this study.**

I. INTRODUCTION

Innovation is a critical factor to sustain competitive advantage in a constantly rapid changing environment. Both practitioners and academics proposed that innovation plays an important role in economic development and competitive success [52],[21],[10],[11]. Accordingly, innovation has been widely discussed in various field, especially for organizational innovation [14],[31],[60],[36].

Some studies have found that innovation could improve organizational performance and effectiveness, and generate novel ideas in an ever-changing environment [36]. Therefore, innovation could be seen as a chief determinant for the survival of organizations.

Team has become the base unit for implementing organizational task [27]. Therefore, team-related factor is also the key determinants of organizational innovation (e.g. [2][62]). For instance, team collaboration could generate novel ideas via the interaction and knowledge sharing of team members, and thereby to improve organizational innovation [45][4]. For this reason, we could know that novel ideas or information have beneficial for organizational innovation, and thereby we may infer that team innovation is likely to have a great impact on organizational innovation.

Team innovation is defined as the introduction or application of new ideas, processes, products, or procedures that are designed to be useful for a team [59][16], which is consistent with the conception of organizational innovation. Therefore, team innovation is likely to have more influential than other team-related factors which could improve organizational innovation. Namely, team innovation is the foundation of organizational innovation. Therefore, we attempt to minimize scope to explore the antecedents of team innovation in this study.

Previous studies find that team members' diversity has great impact on team innovation. For example, some studies have indicated that diverse teams possess a greater range of perspectives which could help them generate the capability of high-quality solutions [53][58], and thereby, to benefit team innovative activities. Moreover, team diversity could foster team members' information sharing and then fire up innovative ideas which could benefit team functioning [53]. However, high level of team diversity has also been found to cause high level of dissatisfaction and turnover, and negative team innovation [53][70]. Therefore, we could find that the diversity- team innovation relationship is not consistent. One of the reasons for this ambivalence might be moderators play a role in the diversity - team innovation relationship [53]. Therefore, the purpose of this study is to shed light on how the relationship between team diversity and team innovation is moderated by other variables.

Many studies have indicated that leader and leadership has a great impact on team innovation [6][69]. According to the example of Apple Corporation founder Steve Jobs, we find that leader's innovative characteristics also have a great beneficial for team outcomes. However, fewer studies have explored the effect of leader's innovative characteristics on team innovation. Therefore, we seen leader's innovative characteristics as the moderating variable to explore it could enhance the relationship between team diversity and team innovation in this study.

II. THEORY FRAMEWORK AND HYPOTHESIS

Innovation is reflected in novel outputs: a new good; a new service; a new market; a new production technology; a new operation procedure; a new administrative strategy; a new organizational structure, or a new plan [14],[36],[11]. Thus, innovation can be defined as an adoption or introduction of new device, system, product, policy, or service. Then, it is a critical factor to sustain competitive advantage in a constantly changing environment. Both practitioners and academics proposed that innovation plays an important role in economic development and competitive success [52],[18],[21],[17],[10],[11]. Therefore, innovation has attracted much attention and it has been widely discussed in organizational innovation field [31],[60],[36].

In a constantly changing and challenging environment, innovation is a vital factor for organizations. Innovation provides organizations with flexibility, which is the key to sustain and improve organizational performance and effectiveness, for facing with an ever-changing environment [14][36]. Furthermore, innovation represents the creation or adoption of novel ideas or behavior for an organization [36]. In today's rapidly competitive changing environment, organizations have to constantly generate novel ideas or acquire external information and technology in order to sustain competitive advantage [35]. Therefore, innovation can be the chief determinant for the survival of organizations. Namely, organizational innovation has been seen as the key determinant of an organizations' success or failure [36].

Organizational innovation is subject to influences in three categories: including the individual, organizational, and environmental factors [14]. In the aspect of individual, previous studies have found that organizational members' absorptive capability [37], attitude [47], personality, job characteristics, employees' mood state [2], and professional background of managers [49] have a significantly impact on organizational innovation. In the aspect of organization, past studies indicate that organization learning [36][34] specialization, functional differentiation, professionalism, formalization, centralization, managerial attitude, managerial tenure, technological knowledge resources, administrative intensity, slack resources, external and internal communications, vertical differentiation [14], structural complexity, size [13],[8],[15], organizational structure, strategy [34][11] are the determinants of organizational innovation. Much of the research on environmental determinants of organizational innovation in the last few decades has addressed many considerations, including market structure and industry characteristics [13], environmental uncertainly or complexity [55], and network [49],[48],[9]. Furthermore, [33] propose that the determinants of organizational innovation are composed of individual, team, and organizational level. Therefore, we could acknowledge that team-related factor is also the key determinants of organizational innovation.

Team has become the base unit for implementing organizational task [27]; namely, organizational performance or innovation is likely to be influenced or improved through the communication or interaction of team [4]. Team structure, team climate, team processes, member characteristics, leadership style, and team members' function heterogeneity have significant impact on organizational innovation [2][62]. Furthermore, team innovation has a tight connection with organizational innovation. Team innovation refers to the introduction or application of new ideas, processes, products, or procedures that are designed to be useful for a team [59][16], which is consistent with the conception of organizational innovation. Therefore, team innovation may have more influential than other team-related factors which could improve organizational innovation. Namely, team innovation is the important foundation of organizational innovation. Furthermore, organizational innovation has been widely explored in previous studies. Accordingly, we attempt to minimize scope to explore the antecedents of team innovation.

Previous studies find that team members' diversity is more complex [61]39], and it is likely to generate negative impact on team management [43]. Under this condition, both practitioners and academics attempt to find the solution in order to decline the effect of team members' diversity on team development, or create team synergy through the characteristic of team members' heterogeneity. For this reason, team heterogeneity or diversity has become a key management issue. Moreover, many studies have attempted to investigate how team heterogeneity or diversity influence in team innovation, but the findings are not consistent. Therefore, we reexamine the relationship between team heterogeneity or diversity and team innovation in this study.

Team diversity

Diversity is a term for the extent to which a team's members are dissimilar (heterogeneous) with respect to individual-level characteristics [43]. Furthermore, [24] proposes that team diversity refers to the social composition of a team; then, team members could differ in various attributes, such as gender, values, personality, organizational role, and cognitive styles [43]

Team diversity could be distinguished into two categories, including task-related and relations-oriented attributes of diversity (heterogeneity) [25][24]. Task-oriented diversity refers to the specific skills and abilities (e.g. tenure, educational level, and job experience) [43]. Relations-oriented diversity is about the demographic characteristic (e.g. gender, age, and religion) [25],[24],[43]. Moreover, other studies has distinguished between diversity in surface-level characteristics, which is included task-oriented and relations-oriented diversity, versus diversity in deep-level characteristics (like attitudes, opinions, information, personality, and values) which could be realized via verbal and nonverbal communication [22][46]. To sum up, based on the previous studies, team diversity could classified into three categories including task-oriented, relations-oriented diversity and deep-level diversity. Moreover, some studies have found that these three types of diversities have different impact in team innovation. For this reason, we attempt to explore how these three diversities influence in team innovation in this study.

Task-oriented diversity. Task-oriented diversity refers to the heterogeneity of specific skills and abilities (e.g. tenure, educational level, and job experience) in a group [43]. In general, task-oriented diversity is composed of education, tenure, and function diversity (e.g. [61][19]) because these diversities mainly capture experiences, information, and perspectives relevant to cognitive task. Educational diversity refers to a great mix of educational background of a team's members; tenure diversity refers to member's entry date to the organization; Functional diversity refers to the diversity

of organizational roles embodied in the team [30][19].

In view of the decision theory, task-oriented heterogeneity is likely to enhance breadth of information, and overall problem-solving capacity of the group through the interaction and experience sharing of team members in the decision-making process [38], and thereby to improve team performance and the quality of decision-making [61]. Furthermore, heterogeneity of educational-level and job experience is likely to generate cognitive conflict, which could decline group-think phenomenon and create novel ideas [59]. According to these studies, we could comprehend that team's task-oriented heterogeneity could increase the team diversity information and flexibility through the interaction of team member, and thereby to generate novel thinking which could improve team innovation. Task-oriented heterogeneity is beneficial to team innovation [57]. Therefore, we could acknowledge that task-oriented diversity has a great benefit to team innovation and development. Therefore, the following is proposed:

Hypothesis 1: Task-oriented diversity will have significantly positive impact on team innovation.

Relations-oriented diversity. Relations-oriented diversity is defined as the differences of observable biological characteristics, gender, and age [19][23]. Gender heterogeneity demonstrate that the mix of males and females in a team. On the other hands, age heterogeneity refers to diversity of age within a team.

From an information and decision-making view, diversity could have positive outcomes because more diverse team is expected to acquire a greater range of perspectives and generate more high-quality solutions, [58],[61],[53]. Therefore, relations-oriented diversity may have positive team outcomes, even though it is likely to generate team conflict [27]. Since, team conflict could decline group-think phenomenon, and thereby generate differently perspectives or ideas [59]. Therefore, team innovation could be improved. For instance, [63] proposes that men and women have qualitatively different catches of knowledge; therefore, gender heterogeneity may spark team creativity and innovation. Based on the above-mentioned, we hypothesize the following:

Hypothesis 2: Relations-oriented diversity will have significantly positive impact on team innovation.

Deep-level diversity. Although the mainstream of team diversity research has focused on demographic diversity, such as task-oriented diversity and relations-oriented diversity [61],[19],[43],23], some studies are beginning to investigate intra-group differences in cognitive abilities [57], Big Five personality traits [44], work-related attitudes [22], and values [29], which are considered deep-level diversity.

The Big Five Factor Model provides a comprehensive framework to examine personality [12][43]; therefore, it has been widely explored in past studies. The Big Five Factor Model is composed of extraversion, openness to experience, conscientiousness, agreeableness, and neuroticism [12]. Furthermore, some studies have indicated that conscientiousness, agreeableness, and neuroticism have less significant impact on innovation [32]. On the contrary, both openness to experience and extraversion have significantly effect on innovation (e.g. [42],[32],[40],[1]). Therefore, both openness to experience and extraversion are examined in the present study.

On the perspectives of similarity attraction [7] and social categorization [54][56] theories, personality diversity may limit within group behavioral and social integration, foster conflict and turnover, and diminish morale, cohesion, and performance [61][28]. Too many extraverts are likely to generate disadvantageous outcomes within a team because of the propensity to pursue social interactions at the expense of task demands [43]. Moreover, extraverted people are dominant and assertive [12], and conflict is likely to occur when there are too many dominant individual in the team [41][43]. Therefore, we hypothesize the following:

Hypothesis 3: Deep-level diversity will have significantly negative impact on team innovation.

Leader's innovative characteristics. Team leader plays an important role in a team because he or she could influence team success or failure [64]. Some studies have indicated that transactional leadership could foster team members' innovative outcomes, and thereby to promote team innovation [65]. Furthermore, leader personality will have a stronger influence on teamwork and new product development project performance [3]. Accordingly, we could acknowledge that team leader's personality and leadership have a great beneficial to team development and innovation performance.

Furthermore, we find that many successful innovative corporations are influenced by leader's innovative characteristics. For instance, Apple Corporation founder Steve Jobs shows his innovative characteristics; then, he leads Apple Corporation to occupy a dominant presence in 3C market. Furthermore, he also leads Apple Corporation to be a successful innovative corporation. Therefore, we could find that leader's innovative characteristics have a great beneficial to team outcomes. However, fewer empirical studies have investigated the conception of leader's innovative characteristics and whether leader's innovative characteristic effect on team innovation.

A good innovator must be satisfy three characteristics, including skills and qualities (e.g. energetic, enthusiastic, competitive, innovative, thrive on change, diversity, challenge, and be able to live with uncertainty), attitudes (e.g. teamwork, problem-solving, and desire to learn), and education (e.g. university qualification). Based on these innovator characteristics, we develop the conception of leader's innovative characteristics in this study [51]. Moreover, we attempt to explore whether leader's innovative characteristics enhance the relationship between team diversity and team innovation. Therefore, we hypothesize the following:

Hypothesis 4: Leader's innovative characteristics have significantly positive effect on the relationship between task-oriented diversity and team innovation.

Hypothesis 5: Leader's innovative characteristics have significantly positive effect on the relationship between relations-oriented diversity and team innovation.

Hypothesis 6: Leader's innovative characteristics have significantly positive effect on the relationship between deep-level diversity and team innovation.

III. METHODOLOGY

A. Sample and Data Collection

A questionnaire survey was employed to test this model. We collect data from the team members of Taiwanese small- and medium-sized design, service and manufacturing firms, so called SMEs. The design firms include interior design and arts; the service firms include product certification and transportation service; and manufacturing firms include automobiles and parts manufacturing, computers, electronic and optical products manufacturing, chemical product manufacturing and so on. To enhance accuracy, we narrowed down the sample by excluding the team size less than three members.

The development of the questionnaire was pretested with three experts to ensure understanding of the questionnaire and determine if the respondents possessed sufficient knowledge to answer. We mail 150 questionnaires to the respondents of 27 teams of the 18 firms; along with the questionnaire, each respondent received a cover letter outlining the objectives of the research. Finally, we receive 138 usable questionnaires from 24 teams in the 18 firms, providing us with a response rate of 92%.

B. Measures

The variables are divided into four types in this study, which are dependent variable, independent variables, moderating variable and control variables. In order to ensuring the conceptual equivalence of both the Chinese and English questionnaire versions, we conduct back-translation by bilingual speaker of the both languages. Participants rate questionnaire items on the five-point Likert scale ranging from strongly disagree to strongly agree.

C. Dependent variable

Team innovation is defined as the introduction or application of new ideas, processes, products, or procedures that are designed to be useful for a team [59][16]. It could be operationalized as the combination of the quantity and quality of ideas which are implemented [69]. Then, it is measured employing 8-item (α =0.92) from the scale developed by [6]. The score ranges from 1 (strongly disagree) to a theoretical high of 5 (strongly agree).

D. Independent variables

Task-oriented diversity is composed by educational level, employment tenure, and functional diversity, which are coded by team members' background straightforwardly [19]. First, educational level diversity is defined as the mix of team members' educational background [19], and it is calculated by [5] heterogeneity index, defined as $D=1-\sum P_i^2$, where i is the proportion of the team in the i_{th} educational level category. The proportion is squared and summed over each educational level category. The summed value represents the degree of educational level homogeneity in the team, and the subtraction of that value from 1 gives the degree of educational level heterogeneity. Educational level categories

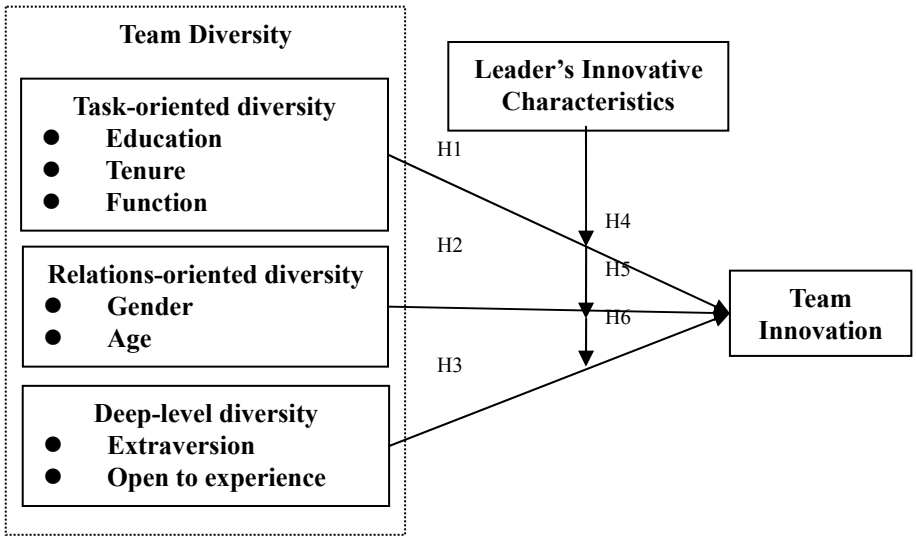

Figure 1 Theoretical Framework

are classified into five types: Doctoral degree, Master degree, Bachelor degree, professional degree (equivalent to junior college diploma), and secondary education degree. Second, employment tenure diversity refers to the heterogeneity in team members' job tenure [19], which is similarly assessed by Blau's index. Third, functional diversity is defined as the heterogeneity of organizational roles in a team [19][26], which is also assessed by Blau's index.

Relations-oriented diversity refers to personal characteristics that are not related to the educational performance, inclusive of gender and age [19]. First, gender diversity is classified into two categories: male and female, which are calculated by Blau's index. Second, age heterogeneity represents the team members' age, which is assessed by Blau's index also.

Deep-level diversity is composed of extraversion and openness to experience of personality dimension in this study. Extraversion and openness to experience are measured with 12-item (α=0.78) short form of the Big five-factor inventory (NEO-FFI) [12][50]. Respondents employ a five-point Likert scale ranging from strongly disagree to strongly agree. Then, we use within-group standard deviation (sd) to reflect deep-level diversity in team members [66][22]. This index ranges from 0 to 1, with 1 representing the highest level of deep-level diversity and 1 representing the lowest.

E. Moderator

Leader's innovative characteristic does not have an applicable scale yet. Therefore, we develop leader's innovative characteristic 10-item (α =0.94) in accordance with the innovators' characteristic and ability which are proposed by [51][20]. Then, these items are measured by employees in order to acquire objective assessment. Questions use five-point Likert-type scales ranging from 1 (strongly disagree) to a theoretical high of 5 (strongly agree).

F. Control variables

Team size is a crucial factor which could influence team operation [67] and team innovation [68]. Therefore, it is regarded as control variable in this study. Team size is calculated via the number of team members.

V. DATA ANALYSIS AND RESULTS

Table 1 shows the means, standard deviations, and correlations for all study variables. Hierarchical regression analyses with team innovation as the dependent variable is reported in Table 2. Model 1of the analysis includes only control variable. Model 2-4 include the main effect: task-oriented diversity, relations-oriented diversity, and deep-level diversity, and model 5-7 include hypothesized interactions.

Hypothesis 1 predicts that task-oriented diversity will have significantly positive impact on team innovation. As shown in Model 2, task-oriented diversity does not have significant effect in team innovation. Therefore, Hypothesis 1 is not supported. According to Hypothesis 2 and 3, teams with higher diversity on relations-oriented and deep-level will have positive and negative team innovation, respectively. As shown in Model 3 and Model 4, the main effects are significant for relations-oriented (beta=0.43, $P < 0.01$) and deep-level (beta=-0.47, $P < 0.01$). Therefore, both Hypothesis 2 and 3 are supported.

Hypothesis 4 predicts that leader's innovative characteristics will positively moderate the relationship between task-oriented diversity and team innovation (beta=0.6, $P < 0.001$). As shown in Model 5, the Hypothesis 4 is supported. Then, we examine that leader's innovative characteristics will positively moderate the relationship between relations-oriented diversity and team innovation (Hypothesis 5). Model 6 shows that leader's innovative characteristics have no significantly moderating effect on the relationship between relations-oriented diversity and team innovation. Therefore, Hypothesis 5 is not supported. Finally, we examine whether leader's innovative characteristics have positively moderating effect on the relationship between relations-oriented diversity and team innovation (Hypothesis 6). As shown in Model 7, Hypothesis 6 is supported (beta=1.62, $P < 0.001$)

TABLE 1. DESCRIPTIVE STATISTICS AND CORRELATIONS

Variable	Mean	S.D.	1	2	3	4	5	6
1.Deep-level diversity	0.84	0.24	1					
2.Relations-oriented diversity	0.74	0.27	-0.55**	1				
3.Task--oriented diversity	1.19	0.50	0.01	-0.05	1			
4.Leader's innovative characteristics	3.74	0.40	-0.13	-0.04	0.13	1		
5.Team innovation	3.73	0.33	-0.49*	0.43*	0.06	0.62**	1	
6.Team size	5.71	3.37	0.26	0.00	0.36	-0.11	-0.20	1

*P < 0.05, **P < 0.01, ***P < 0.001

TABLE 2. HIERARCHICAL REGRESSION ANALYSES

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Control Variables							
Team size	-0.20	-0.25	-0.20	-0.08	-0.14	-0.21	-0.03
Independent Variables							
Task-oriented diversity		0.15			0.38		
Relations-oriented diversity			0.43**			-0.19	
Deep-level diversity				-0.47**			-1.99***
Moderating effect							
Task-oriented diversity *Leader's innovative characteristics					0.60***		
Relations-oriented diversity *Leader's innovative characteristics						0.68	
Deep-level diversity *Leader's innovative characteristics							1.62***
F-value	0.90	0.66	3.08*	3.36	4.50**	2.92*	10.01***
Adj R^2	0.00	-0.03	0.15	0.17	0.31	0.2	0.54

*P < 0.05, **P < 0.01, ***P < 0.001

IV. DISCUSSION AND CONCLUSION

In this study, we attempt to reexamine whether team diversity effect on team innovation. Furthermore, many studies have found that leader's leadership and personality have a great impact on team innovation. Then, by the example of Apple Corporation founder Steve Jobs, we also find that leader's innovative characteristics are a key factor which may influence on team outcomes. However, fewer studies have explored the effect of leader's innovative characteristics on team innovation. Therefore, we also explore whether leader's innovative characteristics enhance the relationship between team diversity and team innovation. The primary findings suggest that (a) relations-oriented diversity leads to improve team innovation, (b) deep-level diversity will diminish team innovation, and (c) the moderating effect of leader's innovative characteristics improve the relationship between team diversity (including task-oriented diversity and deep-level diversity) and team innovation.

Moderating effect of leader's innovative characteristics. Our findings reveal that the leader's innovative characteristics have a positive moderating effect on the relationship between task-oriented diversity and team innovation. Furthermore, it could convert a negative result into positive in the relationship between deep-level diversity and team innovation. Therefore, we could verify that leader's innovative characteristics have a great beneficial for team innovation.

A good innovator is energetic, enthusiastic, and innovative [51]; therefore, he or she is likely to promote positive team atmosphere or encourage team's member participants in innovative activities in order to generate novel ideas, and thereby to improve team innovation. For instance, Apple Corporation founder Steve Jobs shows his innovative characteristics; then, he leads Apple Corporation to occupy a dominant presence in 3C market. Furthermore, he also leads Apple Corporation to be a successful innovative corporation. Therefore, a good innovative leader may have the abilities to assist a team to resurrect. According to the finding, we recommend manager that the successful key factor of team innovation must consider not only team members' characteristics and abilities, but also leader's innovative characteristics.

Task-oriented diversity for team innovation. Our findings reveal that the effect of task-oriented diversity on team innovation is not significant. The possible explanation is task-oriented homogeneity is high in this study. According to the demographic information, 52.6% of team member are undergraduate, and 35% are master. Therefore, educational-level diversity is low. Moreover, 47.4% of respondents major in engineering, and 23.4% are business management. Then, 76.6% team members' tenure less than 5 years. Based on the data, it has demonstrated that task-oriented diversity is low in this study; therefore, it could not improve team innovation.

According to the finding, we recommend that firm should enhance task-oriented diversity in order to improve team innovation. Furthermore, manager should encourage team members participant in cross team collaboration, educational training, and job rotation, and thereby to acquire novel ideas and different perspectives which could improve team innovation.

Relations-oriented diversity for team innovation. Our findings reveal that the effect of relations-oriented diversity on team innovation is significant. From an information and decision-making view, diversity could have positive outcomes because more diverse team is could acquire different information and generate more high-quality solutions [58],[61],[53]. Therefore, relations-oriented diversity may have positive team outcomes, even though it is likely to generate team conflict [27].

Deep-level diversity for team innovation. Finding indicates that deep-level diversity has a significantly negative

effect on team innovation. According to the perspectives of similarity attraction [7] and social categorization [54][56] theories, personality diversity is likely to foster conflict diminish morale, cohesion, and performance [61][28]. Therefore, deep-level diversity has negative effect on team innovation and our research finding is consistent with the previous studies.

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