Predicting the Relationship Between Individual and Team Creativity: Individual Motivation on the Task and Team Climate.

Predicting the relationship between individual and team creativity: individual motivation on the task and team climate.

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Abstract

This study investigated factors contributing to team creativity by examining (i) correlation between team member's individual creativity measured before joining the team (individual creative potential) and team creative output (team creativity), (ii) correlation between team member's intrinsic motivation in the task and team creativity, (iii) correlation between team climate and team creativity, and (iv) role of individual creative potential, intrinsic motivation and team climate, taken together, to predict team creativity. To date, no study has examined the link between individual creativity *before* joining a team and team output. This study contributes to the understanding of how to assemble and nurture teams to maximize their creative performance. The study hypothesized that individual team member creativity prior to joining the team would be positively related to team creativity. Further, the correlation was expected to be stronger when the participant's level of intrinsic motivation and the level of team climate for creativity were higher. Participants were recruited from a second year MBA course at the China Europe International Business School, in Shanghai. Participant's individual creative potential was measured with an on-line version of the divergent thinking task and a self-report measure of creative personality, prior to team assembling. Intrinsic motivation and team climate for innovation were measured after conclusion of the team work using online validated self-report measures. The results showed a significant correlation between individual creative potential and team creative output (R^2 =.284, $F(2,19)=3.77$, $p<.05$), and they also revealed something that was not anticipated in the

initial hypothesis: whereas divergent thinking ability was positively correlated with team creativity after accounting for creative personality, creative personality was negatively correlated to team creativity, after accounting for divergent thinking ability. Otherwise stated, the different aspects to individual creativity can interfere with each other and either enhance or hinder team creativity. Further, the results also suggested that creative personality and team climate for innovation when taken together are significant predictors of team creativity, with team climate positively correlating with team creativity after accounting for individual creative potential (R^2 =.520, F(3,15)=5.42, p <. 05). Intrinsic motivation did not contribute to the multiple regression model due to its high correlation with team climate coupled with a relatively low sample size and further studies with larger sample size are encouraged. This study provides initial evidence suggesting a significant role of individual creative potential and team climate for innovation in team creativity. It is the first study to measure team member's individual creative potential *before* joining the team and the first to suggest a potential negative effect of creative personality in team creativity.

Dedication

I dedicate this thesis to my mother Maria Jose Coarasa, my husband Li Lei Tsien, and our children Mateo, Lorenzo, Jorge and Jacobo, for their love, patience and unconditional support.

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Chapter I.

Introduction

A team is defined as a group of people sharing the responsibility for a set of tasks and working interdependently for the execution of these tasks (van Knippenberg, 2017). Creativity in teams is important to understand given that many of today's innovations are developed by teams. Despite its relevance, team creativity has not yet been studied as comprehensively as personal creativity, and the field is still maturing and consolidating (van Knippenberg, 2017). Companies and business organizations seek creative individuals trusting their skills will lead to increased innovation in their teams. This behavior is grounded in the common belief that the more creative team members are, the more innovative the team output will be. There is theoretical support for the idea that the aggregation of team members' individual creativity is positively correlated with the team creative or innovative output. Creativity in a team takes place both at the individual level and at the team level. Individuals engage in creative behavior and propose their ideas to the team which gives feedback to the individuals who in turn engage again in creative behavior. Multiple iterations of interactions of such kind occur between the individual and the group (Drazin, Glynn, & Kazanjian, 1999).

In addition to the theoretical support, several empirical studies have revealed the link between individual creativity and team creativity and also introduced the role of team-level relationships to intensify this link. Taggar (2002) showed that aggregated peer ratings of individual group member's creativity predicted externally rated group creativity over a 13-week working period. A total of 480 undergrad students were randomly

assigned to 98 groups of 4 and they completed tasks with minimal guidance. An external judge scored the reports for creativity. Results showed that team creativity was highest when aggregate individual creativity was highest, and group creativity-relevant processes were high as well (e.g. team citizenship, communication etc.).

Pirola-Merlo & Mann (2004) studied 54 Research and Development (R&D) teams in four organizations in Australia. The teams had been working on their projects for an average of 3 years and 4 months, and the average team size was 6.9 members. Team members were sent questionnaires at the beginning of the study (Time 1) and each month thereafter over a period of 12 months. Measures of team climate for creativity, individual and team creative performance were obtained at Time 1. Individual and group creativity measures were collected during the subsequent 12 months of the study. Team member individual creativity was measured using an aggregation of self-ratings (asking individuals to recall and rate for innovativeness their work on the project during the last month), and team-leader rating of employee innovativeness during the past month. Recent team creativity was measured by asking project leaders to rate the overall innovativeness of the work completed by the team members in the past month. The study found that team creativity at a particular time can be explained statistically as the aggregation of team member creativity. A team climate supportive of innovation facilitated individual creativity, and thus indirectly had a positive influence on team creativity.

Another study in 100 R&D teams with a total of 485 members in 19 South Korean companies examining team creativity from a team level and an individual level showed that average individual creativity within a team was positively related to team

creativity (Gong, Kim, Lee, & Zhu, 2013). The companies agreed to participate in the study in exchange of receiving a copy of the findings, and all members of the R&D teams were invited to complete a voluntary and confidential survey during working hours. Team leaders reported on both team creativity and individual creativity and team members reported on the team climate for creativity. The study showed that average individual creativity was significantly related to team creativity both directly and through supportive team climate for creativity. Gong et al. (2013) hypothesized that individuals' creative behavior impacted the overall climate of the team by encouraging creative behavior in other team members.

The above studies suggest that hiring creative people for organizations who aim at innovation is a helpful strategy. However, all of these studies measured creativity of individuals when they were already working in their teams. Their creativity was measured through self-reported questionnaires or in some cases through a team leader's ratings. Therefore, the measure of individual creativity in these studies is already deeply inter-connected with the task and the team, its dynamics, and overall environment. It is difficult to separate what originates from the individual only and what has been already shaped by the team. What happens when you gather creative people together to form a new team: does individual creativity always aggregate and result in team creative input? And if not, what are the conditions that are necessary for the creativity of the individual team members to translate into team creativity?

Amabile's componential theory of individual creativity postulates that creativity is driven by four components, three intra-individual components: (a) domain-relevant skills (expertise, technical skills in the domain); (b) creativity-relevant skills (flexible cognitive

style, personality traits, persistent work style); (c) intrinsic motivation in the task, and one external component: (d) the social environment that can influence each of the above intra-individual components, although mostly influencing intrinsic motivation (Amabile & Pillemer, 2012). Conti, Coon, and Amabile (1996) conducted a set of studies that showed early support for the theory. Three laboratory studies carried out during the same semester with overlapping participant populations (90 students of a psychology course) suggested that domain-relevant skills, creativity-relevant skills and task motivation, contributed to creativity. Creativity measures were collected from the same individuals across different tasks, domains and contexts, and the relationships between such measures were explored. In one study, participants were asked to write 3 short stories in response to 3 different pictures, and the creativity level of each story was rated by 5 experienced writers. In another study, also within the domain of writing, students were asked to write a story about two of the characters of a passage that they had previously read, and their creativity level was rated by 4 psychology instructors. In the third study, in the artistic domain, students were asked to engage in 3 different art activities (making a collage, making a pencil drawing, painting a picture with sponges) and each activity was rated for creativity by 8 judges experienced in art. The correlations between the creativity measures taken during the same experimental session (same context) and within the same domain were the strongest, which is consistent with the componential theory because in this case all components of the theory should remain relatively stable. The correlations between creativity measures taken in a different context but in the same domain showed significant correlation although moderate, which is consistent with the componential theory because the different experimental contexts result in differences in motivation and

environment. Measures taken in different domains and different contexts showed the lowest correlation albeit positive, which is consistent with the prediction of the componential model that there are creativity-relevant skills that contribute to creativity across tasks and across domains. There is additional empirical research supporting the role of intrinsic motivation and the role of the social environment as contributors to individual creativity, and a number of these studies are reviewed later in this proposal.

Using intrinsic motivation as individual-level variable, and team climate for innovation as team-level variable, it is hypothesized that these two variables are necessary for individual team members to engage their individual creative potential in the team. Building on Amabile's (year) four components of individual creativity, individual team members bring the first two components with them when a new team is formed: domain-relevant skills and creativity-relevant skills. These first two components can be seen as each team member's creative potential, and are independent of task and environment. However, the third and fourth components, their intrinsic motivation and the social environment (team climate), are task and team-specific. The individual's intrinsic motivation on the task will be influenced by the nature of the task and also by the team's composition and dynamics. A team climate that encourages original thinking and questioning the status-quo will facilitate individual creativity. Intrinsic motivation and a team climate that are conducive to innovation have been shown to be predictors of creativity in numerous studies.

Intrinsic Motivation

A team member's motivation to perform can be intrinsic or extrinsic (Ryan & Deci, 2000). With intrinsic motivation, individuals are energized by the task itself, while

with extrinsic motivation individuals are attracted merely by the external outcomes (for example rewards or absence of punishments) that may come from completing the task. Individuals who are intrinsically motivated tend to exhibit higher cognitive flexibility and be more likely to persevere and find non-traditional approaches and novel solutions to a task or problem (Deci & Ryan, 1987). Thus, when individuals are intrinsically motivated, they are more likely to exhibit higher levels of creative thinking than when they are only extrinsically motivated (Utman, 1997). Zhang & Bartol (2010) studied 367 professional employees and their supervisors in a large information technology company in China using a web-based survey tool. They found that when employees reported being intrinsically motivated, the supervisors rated them and their work, as more creative. Shin & Zhou (2003) conducted a survey in the Research & Development departments of 46 Korean companies and collected 290 pairs of employee and supervisor responses. The data showed that employee self-reported intrinsic motivation was positively related to employee creativity as rated by his or her boss. A 2016 meta-analysis of 68 studies with a combined sample size of 19,695 revealed a correlation between intrinsic motivation and creativity of .34 (Liu, Jiang, Shalley, Keem, & Zhou, 2016).

An individual may possess the necessary skills for creativity (domain specific expertise and creativity expertise), but the intrinsic motivation is what makes him or her use these skills for creative work (Amabile & Pillemer, 2012). Creativity is a process that involves more than generating ideas (divergent thinking). It also entails careful evaluation of the ideas in order to select the most promising ones (convergent thinking), and refinement of the selected ideas until they are viable and ready for successful implementation (Sawyer, 2006). The degree of engagement of an individual in the

creative process can vary. A team member may pay little attention to the task and put forth minimal effort, selecting well established solutions even in situations where the task would benefit from innovative solutions. In a group setting, a team member also has the option of simply agreeing with what other members are proposing, without engaging and contributing. On the other side of the engagement spectrum, people can choose to fully engage in the creative process with the other team members and strive for a creative solution. From this point of view, creativity at the individual level can be considered a choice by the individual to engage in behaviors that lead to production of new ideas. The level of creative engagement varies from situation to situation (Drazin et al., 1999). Managers need to encourage creative engagement and ensure that team processes are supportive of creativity if that is what is desired in a given situation.

Team Climate and Team Climate for Innovation

Schneider & Rechers (1983) defined team climate as the team's shared perception of what is accepted, what is rewarded and what is considered inappropriate by the team. A team climate can promote or hinder team creativity. West & Anderson (1996) developed the four-factor Team Climate Inventory (TCI) as a way to operationalize a team climate that is conducive to innovation. Initially, they conducted a 6-month longitudinal study of the relationship between group and organizational factors and team innovation in 27 hospital teams ranging in size from 4 to 19 members. Their work revealed that although the proportion of innovative team members predicts the quality of the innovations produced (i.e. radicalness, magnitude and novelty) group processes are better predictors of overall team innovation. The authors identified four processes that should in theory be strongly correlated with group innovation by reviewing the previous

literature: 1) Vision: the group needs to have clear and shared goals or objectives so that all members understand what they are trying to achieve as a team. Also, goals need to have a visionary nature or a valued outcome that allows for member commitment to the team goal, 2) Participation, also called participative safety: a climate which is perceived as non-threatening by team members and can encourage active involvement of team members and cross-fertilization of ideas, is a base for creativity. Also, when members contribute to the ideas and decisions they tend to be more committed to the outcomes, 3) Task orientation, or shared concern with the excellence of the team performance: when this is the case, the group engages in evaluations, feedback, appraisal of ideas, exploration of opposite opinions and constructive discussions, and members do not feel that their competence is in question because the emphasis is on the mutually beneficial goals and on performance excellence, 4) Support for innovation: the expectation, approval and explicit support of attempts to improve things or solve problems in new ways. In such an environment, innovative behavior is rewarded. Their longitudinal study of 27 hospital teams revealed that support for innovation by team members accounted for 46% of the variance in overall team innovation, team member participation predicted quality of innovation, and task orientation predicted the administrative effectiveness of the innovations. In a subsequent study (Anderson & West, 1998), the authors validated TCI as a measure of team climate for innovation in 121 work groups of varied nature (health care, social services, psychiatric care and an oil company). Further empirical studies support the positive correlation of TCI with team creativity and innovation, for example, a study of 33 R&D teams in Australia showed that TCI predicted project performance and speed of innovation (Pirola-Merlo, 2010).

A meta-analysis of team-level predictors of creativity and innovation in the workplace (including 104 independent studies) revealed a strong positive relationship between creativity and innovation at the team level, and vision (corrected correlation of $\rho = 0.493$), support for innovation ($\rho = 0.470$), and task orientation ($\rho = 0.415$) (Hülsheger, Anderson, & Salgado, 2009).

Although the relationship between team member individual creativity and team creative output has been established in the literature, it has never been studied measuring individual creativity of team members *before* joining the team. Managers and leaders of organizations need to know whether the teams they create facilitate or hinder the creative talent they recruit, as well as what to do to increase the likelihood that their employees' creative potential is realized in their teams. An individual may have the capacity to be creative, however, in the absence of intrinsic motivation in the task or when placed in a team which climate is not conducive of innovation, she or he may decide to forgo the effort to generate untraditional alternatives or cease to persevere in refining and developing them until they are viable options.

Study Aims & Hypotheses

The aim of this study is to confirm that creative potential of individual team members before joining a team is positively associated with team creative output, and to explore the role of team member intrinsic motivation and team climate for innovation as moderators of the relationship between individual creative potential and team creative output.

The hypotheses are:

1. Individual team member creativity prior to joining the team (creative potential) will be positively related to team creativity
2. The above relationship will be moderated by the individual's level of intrinsic motivation (individual-level variable) and by the level of group process team climate for creativity (team-level variable). The higher the intrinsic motivation and the more the team climate is supportive of creativity, the stronger the relationship will be.

Chapter II.

Method

The study was conducted using an online study format that included two questionnaires administered via Qualtrics. The first questionnaire was sent to participants at the beginning of the study and included the measures for individual creativity. The second questionnaire was sent at the end of the study and included the measures for intrinsic motivation and team climate. The measure for team creativity was an assessment made by the professor teaching the course from which participants were recruited.

Participants

Participants were graduate students from the second year of the Masters in Business Administration (MBA) at the China Europe International Business School (CEIBS), an international business school in Shanghai, China. They were recruited specifically from a course called "Creativity and Design Thinking" that was taught in November 2018 and was an elective offered to second year MBA students. The demographics of this group of students are as follows: 66% Chinese and 34% international; 40% female; 5.8 years average work experience before entering the MBA program. All students are proficient in English which is the language the program is taught in. From this total population, 39 students joined the course "Creativity and Design Thinking". The first day of the class, students were asked by the course Teaching Assistant (TA) to participate in this study. Students were informed that participation was

voluntary and that their responses would be kept confidential. They were also given an explanation of the aim of the study and the procedure.

Participants were asked to complete two short on-line surveys, one at the beginning of the course (to assess individual creativity before joining the team) and another at the end of the course (to assess intrinsic motivation and team climate for innovation). Halfway through the course the students were randomly placed in 6 teams of 4 students each and 3 teams of 5 students each, to work on a final team project that they needed to complete as part of the course. The creativity of the team's output, the final project, was rated by the professor teaching the course, who was someone external to this study. The rating constitutes the measure for team creativity. The measures and the detailed procedure are described below.

The first on-line questionnaire was e-mailed through Qualtrics to the 39 students enrolled in the course. A total of 35 students responded to the first questionnaire (the two individual creativity measures), although 10 of them did not complete one of the two creativity measures administered, the divergent thinking task. All 35 respondents were emailed the second on-line questionnaire at the end of the course, however a lower 25 of them completed the second survey completely or partially. After eliminating incomplete responses, a total of 22 students remained as having participated to the complete study.

Measures

The study protocol included various measures to capture individual creativity before joining the team, intrinsic motivation, team climate and team creativity.

Measures of individual creativity, taken before teams were formed:

Two measures of individual creativity were used to assess the potential for creativity of an individual before joining a team, the Gough Creative Personality Scale and a Divergent Thinking Task. There are numerous approaches to measuring creativity in the literature: psychometric tests (cognitive style, personality, etc.), divergent thinking tasks, ratings by observers, or measures of real-life creative production. Given the lack of consensus on one single accurate measure for creativity, it is favorable to use multimethod research for creativity in order to have a more complete picture of the creative potential of participants (Batey & Furnham 2006).

Gough Creative Personality Scale [CPS]This is a 30-item self-reported measure to assess creativity-relevant personal characteristics estimated to take 5 minutes to complete. Participants were asked to "place a check mark next to each adjective that you think describes you." Of the 30 adjectives, 18 describe highly creative people (examples: capable, clever, confident, humorous, unconventional). The remaining 12 adjectives describe less creative people (examples: cautious, commonplace, conservative, conventional, submissive). Each of the checked adjectives within the first list of 18 were given a value of + 1 by the rater, and each of the checked adjectives within the second list of 12 were given a value of - 1 by the rater. The values then were summed to form a CPS index.

This measure has been shown to robustly predict creative performance (Gino & Ariely, 2012; Gough, 1979; Zhou, 2003). The measure is significantly and positively correlated with other measures of creativity and with creativity tasks (Barron & Harrington, 1981; Gino & Ariely, 2012; Gough, 1979). Predictive validity and temporal stability of the construct was stablished in a 5-year follow up study (Schaefer, 1973). Reliability of this

measure was calculated using a weighted composite technique and was 0.7 (Lord & Novick & Birnbaum, 1968).

Divergent Thinking [DT] Two validated tasks adapted from Torrance (1968), including an alternate uses task (uses for an empty soup can) and a consequences task (what if humans had six fingers on each hand instead of five) designed to assess divergent thinking ability. These tasks are widely used and are reliably correlated with other measures of creativity (Carson, Peterson, & Higgins, 2005; Prabhakaran, Green, & Gray, 2014. For each task, subjects were asked to generate as many creative answers as possible for the given prompt in a limited time period (three minutes). The tasks were scored by a doctoral-level expert with multiple years of experience in evaluating divergent thinking tests. Two subscales were assessed: fluency (the number of responses produced), and originality (the statistical infrequency of each response relative to responses of other subjects in the study). Subjects received one fluency point for each non-repetitive response. Subjects received one originality point for each response given by 10% or less of the total sample, two points for each response given 5% or less of the sample, and three points for each unique response given. Fluency and originality scores were standardized and summed to produce a total divergent thinking (DT) score.

Measures taken after completion of team project:

The Intrinsic Motivation Inventory [IMI] is a multidimensional self-reported measurement device used to measure intrinsic motivation and self-regulation in various situations and contexts (Ryan, 1982). It has been applied in numerous studies to assess participants' subjective experience when engaged in an activity (Deci, Eghrari, Patrick, & Leone, 1994; Martens, & Webber, 2002; Ryan, 1982). The instrument assesses

participants' interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six subscale scores. The interest/enjoyment subscale is considered the self-reported measure of intrinsic motivation and can be used independently. It consists of 7 statements (e.g. 'I enjoyed doing this task very much'. 'This task was fun to do', 'I would describe this task as very interesting'). The participants were asked to report the extent to which they agreed with the statements on a Likert-type scale ranging from 1 = strongly disagree, 2 = agree, 3 = neither agree nor disagree, 4 = agree, to 5 = strongly agree. To score this instrument, first items 3 and 4 were reverse scored by subtracting the item response from 8, and using the resulting number as the item score. Then, the scale score was calculated by averaging across the 7 items on the scale.

Tsigilis & Theodosiou (2003) studied the temporal stability of the Intrinsic Motivation Inventory on 144 subjects and concluded that it is a temporally stable measure. Computed intra class correlation coefficients (ICC) were .86 for the Interest/enjoyment subscale of the IMI and .61 for the whole scale. Monteiro, Mata, & Peixoto (2015) study of a total of 3,685 students from the 5th to the 12th grades highlighted satisfactory reliability scores both through Cronbach's alpha scores and Composite reliability scores. Cronbach's alpha scores ranged from .82 to .91. Cronbach's alpha scores for or the enjoyment subscale ranged from 0.85 to .86.

Team Climate Inventory [TCI] a 34-item tool using both 5 and 7-point scales with an estimated completion time of 10 minutes. The measure has 4 subscales: vision, participative safety, task orientation, and support for innovation, Cronbach's α= .84 - .94

(Anderson & West, 1998). There is an additional subscale, interaction frequency, which is sometimes included in the inventory.

Vision is an 11-item subscale designed to understand team members' views on the clarity, and value of the team objectives as well as the degree to which they share the objectives as a team.

Participative safety is an 8-item subscale designed to understand the level of team participation and the extent to which team members feel safe to participate. It is a 5-point scale with responses ranging from 1=*strongly disagree* to 5=*strongly agree*. Sample items are "Everyone's view is listened to even if it is in a minority", and "We have a 'we are in it together' attitude".

Support for innovation is an 8-item subscale to assess the extent to which team members receive support, cooperation and resources to implement new ideas. It is a 5-point scale with responses ranging from 1=*strongly disagree* to 5=*strongly agree*. Sample items are "This team is open to and supportive of change", and "People in this team are always open to fresh, new ways of looking at problems".

Task orientation, or climate for excellence, is a 7-item subscale that addresses the extent to which team members strive to promote the excellence of the team output. It is a 7-point scale with responses ranging from 1= *to a very little extent* to 7= *to a very great extent*. Sample items are "Do you and your colleagues monitor each other so as to maintain a higher standard of work?", and "Are team members prepared to question the basis of what the team is doing?".

Interaction Frequency is a 4-item subscale to assess the extent to which team members interact with one another. It is a 5-point scale with responses ranging from 1=*strongly*

disagree to 5=*strongly agree*. Sample items are "We keep in touch with each other as a team", and "We keep in regular contact with each other".

To score this instrument, first the items of each subscale were aggregated to obtain a subscale score. Then, TCI was calculated as an aggregation of each of the subscales' scores. No item needed reversed scoring.

Psychometric properties were evaluated on a sample of 155 participants from 27 teams (Anderson & West, 1998). Alpha coefficients ranged between 0.84 and 0.94 suggesting internal homogeneity and reliability for the scale. Predictive validity was established by comparing the predicted scores of the TCI on innovativeness of team with ratings by external expert and naïve judges on the innovative of actual team's outputs 6 months after the administration of the TCI. To establish the robustness of the scale, a confirmatory factor analysis was performed on an additional sample of 971 individuals in 121 teams (Anderson & West, 1998).

Team Creativity: One judge independent from this study and blind to the hypothesis evaluated the final team projects for creativity and originality. The evaluation rated the appropriateness of the solution, originality and elaborateness of the creative ideas. Each of the items were rated using a 5-point scale ranging from 1= *insufficient* to 5= *excellent*. The project consisted on the application of the Design Thinking methodology to creatively solve a problem or approach an opportunity.

Procedure

After getting permission from the Committee on the Use of Human Subjects, participants were recruited at the beginning of the course "Creativity and Design

Thinking" in November 2018. The class TA explained to the students that they had the possibility to participate in a study about creativity in teams, that participation was voluntary and confidential, and that it would take a maximum of 10 minutes of their time to fill in the first questionnaire (1st step of data collection) and a maximum of 15 minutes to fill the second questionnaire at the end of the course (second step of data collection point). Later that day, participants received an email including a unique personalized URL link to access their questionnaire in electronic format. The questionnaire contained the two measures of individual creativity, Gough Creative Personality Scale and the Divergent Thinking Task. Once they completed the survey, their responses were automatically stored by Qualtrics. Students who didn't fill in the survey, received a reminder email from Qualtrics three days later.

As part of the course students were randomly placed in 6 teams of 4 students each and 3 teams of 5 students each when they were halfway through the course. They were asked to work on a final project that consisting on solving a problem creatively applying design thinking methodology. Once the students presented their final project to the class, the course was finished. At this point, the students who had participated to the first questionnaire were sent the second questionnaire to complete the last two measures, the Intrinsic Motivation Inventory (IMI) and the Team Climate Inventory (TCI). The questionnaires were sent electronically through Qualtrics. Students who did not complete the measures were sent an email reminder. A total of five reminders were sent.

The last step in the data collection was the completion of the team creativity measure by the external rater, the professors teaching the course, who rated the projects and presentations in terms of originality, appropriateness and elaborateness. The

professors can complete the measure at the same time they grade the performance for the course.

Data Analysis

Data Analysis was conducted separately for each hypothesis and was followed by exploratory analyses when necessary. Prior to analysis, data was examined for completion and any missing data point was replaced with the mean of that variable. This was the case for three data points only, one in the Intrinsic Motivation scale and two in the Team Climate scale. Then, the different variables were computed and descriptive statistics for each variable were calculated and examined. Internal consistency of multi-item scales was assessed by calculating Cronbach's alphas.

Hypothesis 1

In order to investigate the relationship between individual creative potential and team creativity, Pearson correlations between the variables were calculated and examined. Then, a regression analysis was performed to understand the nature of the relationship, followed by an analysis of partial correlations between the two predictors (creative personality and divergent thinking ability) and the dependent variable (team creative output).

Hypothesis 2

A series of analysis were performed to understand the effect of team member’s intrinsic motivation and the team climate on creative output of the team, as well as the interactions of these variables with the creative potential of individual team members. Correlations between the variables were analyzed and multicollinearity between intrinsic motivation

and team climate was investigated. Multiple regression analysis between variables was performed to investigate the effects of the various predictors on team creativity. Interactions between individual creativity and team climate and intrinsic motivation were included in a multiple regression model in order to understand potential moderation effects.

Chapter III.

Results

This chapter includes the demographic characteristics of the sample, an analysis of the variables' main statistics and reliability of scales, an examination of gender differences, and the various statistical analyses performed to test the study's hypotheses.

Demographic characteristics of the sample

The final sample included in this study consisted of 22 participants: 15 males and 7 females. The demographic details of the sample are shown in Table 1. The sample was diverse in terms of nationality, but predominantly Asian in terms of ethnicity and cultural background (82% of Asian descent, mostly Chinese).

Table 1 Sample Demographics

Nationality	**#**	**%**	**Ethnic group**	**#**	**%**
China	7	32%	Asian	18	82%
USA	3	14%	European-American	4	18%
India	2	9%		22	100%
Australia	2	9%			
Canada	2	9%	**Gender**	**#**	**%**
South Korea	1	5%	Male	15	68%
Thailand	1	5%	Female	7	32%
Philippines	1	5%		22	100%
Malaysia	1	5%			
Germany	1	5%			
Spain	1	5%			
	22	100%			

Descriptive statistics of variables and internal consistency of scales

Table 2 includes a summary of the variables included in this study, the measure used to capture them, and the variable name used in the various SPSS analyses and statistical models.

Table 2 Variables, Measures and Variable names in SPSS analyses

Variable Description	**Measure**	**Variable Name in SPSS**
Creativity of team's output	Team Creativity	TeamCreativity
Creative Personality	Gough Creative Personality Scale (CPS)	CPS
Divergent Thinking Ability	Divergent Thinking Task (DTT)	DTTotal
Team Climate	Team Climate Inventory (TCI)	TCI_Total
Intrinsic Motivation	The Intrinsic Motivation Inventory (IMI)	INTRIN_MOTIV

Table 3 displays means and standard deviations of the variables studied. The means and standard deviations for the Team Climate Inventory and the Intrinsic Motivation Inventory are consistent with previous findings (Anderson & West, 1998; Tsigilis & Theodosiou, 2003). The mean of the Gough Creative Personality Scale (M = 1.84) is lower to the norm which is typically around 4 (Gough, 1979; Zhou, 2003). However, Asian populations tend to score lower than American or European and our sample is predominantly Asian. The values for our sample (M = 1.84, SD = 2.75) are consistent to what has been observed in Chinese and Korean populations (Luescher, Barthelmess, Kim, Richter, & Mittag, 2019).

Table 3 Descriptive Statistics

	N	Mean	Std. Deviation
TeamCreativity	22	3.70	1.02
CPS	22	1.84	2.75
DTTotal	22	-.15	1.67
TCI_Total	22	161.18	11.18
INTRIN_MOTIV	22	6.36	.79

In order to confirm internal consistency and reliability of the two multi-item scales (intrinsic motivation inventory and team climate inventory), Cronbach's alphas (α) were calculated. Cronbach's alpha for the 7 intrinsic motivation items was .79. Team climate is comprised of five subscales and Cronbach's alphas were calculated for each subscale. The vision subscale consisted of 8 items (α = .88), the participative safety subscale consisted of 8 items (α = .89), the support for innovation subscale consisted of 8 items (α = .82), the task orientation subscale consisted of 7 items (α = .79), and the interaction frequency subscale consisted of 4 items (α = .93). These α values are all within the acceptable range of more than .70.

Gender Differences

In order to determine whether there were sex differences in creativity and intrinsic motivation scores, comparison of means t-tests were conducted.

Divergent Thinking (DTT): There was no significant difference between males (M = .13, SD = 1.82) and females (M = -.65, SD = 1.32) on divergent thinking scores ($t(20) = 1.054$, p = .304).

Creative Personality (CPS): There was no significant difference between males (M = 2.50, SD = 2.80) and females (M = -.67, SD = 2.35) on creative personality scores ($t(23) = 1.658$, $p = .111$).

Intrinsic Motivation (IMI): There was no significant difference between males (M = 6.20, SD = .88) and females (M = 6.69, SD = .39) on intrinsic motivation scores ($t(19.998) = -1.801$, $p = .087$).

Hypothesis 1

The first hypothesis of this study was that individual team member creativity prior to joining the team (creative potential) would be positively correlated with team creativity. Before choosing the regression model to fit the data, I examined the correlations between the three variables involved. Table 4 shows that there was a nonsignificant negative correlation of -.25 (p = .23) between creative personality (CPS) and team creativity, and a nonsignificant positive correlation of .30 (p = .17) between divergent thinking ability (DTTotal) and team creativity. Both the non-significance of the correlations and the negative sign of the correlation between creative personality and team creativity, were unexpected and conflicting with the study's hypothesis.

The information highlighted on Table 4 suggests that neither creative personality nor divergent thinking ability predict team creativity for the studied sample, when used as stand-alone predictors of team creativity. Given this information, I decided to fit the data to a multiple regression model that included both predictors together:

- Model 1: TeamCreativity= $\beta_0+\beta_1$CPS+ β_2 DTTotal + ϵ

The formal hypothesis for the above multiple linear regression was that the CPS coefficient would be greater than zero ($\beta_1 > 0$) and the DTTotal coefficient would be also greater than zero ($\beta_2 > 0$), and that both would be significantly different from zero.

Table 4 Correlations TeamCreativity, CPS and DTTotal

		TeamCreativity	CPS	DTTotal
TeamCreativity	Pearson Correlation	1	-.248	.301
	Sig. (2-tailed)		.232	.174
	N	25	25	22
CPS	Pearson Correlation	-.248	1	.326
	Sig. (2-tailed)	.232		.139
	N	25	25	22
DTTotal	Pearson Correlation	.301	.326	1
	Sig. (2-tailed)	.174	.139	
	N	22	22	22

Note: The correlations between team creativity, creative personality and divergent thinking ability, as well as their significance, are highlighted.

Multiple regression analysis was performed using SPSS and the final model produced was:

TeamCreativity= 4.03-.17CPS+ .27DTTotal + ϵ

After checking and verifying the assumptions for linear regression, the results of the multiple regression (Tables 5-7) could be interpreted. They indicate that the two predictors, when together, explained 28.4% of the variance ($R^2 = .284$, $F(2,19) = 3.77$, $p < .05$). It was found that creative personality (CPS) significantly predicted team creativity ($\beta = -.45$, $p < .05$) after accounting for thinking ability (DTTotal), as did divergent thinking ability (DTTotal) ($\beta = .45$, $p < .05$) after accounting for creative personality. The correlation between CPS and team creativity was negative, consistent with what had been hinted by the correlation analysis (Table 4).

Table 5 Model 1 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.533	.284	.209	.87531

Note: Predictors: (Constant), DTTotal, CPS. Dependent Variable: TeamCreativity

Table 6 Model 1 Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.772	2	2.886	3.767	.042
	Residual	14.557	19	.766		
	Total	20.330	21			

Note: Dependent Variable: TeamCreativity. Predictors: (Constant), DTTotal, CPS

Table 7 Model 1 Analysis of Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	4.030	.229		17.598	.000
	CPS	-.165	.073	-.465	-2.266	.035
	DTTotal	.267	.121	.452	2.202	.040

Note: Dependent Variable: TeamCreativity

Hypothesis 2

This hypothesis states that the relationship between individual creativity and team creativity will be moderated by the intrinsic motivation of the team member and team climate. Before choosing a statistical model to fit the data, I examined the correlations between the new variables and the dependent variable. Table 8 shows that there was a significant positive correlation of .473 ($p < .05$) between a team member's intrinsic motivation (INTRIN_MOTIV) and team creativity, and a significant positive correlation of .596 ($p < .01$) between the team climate for innovation (TCI_Total) and team

creativity. The significance and positive direction of these correlations was in line with the hypothesis. However, a surprisingly strong correlation of .796 ($p < .01$) between intrinsic motivation and team climate emerged as well. The scatterplot matrix in Figure 1 offers a visual confirmation. Out of the five subscales of team climate, intrinsic motivation showed a positive and significant correlation with four of them: vision (.463, $p < .05$), support for innovation (.738, $p < 001$), task orientation (.531, $p < .05$), and interaction frequency (.689, $p < 001$). This meant that it would be necessary to consider potential multicollinearity effects when interpreting the individual coefficients of the regression model with both INTRIN_MOTIV and TCI_Total as predictors.

Table 8 Correlations TeamCreativity, INTRIN_MOTIV and TCI_Total

		TeamCreativity	INTRIN_ MOTIV	TCI_Total	CPS	DTTotal
TeamCreativity	Pearson Correlation	1	.473*	.596**	-.248	.301
	Sig. (2-tailed)		.026	.003	.232	.174
	N	25	22	22	25	22
INTRIN_MOTIV	Pearson Correlation	.473*	1	.796**	.216	.114
	Sig. (2-tailed)	.026		.000	.335	.643
	N	22	22	22	22	19
TCI_Total	Pearson Correlation	.596**	.796**	1	.083	-.080
	Sig. (2-tailed)	.003	.000		.715	.744
	N	22	22	22	22	19
CPS	Pearson Correlation	-.248	.216	.083	1	.326
	Sig. (2-tailed)	.232	.335	.715		.139
	N	25	22	22	25	22
DTTotal	Pearson Correlation	.301	.114	-.080	.326	1
	Sig. (2-tailed)	.174	.643	.744	.139	
	N	22	19	19	22	22

*Note: Significant correlations are highlighted. *. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).*

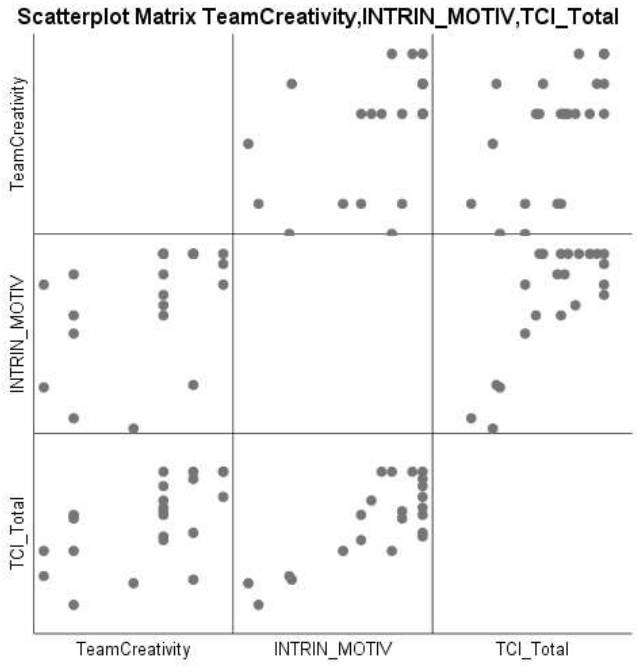

Figure 1 Scatterplot Matrix team Creativity, Intrinsic Motivation and Team Climate

This graph shows the positive correlation between intrinsic motivation and team climate for innovation.

Before fitting a model containing all four predictors together. I performed two separate simple linear regression analyses, one with intrinsic motivation as sole predictor and another with team climate as sole predictor, in order to better understand the individual relationships and the effect sizes:

- Model 2: Team_Creativity= $\beta_0+\beta_1$ INTRIN_MOTIV + ϵ

  The results of the regression indicated that team member's intrinsic motivation explained 22.3% of the variance ($R^2 = .223$, $F(1,20) = 5.572$, $p < .05$). It was found that intrinsic motivation significantly predicted team creativity ($\beta = .47$, $p <$

.05), and the relationship between both variables was positive. The conditions for linear regression were checked and confirmed.

- Model 3: Team_Creativity= β_0+β_1 TCI_Total + ϵ

  The results of the regression indicated that team climate for innovation explained 35.5% of the variance (R^2 = .355, F(1,20) = 10.996, p < .01). It was found that team climate significantly predicted team creativity (β = .596, p < .01), and the relationship between both variables was positive. The conditions for linear regression were checked and confirmed.

Given that team climate for innovation (TCI_Total) is composed of five subscales, I calculated the correlations between each of the subscales and team creativity in order to understand which components of team climate contributed most to team creativity. Table 9 shows that there was a significant and strong positive correlation of .706 (p < .01) between the vision subscale and team creativity, and a significant positive correlation of .578 (p < .01) between the interaction frequency subscale (INT_FREQ) and team creativity. The correlations of the remining three subscales with team creativity were positive but non-significant.

The statistical model to understand the predictive power of the four variables together is the following:

- Model 4: Team_Creativity= β_0+β_1 CPS + β_2 DTTotal + β_3 INTRIN_MOTIV +β_4 TCI_Total + ϵ

The formal hypothesis for the above multiple linear regression was that the TCI_Total, the INTRIN_MOTIV, and the DTTotal coefficients would be greater than

zero ($\beta_2, \beta_3, \beta_4 > 0$) and significantly different from zero, and that the coefficient for CPS would be smaller than zero ($\beta_1 < 0$) and significantly different from zero.

Table 9 Correlations TeamCreativity, and TCI_Total subscales

		TeamCreativity	VISION	SAFETY	SUPPORT_INNO	TASK_ORIENT	INT_FREQ
TeamCreativity	Pearson Correlation	1	.706**	.332	.342	.081	.578**
	Sig. (2-tailed)		.000	.132	.119	.719	.005
	N	25	22	22	22	22	22
VISION	Pearson Correlation	.706**	1	.165	.468*	.375	.419
	Sig. (2-tailed)	.000		.463	.028	.085	.052
	N	22	22	22	22	22	22
SAFETY	Pearson Correlation	.332	.165	1	.600**	.000	.282
	Sig. (2-tailed)	.132	.463		.003	1.000	.204
	N	22	22	22	22	22	22
SUPPORT_INNO	Pearson Correlation	.342	.468*	.600**	1	.453*	.376
	Sig. (2-tailed)	.119	.028	.003		.034	.085
	N	22	22	22	22	22	22
TASK_ORIENT	Pearson Correlation	.081	.375	.000	.453*	1	.468*
	Sig. (2-tailed)	.719	.085	1.000	.034		.028
	N	22	22	22	22	22	22
INT_FREQ	Pearson Correlation	.578**	.419	.282	.376	.468*	1
	Sig. (2-tailed)	.005	.052	.204	.085	.028	
	N	22	22	22	22	22	22

**. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).*

Once the assumptions for linear regression were verified, the results of the multiple regression in Model 4 could be interpreted (Tables 10-12). The results indicate that the four predictors, when together, explained 52.4% of the variance ($R^2 = .524$, $F(4,14)=3.86$, $p < .05$). It was found that when these four predictors were together: divergent thinking ability (DTTotal) significantly predicted team creativity ($\beta = .51$, $p < .05$), both creative personality (CPS) and team climate for innovation (TCI_Total) were

close to significantly predicting team creativity (β = -.43, p = .054, and β = .63, p =.051, respectively), and intrinsic motivation (INTRIN_MOTIV) was a non-significant predictor and had a negative coefficient (β = -.11, p = .731).

The above findings seemed contradictory with the results of the simple linear regression in Model 2 which suggested that intrinsic motivation had a significant and positive linear relationship with team creativity. However, when there is multicollinearity between predictors, seemingly incoherent results can appear making it difficult to interpret the individual coefficients.

Table 10 Model 4 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	.724	.524	.388	.71829

Predictors: (Constant), TCI_Total, CPS, DTTotal, INTRIN_MOTIV. Dependent Variable: TeamCreativity

Table 11 Model 4 Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	7.961	4	1.990	3.857	.026
	Residual	7.223	14	.516		
	Total	15.184	18			

Dependent Variable: TeamCreativity. Predictors: (Constant), TCI_Total, CPS, DTTotal, INTRIN_MOTIV

Table 12 includes an additional analysis performed to assess multicollinearity. The Variance Inflation Factor (VIF) was calculated to provide further understanding of multicollinearity issues. A VIF equal to 1 implies no multicollinearity among factors, but a VIF greater than 1 implies that the predictors may be moderately correlated. A VIF

higher than 3 indicates concerning collinearity issues. In this case, both INTRIN_MOTIV and TCI_Total have VIF coefficients close to 3 (2.65 and 2.59, respectively), indicating high probability of multicollinearity.

Table 12 Model 4 Analysis of Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
4	(Constant)	-3.875	2.696		-1.437	.173		
	CPS	-.137	.065	-.426	-2.102	.054	.826	1.211
	DTTotal	.275	.110	.514	2.503	.025	.806	1.241
	INTRIN_MOTIV	-.125	.355	-.105	-.351	.731	.377	2.651
	TCI_Total	.054	.025	.633	2.133	.051	.386	2.593

Dependent Variable: TeamCreativity. Predictors: (Constant), TCI_Total, CPS, DTTotal, INTRIN_MOTIV

Given the multicollinearity between intrinsic motivation and team climate, and the non-significance of intrinsic motivation as a predictor in Model 4, I decided to remove intrinsic motivation from the equation and fit a multiple linear regression model with three predictors:

- Model 5: Team_Creativity= $\beta_0+\beta_1$ CPS + β_2 DTTotal + β_3 TCI_Total + ϵ

The formal hypotheses for the above multiple linear regression was that the DTTotal and TCI_Total would be greater than zero ($\beta_2, \beta_3 > 0$) and significantly different from zero, and that the coefficient for CPS would be smaller than zero ($\beta_1 < 0$) and significantly different from zero.

Table 13 and 14 show that the three predictors, when together, explained 52% of the variance ($R^2 = .520$, $F(3,15) = 5.42$, $p <. 05$). All three predictors were significant.

Table 15 shows that creative personality (CPS) significantly predicted team creativity (β = -.44, $p < .05$), divergent thinking ability (DTTotal) significantly predicted team creativity (β = .50, $p <. 05$), and team climate for innovation (TCI_Total) significantly predicted team creativity (β = .55, $p <. 01$). The conditions for linear regression were checked and confirmed.

Table 13 Model 5 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
5	.721	.520	.424	.69698

Predictors: (Constant), TCI_Total, CPS, DTTotal. Dependent Variable: TeamCreativity

Table 14 Model 5 Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
5	Regression	7.898	3	2.633	5.419	.010
	Residual	7.287	15	.486		
	Total	15.184	18			

Dependent Variable: TeamCreativity. Predictors: (Constant), TCI_Total, CPS, DTTotal

Table 15 Model 5 Analysis of Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
5	(Constant)	-3.550	2.457		-1.445	.169
	CPS	-.140	.062	-.437	-2.245	.040
	DTTotal	.267	.104	.500	2.559	.022
	TCI_Total	.047	.015	.552	3.071	.008

Dependent Variable: TeamCreativity

When comparing Models 4 and 5, the following differences were noted:

- Although R^2 was practically the same for both models (.524 for Model 4 vs. .520 for Model 5), adjusted R^2 was higher for Model 5 (.424 vs .388 for Model 4). The adjusted R^2 is a modified version of R^2 that has been adjusted for the number of predictors in the model, and it is therefore the best measure of overall fit when comparing models with different number of predictors.
- The significance of the overall model was higher for Model 5 than for Model 4 (.010 vs .026, respectively)
- All predictors in Model 5 were significant and the direction of their relationship with the dependent variable was consistent with previous findings in this study (creative personality negatively influence team creativity, divergent thinking ability and team climate for innovation positively affect team creativity).

As a result, despite the significant and positive correlation of intrinsic motivation with team creativity, excluding intrinsic motivation from the multiple regression resulted in a better to fit for this sample's data set. Given the high correlation between intrinsic motivation and team climate, and the small sample size of this study (n=22), there was not enough statistical power to understand the effects and interrelations, and it was better to remove intrinsic motivation from the model.

Hypothesis 2 included a moderation effect, an interaction between individual creativity and both intrinsic motivation and team climate. An interaction between two variables is modeled in multiple regression by adding a new term that is the product of the two variables. The multiple linear regression model that captures the moderation effects in Hypothesis 2 is the following:

- Model 6: Team_Creativity= β_0+β_1 CPS + β_2 DTTotal + β_3 INTRIN_MOTIV +β_4 TCI_Total + β_5Interaction_IM + β_6Interaction_TCI + ϵ

SPSS was used to fit the data to Model 6. The results of the regression indicated the overall model was significant and the combination of predictors explained 46.8% of the total variance after adjusting for the number of predictors in the model (Adjusted R^2 = .468, $F(6,12) = 3.63$, $p <. 05$). However, as seen in Table 16, only one predictor, team climate for innovation, was significant ($\beta = .70$, $p <. 05$). All other predictors were non-significant. Given that five predictors are a high number for the small sample size (n=22) and that there are multicollinearity effects between some of them, there was not enough statistical power to adequately understand the interaction effects of the various predictors.

Table 16 Model 6 Analysis of Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
6	(Constant)	-4.610	2.679		-1.721	.111	-10.446	1.226
	TCI_Total	.059	.025	.697	2.409	.033	.006	.113
	INTRIN_MOTIV	-.118	.332	-.099	-.354	.730	-.842	.607
	CPS	-.123	.061	-.383	-2.012	.067	-.256	.010
	DTTotal	-3.407	2.821	-6.374	-1.208	.250	-9.553	2.740
	Interaction_IM	-.844	.451	-9.960	-1.873	.086	-1.827	.138
	Interaction_TCI	.056	.034	16.786	1.636	.128	-.019	.131

Dependent Variable: TeamCreativity

However, reviewing the correlations between the different subscales of team climate for innovation and the two measures of individual creative potential uncovered an interesting relationship: a significant negative correlation between the task orientation

subscale and divergent thinking (-.519, $p < .023$). Given that this was the only significant correlation between the subscales and individual creativity, a linear regression model was fitted including the interaction between task orientation and divergent thinking capability:

- Model 7: Team_Creativity= β_0+β_1 CPS + β_2 DTTotal +β_3 TCI_Total + β_4Interaction_DTTask+ ϵ

Table 17 Model 7 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
7	.794	.630	.524	.63349

Predictors: (Constant), Interaction_DTTask, TCI_Total, CPS, DTTotal

Table 18 Model 7 Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
7	Regression	9.566	4	2.391	5.959	.005
	Residual	5.618	14	.401		
	Total	15.184	18			

Dependent Variable: TeamCreativity. Predictors: (Constant), Interaction_DTTask, TCI_Total, CPS, DTTotal

Table 19 Model 7 Analysis of Coefficients

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
7	(Constant)	-4.292	2.263		-1.897	.079
	CPS	-.149	.057	-.464	-2.615	.020
	DTTotal	2.042	.876	3.820	2.332	.035
	TCI_Total	.051	.014	.596	3.615	.003
	Interaction_DTTask	-.058	.028	-3.324	-2.039	.061

Dependent Variable: TeamCreativity

Table 17 and 18 show that the four predictors, when together, explained 63% of the variance (R^2 = .630, $F(4,14) = 5.96$, $p <$. 01), and adjusted R^2, after accounting for the number of predictors, was .524. All three independent predictors were significant and the interaction predictor was close to significance. Table 19 shows that, after accounting for the other predictors, creative personality (CPS) significantly predicted team creativity (β = -.46, $p < .05$), divergent thinking ability (DTTotal) significantly predicted team creativity (β = .38, $p < .05$), and team climate for innovation (TCI_Total) significantly predicted team creativity (β = .60, $p <$. 01). The interaction between divergent thinking and task orientation (Interaction_DTTask) was close to significance (β = -.3.324, $p <$. 061). The conditions for linear regression were checked and confirmed.

When comparing Models 7 and 5, the following differences were noted:

- R^2 and adjusted R^2 were higher for Model 7 than for Model 5. After adjusting for the number of predictors ion the model, Model 7 explained 52.4% of the variability in team creativity whereas Model 5 explained a lower 42.4%.
- The significance of the overall model was higher for Model 7 than for Model 5 (.005 vs .010, respectively)
- All three predictors in Model 5 were significant. The same three predictors were significant in Model 7. The additional predictor incorporated in Model 7, the interaction between task orientation and divergent thinking, was close to significance (p = .61).

Therefore, Model 7 seemed to predict team creativity better than Model 5, although a larger data set would be required to confirm the significance of the interaction term.

Chapter IV

Discussion

Creativity is a highly valued skill and innovation is a highly sought outcome. In today's world, most innovations are conceived and developed by teams, hence the importance of understanding team creativity. When creative individuals are brought together in a team, does it necessarily result in team creativity? are there other factors at play? The present study aimed to investigate the correlation between the team members' creative potential measured before they join the team, and the creative output of the team. It also explored the role that the individual's intrinsic motivation for the task and the team climate play in the correlation. The study's hypotheses were that: (1) individual team member creativity prior to joining the team would be positively related to team creativity, and (2) the correlation would be stronger when the individual's level of intrinsic motivation and the level of team climate for creativity were higher.

Hypothesis 1

Is individual team member creativity prior to joining the team related to team creativity? The analysis suggests that it is. Is it positively related? The analysis suggests that it depends on which aspect of individual creativity is considered and measured. In the present study, we measured both creative personality (using Gough Creative Personality Scale) and divergent thinking skills (as an aggregation of fluency and originality results for two tasks). The analysis of the data showed that both measures, when taken together, correlated with team creative output and they explained 28.4% of

the variability in team creativity (Regression Model 1), but they acted in different directions. Whereas divergent thinking ability was positively correlated with team creativity, creative personality was negatively correlated with team creativity. Individually, neither divergent thinking ability nor creative personality correlated with team creativity in a statistically significant way, but when accounting for the other, they both did. This means that someone who scored high in divergent thinking ability may nevertheless end up scoring low in team creative output if they had also scored high in creative personality. It also implies that for a given level of divergent thinking capability, a lower score in creative personality may be beneficial for team creativity.

Divergent thinking is the ability to think originally and to come up with many ideas, and the fact that it was positively correlated with team creative output was expected and in line with the hypothesis of this study. However, the fact that creative personality was negatively correlated to team creative output was not hypothesized and was unexpected. Why is creative personality negatively associated to group creativity? A possible explanation emerges when delving into the measure itself. The Gough CPS consists of an adjective checklist that includes 30 adjectives, and participants were asked to choose the adjectives that best suited them. The scale includes 18 items positively linked to creativity and 12 negatively linked. The positive items are capable, clever, confident, egotistical, humorous, individualistic, informal, insightful, intelligent, interests wide, inventive, original, reflective, resourceful, self-confident, sexy, snobbish, and unconventional. The negative items are affected, cautious, commonplace, conservative, conventional, dissatisfied, honest, interests narrow, mannerly, sincere, submissive, and suspicious. Some of the adjectives describing the creative personality, like egotistical, or

snobbish, may not be well appreciated by teammates in a group setting, and this could result in the person not contributing fully their ability to think originally, or in their ideas not being accepted by the group. Moreover, the sample of this study was predominantly Asian and largely Chinese. Chinese and other East Asian cultures rank higher than some other cultures (e.g., the United States) in collectivism, where group harmony is highly valued and the needs and goals of the group as a whole are emphasized over the needs and desires of each individual (Triandis, Chan, Bhawuk, Iwao & Sinha, 1995). Adjectives, like individualistic, or unconventional, although being part of the creative personality, may not necessarily be well accepted in a group setting. A larger data set is necessary to confirm this explanation by isolating the predictive effect of some of the adjectives when accounting for the others. Research in different cultures would be desirable to understand potential cultural aspects in the findings.

Hypothesis 2

Hypothesis 2 explored the role of the two predictors measured after the team project was completed: intrinsic motivation of the team members and team climate for innovation. The analyses showed that both team climate for innovation and the individual's intrinsic motivation were positively correlated with team creativity. The simple linear regression analysis suggested that team climate, on its own, explained 35.5% of the variability in team creativity (Regression Model 3), and intrinsic motivation, on its own, explained 22.3% of the variability in team creativity (Regression Model 2). Of the five subscales that constitute team climate, vision and interaction frequency were significantly correlated with team creativity (.706, $p<.001$, .706, $p<.01$, respectively), suggesting that clear and shared goals and frequent interaction between

team members played an important role in the creativity of their teamwork. The analyses performed also suggested that intrinsic motivation and team climate were highly and positively correlated with each other. Although a certain positive correlation was expected, the extent of this correlation (.796, $p<.01$) had not been expected. As discussed in the Introduction Chapter of this thesis, Amabile's componential theory of creativity postulates that social environment can influence each of the intra-individual components (domain relevant skills, creativity relevant skills and intrinsic motivation), and it mostly influences intrinsic motivation (Amabile & Pillemer, 2012). A reason for the higher than expected correlation may lie in the testing protocol of this study. The intrinsic motivation measure was administered at the same time as the team climate measure. Given that the team climate questionnaire is relatively long (45 items), it is possible that respondents were influenced by it when they answered the 7-item intrinsic motivation scale immediately after. A future study can avoid this effect by positioning the intrinsic motivation questionnaire before the team climate one or, if possible, introducing a time-lag between both measures.

As a result of the above described correlation, when the four predictors were introduced together in a regression analysis, intrinsic motivation became non-significant and had to be dropped. The resulting analysis showed that individual's creative potential (including both divergent thinking ability and creative personality) and team climate for innovation together predicted team creativity and explained 52% of its variability (Regression Model 5). Although intrinsic motivation was a predictor of team creativity on its own, given its correlation with team climate and the sample size (n=22), there was not enough statistical power to understand its effect after accounting for team climate.

Hypothesis 2 also claimed that intrinsic motivation and team climate would moderate the relationship between individual creative potential and team creativity. These moderation effects were tested statistically by introducing two interaction variables in the regression analysis. Although the overall model was significant and accounted for 46.8% of the variability in team creativity (adjusted R^2, Model 6), team climate was the only predictor that was statistically significant. Given the combination of high number of predictors in the model (6, including 2 interactions), the fact that several of the predictors were interrelated, and the small size of the sample (n=22), there was not enough statistical power to understand moderation effects. However, the results were encouraging as the model as a whole was significant and explained more variance of team creativity than the model without interactions (46.8% for Model 6 vs. 42.4% Model 5). Further analysis unveiled a strong and significant negative correlation between one of the subscales of team climate, task orientation, and divergent thinking capability (-.519, $p < .023$). A possible explanation for this relationship could be that people high in divergent thinking capability, original ideators, do not necessarily focus on high standards of performance for their team. A regression model including individual creative potential, team climate and the interaction between task orientation and divergent thinking was significant and accounted for 65.4% of variance in team creativity (adjusted R^2, Model 6). Three of the four predictors in the model were significant (creative personality, divergent thinking and team climate) and the interaction variable was close to significance ($p = .61$), suggesting that task orientation may play a moderation role in the relationship between individual creativity (as divergent thinking capability) and team creativity. Further studies with larger sample sizes are necessary to confirm and fully

understand the moderation hypothesis as well as to disentangle the effects of intrinsic motivation and team climate on team creativity.

Limitations and Next Steps

Given time and resource constraints, the study targeted a sample of 39 subjects and 9 teams. The study required that the measures be taken in two separate occasions (before the teams were formed, and after the team project was completed), participation was voluntary. As a result of these various constraints, a limited sample of 22 participants completed all measures. The sample was too small to understand some of the effects hypothesized and to fully interpret some of the findings. A future study with a larger sample can further investigate why and when creative personality is negatively correlated to team creativity, disentangle the relationship between intrinsic motivation and team climate in the prediction of team creativity, explore moderation effects and boundary conditions, and extend this research by exploring whether aggregation of individual creativity before joining the group or average or maximum creativity of a team member are better predictors of team creative output.

The measure of intrinsic motivation was administered in the same on-line questionnaire as the measure for team climate for innovation, and it was positioned immediately after team climate. A future study may separate these two measurements if possible, or administer intrinsic motivation first to avoid possible spill-over effects.

All the participants in this study were graduate students from the same school and the same MBA program. Although the sample was diverse in terms of nationalities represented, it was quite homogeneous in terms of ethnicity and culture, age, work background and current occupation (all students). As a result, this study cannot be

directly generalizable to other different populations. Future research may replicate this study in other cultures and explore if cultural differences are at play in the relationships observed, particularly in the effect of creative personality in team creativity. The study was conducted with students of one MBA class and the class project was used to assess team creativity. Future research may open up to other team creativity situations and contexts.

Three of the five measures used in this study were self-reported: Creative Personality Scale, Intrinsic Motivation Inventory and Team Climate Inventory. Although self-reported measures are common in team creativity and innovation literature, there are limitations to such approach in psychology, as responses may be subject to social desirability bias or other effects. To minimize these issues, the measures selected for this study were all assessed for validity, test-retest reliability, and internal consistency. Internal consistency was confirmed for the dataset from this study. In order to encourage candid responses, participants were informed that their responses would be handled confidentially.

Conclusions

Individual team member creative potential, measured before the team was formed, was a predictor of team creative output. However, the correlation was not always positive. It depended on the person's scores on the two aspects of creativity measured: divergent thinking ability and creative personality. The data suggests that there was a significant positive relationship between divergent thinking potential and team creative output, after accounting for creative personality. The data also suggests that there was a significant negative relationship between creative personality and team creative output,

after accounting for divergent thinking capability. The conclusion is that, for the population studied, divergent thinking capability of team members enhances the team's creative output, but their creative personality may interfere with this relationship and reduce its influence.

Team member's intrinsic motivation and team's climate for innovation, both measured at the end of the team's project, independently predicted team creativity and were positively correlated to team creative output. However, both variables were also significantly correlated among each other and the sample did not have enough statistic power to disentangle the effect of each variable when together in a regression analysis.

When all the predictors were considered together, individual creative potential (measured before the team was formed) and team climate for innovation predicted team creative output and explained 42.4% of its variance (adjusted R^2). The potential moderation effect that both team climate for innovation and intrinsic motivation may have on the relationship between individual creativity and team creativity could not be investigated due to lack of statistical power. However, the model containing the interaction between one of the team climate subscales, task orientation, and divergent thinking capability was overall significant and accounted for 42.4% of the team creativity's variance (adjusted R^2), providing an encouraging basis to continue the research with a larger sample size.

In summary, for the population studied, team member's divergent thinking capability and creative personality, together with the climate for innovation established in the team, predict team's creative output. Higher scores of team member's divergent

thinking capability and team's climate for innovation are desired, whereas higher scores of team member's creative personality may affect the team's creative output negatively.

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