



Supportive Chinese supervisor, innovative international students: a social exchange theory perspective

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Abstract

This study investigates the impact of supervisor support on research innovation pursuit among international doctoral students in China. A total of 120 international doctoral students' responses were employed through random sampling from the three business schools of Chinese public universities. The data were analyzed using the partial least squares technique, a second-generation statistical software package for structural equation modeling. The results revealed that supervisor support significantly affects students' research innovation endeavors. The study also suggests that supportive supervision is necessary for fostering citizenship behavior, creativity and innovation pursuit among international doctoral students. The findings of this pioneering study will help higher education administrators, and policymakers revisit existing doctoral program management and deliveries processes and encourage academic supervisors to modify guidance and mentoring procedures for doctoral students.

Keywords Supportive supervisor · Creative students · Innovation pursuit · Citizenship behavior · Doctoral students

Introduction

Increased global competition and the emergence of the knowledge economy have compelled a nation to increase investment in education, training, research, and innovation in order to compete in global markets (Hammond 2016). Globally, universities are primary sources of knowledge creation, and they have increased doctoral student enrollment in various domains of knowledge creation and innovation process (Martín et al. 2017; Shin et al. 2018). A recent study of OECD countries revealed an increase in doctoral student enrollment from 158,000 in 2000 to 247,000 in 2012 (OECD

2014). Peoples' Republic of China, the second-largest economy and doctoral degree-granting in the world (Shin et al. 2018), allocates a sizeable budget to research for domestic and international doctoral students (Gu 2012) and offer scholarships to international students in China from all continents pursuing bachelor's, master's, and doctoral degrees, as well as post-doctoral research at top research-intensive universities (CSC 2014, 2015; Alemu and Cordier 2017). Chinese scholars' contributions to peer-reviewed journals were 3rd in 2015 (Yang 2015), and 2nd in 2017 (Nature 2017). Both the research contributions of Chinese academics (Nature 2017), and the arrival of international doctoral students in China are mounting up (Yang 2015).

With very few exceptions, all international research students with Chinese Government Scholarships (CGS) conduct scientific research supervised by Chinese supervisors (professors). Usually, a doctoral degree is bestowed for making a substantial contribution to the advancement of new knowledge, and doctoral students are supposed to be innovative in their research pursuits (Park 2005). However, the outcomes of academic research, including doctoral studies, are sometimes far below expectations, and academic researchers are blamed for not creating enough new knowledge and for falling victim to academic inbreeding. In fact, innovation is not a choice but stems from the supervisor and integrated

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research team initiatives (Agbor 2008). Supportive supervisor attitudes stimulate creativity engagement among students (Gu et al. 2017). Earlier studies in non-academic settings encapsulated that employee creativity and innovations are influenced by their managers' supervision styles (Agbor 2008; Barsh et al. 2008; Borins 2002; Moos 2014). A supportive supervisor contributes to an organizational culture that encourages members to transform their creative skills into innovative performance in addition to adequately addressing personal and cultural issues, and experiences in any setting (Wisker et al. 2003). In parallel, in a rapidly changing academic environment, the task of an academic supervisor has become more of a manager (Ahmed et al. 2017; Devine and Hunter 2017).

Innovation in the academic arena is considered the outcome of the interactive efforts of students, supervisors, and other resource persons (Lindquist 1974; Wang and Li 2011; Mainhard et al. 2009). Supervising international students is comparatively more complicated than domestic students as they are distinctive in terms of differences in personal attributes, economic and socio-cultural backgrounds (Shin et al. 2018; Sidhu et al. 2017). Influence of those multi-faceted factors makes the innovation pursuits more complicated for the doctoral students. Development of students' identity, sense of agency, autonomous belief, supervisor's intercultural knowledge to manage students from diverse cultures, and the capacity of the supervisor for being explorative to meet the students' real-time requirements (Brodin 2018). Yet, very few studies have been directed to the research innovation processes of higher education institutions (Al-Husseini and Elbeltagi 2014; Cachia et al. 2010; Trivellas and Dargenidou 2009; Bergendahl and Magnusson 2015), and research on the role of academic supervisor support in stimulating international doctoral students innovation is almost absent and less researched (Armstrong 2004).

As the quality, progress and outcomes of doctoral studies are heavily influenced by the supervisor. This study assumes that creativity of doctoral students' research projects is affected by the support and guidance of their supervisors (Mantai 2017; Wang and Li 2011). Importantly, the gravity of the socialization is immensely significant for students because of the cultural shock they encountered when they faced the clash in the host country's dynamics with their home country's learning (Weidman et al. 2001). Thus, supervisors are expected to provide academic support, socialization, coaching and mentoring over the course of research projects and early in career development (Mainhard et al. 2009; Tan and Weidman 2013). Henceforth, the supervisor's role to socialize the various country-specific factors among their supervising students plays an intriguing role to think and act accordingly, leaving the phobia of social alienation which prevents employees' engagement in the creative-related activities.

Since creativity and innovation are connected (Sousa and Luís 2013), the supervisor can help transform doctoral students' creative ideas into innovative research and new knowledge (Mittal and Dhar 2015; Zacher and Johnson 2015). Against the backdrop of investigation on doctoral students' research supervision and innovation pursuit, this study explores the relationship between Chinese supervisor support and international student innovation pursuits in China, as well as the mediating effects of student creativity and citizenship behavior (CB). The trends of international students' arrival are rising in China from abroad each year than any of the Asian nations (Alemu and Cordier 2017). However, the extant literature witnesses no studies on the relationships between Chinese research supervisor and international students in China. Since international students from different continents belong different cultures, this study also could help policymakers understand the effectiveness of Chinese professors' supervision of international students who have been graduating in China. Thus keeping the gravity of the relationship among supportive supervisor, citizenship behavior, creativity, and innovation pursuit in the Chinese academic setting, the present research delineates the following two research questions (RQ):

RQ 1: Does a supportive supervisor influence students' innovative outcome?

RQ 2: Would citizenship behavior and students' creative mindset mediate the impact of the supportive supervisor on students' innovativeness?

The contributions of this paper are as follows. First, this is thought to be the first empirical study assessing the role of home country's supervisor support in foreign doctoral students' pursuit of research innovation. The findings could be useful for academic administrators and policymakers who seek to harness more congenial and productive research climate in academic contexts. Second, as it examines students' CBs and creativity skills as mediating factors, supervisors could be interested in nurturing these qualities and attitudes among their students. Nurturing these factors may increase innovation pursuit among doctoral students. Third, universities and funding agencies should be aware of the impact of supervision on the knowledge creation process in the context of higher education. In addition to focusing on logistics and research facilities support, human factors may be vital to the innovation process in doctoral research. Finally, this study validates the applicability of social exchange theory in an education context. Students' involvement in the learning process can be seen as reciprocal efforts without an obligatory exchange relationship. The mutual exchange attitude trickles down from students' CBs to the innovative pursuits instigated by their supervisors.

Theoretical background of the study

Students' innovative outcome at their research degree is a complex phenomenon which is influenced by so many factors, such as attitude, responsibility, gender, age, country type, personality, academic background and the so forth of supervisor and students and the impact of those factors (Woodman and Schoenfeldt 1990; Jarvis and Parker 2006; Zennouche et al. 2014). The influence of those factors could be explained by the understanding of voluminous theories, for example, supervisor's impact on students' innovative and citizenship behavior by contingency theory (Fiedler 1964), personality, attitude, country types, and country of origin of the students and supervisor by cross-cultural perspective (Hofstede 1998), innovation, resources, and supervisor supports by resource-based view (Barney 1991, 2000), individual and group behavior by psychological perspective (West et al. 2009; Simbula and Guglielmi 2013), interactive effects of leadership, organizational, and individual by interactionism perspective (Woodman and Schoenfeldt 1990), perceived organizational supports (Eisenberger et al. 1986), and componential theory of creativity (Amabile 1988), and interactions at multi-level by multi-theoretical perspective (Zennouche et al. 2014). Among all of these theories, the present study focuses on the positive transformation of students stimulated by the supportive supervisor in a psychological mechanism, and we, therefore, followed the tenet of social exchange theory.

The study instead aims to assess the potential impact of Chinese supervisors' supportive behavior on the innovative research pursuits of international doctoral students in Chinese universities by encouraging creative skills and CBs. Almost all international doctoral students in China receive CGS for their studies. The research question and the hypotheses are formed from the tenets of social exchange theory (SET). Among many other dominant theories, this study used the SET framework as a unique conceptual model which demonstrates the effectiveness of student-supervisor voluntary and non-voluntary reciprocal relationship in educational contexts. The proponents of SET argue that social exchange requires a series of interdependent interactions or transactions that obligate complementary actions from another entity (Emerson 1976; Cropanzano and Mitchell 2005). SET postulates that a particular transaction or behavior by a party creates a mutual obligation for the other party in the exchange process (Homans 1958; Blau 1964; Cropanzano and Mitchell 2005; Emerson 1976). According to Blau (1964), SET understands the action of a party as conditioned on the rewarding reaction of the other party involved in any particular exchange or transactional relationship.

From the SET perspective, doctoral students enroll in a university based on a contractual agreement as well

as an expectation that the university will provide a supportive supervisor to guide the student toward creative ideas and to help execute those ideas through innovative pursuits. When institutions provide supportive supervisors that foster a research culture, students feel a moral obligation to recompense the university and the funding authority. In such situations, students also feel obligated to engage in extra-role behaviors beyond the transactional relationships with the supervisor, university, and funding authority. Earlier research on corporate contexts found that when employees were treated fairly, they were more likely to engage in reciprocal behaviors (with their organizations) (Homans 1958; Blau 1964). In addition to moral obligations, exchange relationships foster social compulsions toward institutional stakeholders. When the supervisor trusts and supports students, they tend to engage in more CBs, such as sharing views, communicating new ideas that not only help generate creative ideas but also facilitate innovative outcomes when these creative ideas are applied. It is presumed that the reciprocal social exchange mechanism works faster when each party in the exchange process perceives and values their interactions positively (Coyle-Shapiro and Shore 2007; Flint et al. 2013). Therefore, based on the ideas of SET, this study assumes that a suitable supervisor will stimulate CB and encourage creative ideas that enhance innovative pursuits.

Literature review and hypothesis development

Supportive supervisors and doctoral students' innovation pursuits

The importance of supportive leadership for employees' growth, development, and other job-related outcomes is evident in previous research (Mainhard et al. 2009). Supervisors, similar to the role of managers in other settings, play a significant role in fostering employee creativity and innovation (Khalili 2016; Nisula 2015; Devine and Hunter 2017). Jarvis and Parker (2006) argued that post-graduate supervision is a holistic framework that comprises of three major dimensions: institutional factor (special reference to university's supports), supervisory factor, and student-related factors. Sidhu et al. (2017) further identified guidelines, counseling, funding, and training and development as institutional factors; roles, responsibilities, student-supervisor relationships, and supervisor practices as supervisory factors; and roles and responsibilities, readiness, personal issues and challenges as individual (student) factors. However, among different factors, supervisors' support and encouragement boost employee self-confidence and stimulate involvement in creative and innovative work processes. In academic contexts, supervisors catalyze

the learning process (Rosenholtz 1991; Geerdink et al. 2016; Leong 2010). Usually, doctoral students' supervisors play different roles, such as a teacher, guide, coach, mentor, and even critic, to improve the quality of their research projects (Eley and Jennings 2005). Phillips and Pugh (2005) mentioned that supervisees expect their supervisors to have advanced knowledge in relevant academic domains and to be friendly, cooperative, critically constructive, and sufficiently involved in theoretical development works. Burgess et al. (1992) reported that supervision is a tough teaching task, starting as a project manager and becoming a critical friend. It seems that supervision requires ceaseless commitment and energy to foster students' creativity and provide creative solutions to problems.

Mathews and Fraser (1999) revealed that students rate supervisors who provide support and critical guidance on students' work more highly than they do those who have expertise. Supportive supervisors will not only assist their students but also teach them well how to cooperate with each other. Briefly, pro-student supervisors have students who think outside the box, devise their objectives and create their worlds (Núñez et al. 2015; Nisula 2015). Thus, supportive supervision (SS) makes students self-sufficient, imaginative, creative, and innovative (Devine and Hunter 2017). Trivellas and Dargenidou (2009) revealed that in academic contexts, innovations require proactive and supportive leaders with a clear understanding of research projects and sincere engagement with academic and research staff. Supportive supervisors create formal and informal feedback systems (such as CB) and social interaction among both students and faculties so that all students can help themselves and reap from each other (Leong 2010; Weidman and Stein 2003). Conversely, poor interpersonal relation and lack of intimate rapport with the supervisor are perceived to be the single most responsible factor affecting the doctoral students' withdrawal, attrition, procrastination, and dropout in their degrees (Armstrong 2004; Sidhu et al. 2017). Research in industrial contexts also suggests that subordinates with supportive supervisors come up with innovative and creative solutions (Choi 2007; Oplatka 2006). Based on the above literature review and theoretical assumptions, this study proposes the following hypotheses.

H1: Supervisor support is positively correlated with the research innovation pursuits of doctoral students.

H2: Supervisor support has a significant direct effect on the innovation pursuits of doctoral students.

Creativity as a mediator of the supportive supervisor–innovation pursuit relationship

Creativity is the development of novel and useful ideas in any domain or the bringing of something new into the real world (May 1959; Amabile et al. 1996; Baer 2012). Yu

(2015) considered creativity the seed and innovation of the fruit. Innovation stems from the creative ideas of employees and their supportive organizational environments (Yu 2015). Innovation comes from the application of creative ideas, which in turn come from productive employees or individuals. Effective supervision propels subordinates creativity toward the target or achievement (Saxena 2015). The nature of the supervisor–subordinate relationship is essential for encouraging creative effort. The more cooperative, helpful, and open the relationship, the more creative and innovative works that are produced. The role of the supervisor is necessary during the creative process generally (Basadur et al. 2000) and during idea generation specifically (Chua et al. 2010). Basadur et al. (1982) postulated that creative thinking consisted of two steps: ideation (divergence) with no judgment and evaluation (convergence) with full judgment. Research in an academic field requires cogent and academically sound expertise to elicit innovative outcomes. In line with SET (Homans 1958; Blau 1964), it is likely that students, who are treated well and valued by their supervisors, feel safe enough to engage in unconventional activities, such as sharing research activities, discussing creative ideas, and yielding problem construction and solutions, and so forth, as long as they are not in conflict with school rules and policies (Shouse and Ma 2015). Positive attitudes among researchers can lead to synergy in their collective work and catalyze their areas of knowledge. This kind of CB stemming from peers, colleagues, and other research students helps everyone improve their research skills, thus increasing their creativity and accelerating their innovation pursuits (Lepp et al. 2016).

H3: Doctoral student creativity mediates the supportive supervisor–innovative pursuit relationship.

Citizenship behavior as a mediator of the supportive supervisor–innovation pursuit relationship

CBs, or organizational citizenship behaviors (OCBs), are defined as deliberate and non-mandated actions that are not part of formal job descriptions (Biestock et al. 2003). The SET perspective suggests that individuals tend to engage in reciprocity when they feel that they are treated fairly by organizations (Yılmaz and Taşdan 2009). In an academic context, when students think that they are treated fairly and valued by their supervisors, they feel obliged to produce for a supervisor and the institution. Research students require constant support and feedback from their supervisors while conducting research projects (Núñez et al. 2015). In addition to an intrinsic interest from students, the outcomes of CB among students can also stem from very supportive supervisors who encourage openness, original thought, and flexible work schedules by creating friendly and supportive environments for the individual and the group (Oplatka 2009; Lepp et al. 2016). A supportive supervisor can instigate CB among

supervisees and can spur creative and innovative outcomes by ensuring a supportive working environment. However, in this study, researchers noted the limited research on the CB of research students and the generation of creative ideas and, thereby, innovative outcomes. The creation of new ideas and their transformation into the unique and useful results will never occur if supportive supervisors do not furnish environments that encourage unconventional activities, such as problem-solving as a team, and allow flexible work schedules and task relationships (Ren and Zhang 2015; Fay et al. 2015). Based on previous research and assumptions drawn from the theoretical discussion, this study proposes the following hypothesis.

H4: The CB of students mediates the supportive supervisor–innovation pursuit relationship.

This study assumes that supportive supervisors influence students' innovation pursuits by instigating CB and encouraging creative team endeavors. Therefore, it would be challenging to pursue innovation through voluntary cooperation if students lack commitment and supervisors do not provide the necessary environment. Based on previous research and the theoretical assumptions, this study proposes the following hypothesis.

H5: Citizenship behavior and creativity play mediated mediation roles in the supportive supervisor–innovation pursuit relationship.

Conceptual model

Figure 1 displays the conceptual framework concerning the supportive supervisor, student CB, creativity, and innovative outcomes. The model indicates that a supportive supervisor predicts student CB, creativity, and novelty through the positive psychological mechanism of direct and indirect effects. Based on the tenet of SET, it is framed that students tend to exhibit more inclinations toward innovation, creativity, and CB when they are seemingly valued and supported. Apart from the theoretical underpinning in SET perspective, the underlying relationship in the conceptual model can also be further explained by other theories, namely psychological perspective, interactionism perspective of creativity,

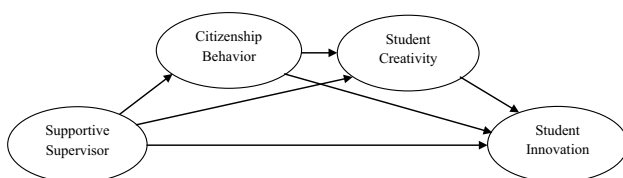


Fig. 1 Research model

perceived organizational support, the componential theory of creativity. The latter theories also manifest that individuals can do very little if they are not supported by their ascribed group and institution in a given setting. Henceforth, given the supervisor is supportive, students, being free from social and academic alienation, would engage more in CB and creative efforts leading toward innovative pursuit. Thus, the proposed research model shows that student CB and creativity mediate the association between a supportive supervisor and the degree of originality of students' research.

Research methods

Participants

Four Chinese universities were selected considering the relative high concentration, and enrollment of international students in the business schools as well as resource limitations of the researchers. Two of them were from Shanghai, i.e., Shanghai University and Donghua University, and the two universities were from Wuhan, i.e., Wuhan University of Technology and Huazhong University of Science and Technology. After repeated requests, only three universities gave the permission and well allowed to collect data from the doctoral students. These three universities, i.e., Shanghai University, Huazhong University of Science and Technology, and Wuhan University of Technology are public universities which provides homogeneities and matching sample principality of the selected organizations. Only two cities were preferred because Shanghai is the most industrially developed city, and Wuhan is known as “the city of universities” in China. Moreover, respondents from more other cities might not significantly deter the studied results because of the homogeneity of respondents with respect to the guidance, supervision and financial grants or scholarship elsewhere in China. The survey questionnaire was delivered directly to all 150 international research students registered in Ph.D. in Management related-programs through students' representative of all three respective universities. A total of 125 responses were received from 150 survey questionnaires from the three universities, yielding a response rate of 83.33%. After final cross-checking, 120 questionnaires were used in the analysis. This ‘simple random sampling method’ is considered as appropriate sampling technique to ensure the generalizability and validity of the results from known and homogeneous population (Zikmund and Babin 2007; Yamane 1967; Israel 2003). The response rate (83.33%) is substantially higher than the ordinary rate mentioned by Tomaskovic-Devey et al. (1994) to avoid non-response bias. The final responses also fulfilled the required sample size as suggested in the ‘Table method’ (i.e., 110) with the formula $n = [N/(1 + N(e))]$ where n is sample size, N is

the population size, and e is the level of precision (Yamane 1967; Israel 2003). The results of 120 responses out of a total population of 150 Ph. D. students from those three universities could be therefore considered valid at 95% confidence and 5% precision level (Tomaskovic-Devey et al. 1994; Israel 2003; Singh and Masuku 2014). There is no rule of thumb, yet Hair Jr. et al. (2014a, b) underlined on using minimum 110 to 150 responses for applying SEM when the data were normality distributed with no missing value, leaving the complex model and heterogeneity of respondents. Thus, 120 replies are adequate since the study does not witness any abnormality in data distribution, missing value, homogeneity of respondents. The raw data were then entered into SmartPLS2 and the SPSS 20 data editor before conducting the statistical analysis.

Measurement tools

Four different measures, a supportive supervisor, CB, creativity, and innovation have been selected from prior studies. We have made some obligatory changes in the wording of the sentences for making it respondents' friendly. Focus group studies between two groups of post-graduate students and one to one interview of four professors who are supervising doctoral students were conducted to oversee the consistencies of contents in the measures with the concept in the academic settings. The cross-loading through principal component analysis demonstrated that items are rather highly loaded to their latent variable. Other issues regarding the authenticity of the survey measures were performed through checking the reliability and validity in the measurement model analysis.

Supportive supervisor

The supportive supervisor (SS) construct consists of four items from Parker et al. (2006). Each respondent was asked to rate each item on a 5-point Likert scale (1 = strongly agree...5 = strongly disagree). Sample items in this scale include "... encourages us to expect a lot from ourselves" and "... encourages us to be aware of our level of performance."

Citizenship behavior

A total of five items from the CB construct of Ritz et al. (2014) were used, and each respondent was asked to rate the items on a 5-point Likert scale (1 = strongly agree...5 = strongly disagree). Sample items for this scale include "... adapt my schedule to help other co-workers" and "... try hard to help others so they can become integrated into my organization."

Creativity

A 9-item creativity construct (denoted CR) developed by Rice (2006) was used, and respondents were asked to rate each item on a 5-point Likert scale (1 = strongly agree...5 = strongly disagree). Sample items for this scale were "... feels that I am creative in my job," "...try to be as creative as ... can in my job," and "When new trends develop in my workplace, ... usually, the first to get on board."

Innovation

A 6-item innovation pursuit construct developed by Ismail et al. (2002) was used, and respondents were asked to rate each item on a 5-point Likert scale (1 = strongly agree...5 = strongly disagree). Sample items for this scale were "When it comes to the work ...do, there is usually one best way to achieve a particular outcome" (reverse coded) and "It is dangerous to experiment with innovations that are not 'tried and true'" (reverse coded).

Findings

Sample characteristics

Table 1 displays the demographic profile of the respondents ($n = 120$), including the gender, age, work experience, and the continent of origin variables. The respondents were

Table 1 Demographic profile of respondents ($n = 120$)

Descriptions	Frequency	Percentage
Gender		
Male	80	67
Female	40	33
Age		
Above 18	14	12
Above 25	76	63
Above 35	24	20
Above 45	6	5
Tenure		
Above 1 year	50	42
Above 5 years	42	35
Above 10 years	20	17
Above 15 years	8	6
Nationalities		
African	38	32
American	12	10
Asian	68	56
European	2	2

asked to rate their supervisors' supportive behavior and to answer some questions about themselves. Of the 120 respondents, 40 respondents (33%) were female; 80 (67%) were male. Respondents ranged widely in age with 7%, 38%, 12%, and 3% being above 18, 25, 35, 45 years old, respectively. A total of 50, 42, 20, and 8 respondents reported work experience of more than 1, 5, 10, and 15 years, respectively. Moreover, 38, 12, 68, and 2 respondents originated from Africa, America, Asia, and Europe, respectively.

Control variables

In line with the prior studies, students' gender, age, job tenure, and continent of origin were controlled (Zacher and Johnson 2015; Martín et al. 2017; Meng et al. 2017). Gender was coded as 1 = female and 2 = male, age was coded as 1 = 18–24 years old, 2 = 25–34 years old, 3 = 35–44 years old and 4 = older than 44 years old, job tenure was modeled as 1 = 1–4 years, 2 = 5–9 years, 3 = 10 to 14 years and 4 = more than 14 years. Finally, respondents from different continent were also given various codes (1 = African, 2 = America, 3 = Asia and 4 = Europe). All the control variables were labeled as categorical variables. Table 2 highlights that other than the effect of age on students' creative, no significant association was documented among other variables.

Response bias

We collected data from the same source using the self-report survey on the observed variables. Thus, there is a high chance that the result might be influenced by the response bias (for example, halo effects, social desirability, acquiescence, yea- and nay saying) (Mahmood et al. 2018) or the same method (Podsakoff et al. 2012). To limit the bias issues, we took several steps. First, respondents were assured

the privacy and the confidentiality of their data, and was also guaranteed that, their responses will not be made public and will only be used for academic purpose. This assurance encourages their valid answers to statements (Podsakoff et al. 2012). Second, Harman's one-factor statistical analysis shows that not a single component explains more than 50% of the variance in innovation (Podsakoff et al. 2012). Finally, we also examined, in Table 2, the correlation matrix, which denoted that the highest correlation between two variables is 0.526, and no correlation exceeds 0.90, which demonstrates no concern on bias issues (Pavlou 2003).

Model evaluation

Measurement model evaluation

Convergent validity and discriminant validity were tested used through SmartPLS 2 (Ringle et al. 2005). Reliability is an indicator of a measure's internal consistency. Cronbach's alpha (α) is the most widely used measure of the reliability of the scale. Scales with α coefficient ranging from .70 to .80 and 0.80 and above are considered to have good and excellent reliability, respectively (Zikmund and Babin 2007). Table 2 (discriminant validity) and Table 3 (convergent validity) report that all constructs pass the validity tests. The discriminant validity analysis (Table 2) reports an excellent result, which shows that the square root of the average variance extracted (AVE) of each construct is higher than the construct's highest correlation with any other construct in this study. Table 3 demonstrates the convergent validity and other reliability conditions are also satisfied based on the factor loadings (all > 0.50), AVE (AVE > 0.50) and composite reliability (CoR > 0.906). Therefore, the validity and reliability analyses both suggest that these constructs are valid and reliable (Hair Jr. et al. 2014a, b).

Table 2 Correlation matrix for discriminant validity (DiV)

Variables	1	2	3	4	5	6	7	8
Control variables								
1. Age	1							
2. Tenure	.690 ^b	1						
3. Nationalities	-.131	-.179	1					
4. Gender	-.237 ^b	-.152	-.182 ^a	1				
Latent variables								
5. Supportive supervisor	-.064	-.126	.062	.000	0.861			
6. Citizenship Behavior	-.119	.012	.095	-.002	0.414 ^a	0.719		
7. Creativity	-.228 ^a	-.105	.057	.055	0.482 ^a	0.526 ^a	0.886	
8. Innovation	-.086	-.078	.177	-.067	0.414 ^a	0.482 ^a	0.523 ^a	0.854
Mean	–	–	–	–	1.87	1.85	1.77	1.86
Standard deviation	–	–	–	–	0.58	0.59	0.46	0.66

^aCorrelation is significant at the 0.01 level (2-tailed)

^bCorrelation is significant at the 0.05 level (2-tailed)

Table 3 Convergent validity

Latent variable	Items	Factor loadings	CoR	R ²	AVE ^a	DiV	α
Supportive supervisor	ss1	0.851	0.915	-	0.729	Yes	0.876
	ss2	0.879					
	ss3	0.803					
	ss4	0.878					
Citizenship behavior	cb1	0.876	0.935	0.274	0.742	Yes	0.913
	cb2	0.874					
	cb3	0.861					
	cb2	0.845					
	cb5	0.849					
Creativity	cr1	0.704	0.906	0.271	0.517	Yes	0.883
	cr2	0.697					
	cr3	0.750					
	cr4	0.739					
	cr5	0.766					
	cr6	0.687					
	cr7	0.730					
	cr8	0.705					
	cr9	0.687					
Innovation	in1	0.897	0.945	0.418	0.785	Yes	0.922
	in2	0.880					
	in3	0.877					
	in4	0.880					
	in5	0.901					
	in6	0.881					

^aBoth AVE and communalities represent the same thing

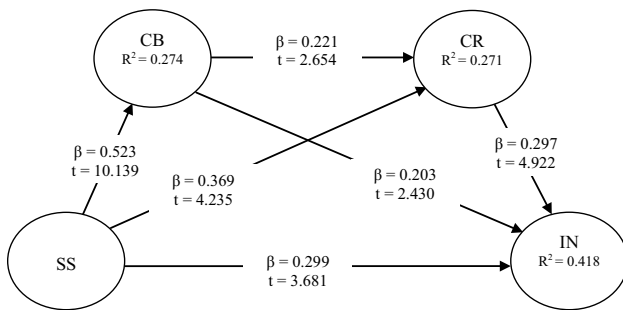


Fig. 2 Path structural model

Structural model evaluation

Researchers apply multiple criteria to estimate structural model quality and fitness rather than relying solely on beta coefficients and coefficients of determination. Bootstrapping with 5000 samples was applied to test the hypotheses. First, the standardized coefficient (β) was estimated, and the percentage of variance explained was determined (R²). The significance levels and the path model relationships are represented in Fig. 2.

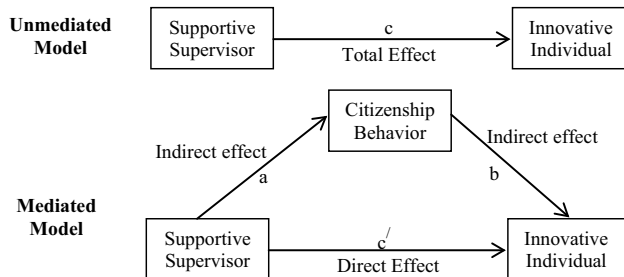
In line with the model fitness criteria of Tenenhaus et al. (2005), the model goodness of fit (GoF) was calculated using SmartPLS 2 (Fig. 2) using the square root of the product of CVs of all the constructs and the average R² of all endogenous variables as follows:

$$\begin{aligned}
 \text{GoF} &= \sqrt{(\text{average CM}) * (\text{average } R^2)} \\
 &= \sqrt{(0.693 * 0.321)} \\
 &= 0.471
 \end{aligned}
 \tag{1}$$

Cohen (1988) mentioned that 0.10, 0.25, and 0.36 were GoF values for small, medium, and substantial effects upon fulfilling the minimum threshold for communality for any construct of above 0.50 (Fornell and Larcker 1981). The results show that the GoF value is 0.471, and the minimum communality of the AVE for any construct is 0.517. According to the estimation methods of Cohen (1988) and Fornell and Larcker (1981), the effect size of the good-ness fit is large, and the minimum communality is also observed.

Table 4 Unmediated regression path coefficient

Hypothesis	Path relation	Path coefficient (β)	R^2	t -value	p -value
H2	SS \rightarrow IN	0.552	0.305	10.661	0.000

**Fig. 3** Total, direct, and indirect effects in mediated and unmediated models

Hypothesis testing

Unmediated model

We run a discriminant validity test that conceives the correlation matrix in Table 2. It reported that SS and innovation pursuits are significantly associated at $p < 0.000$. *H1* assumes that SS and IN are correlated. The estimated result supports the hypothesis; hence, our first hypothesis on the relationship between the perception of the supervisory support and creative researchers' is supported. The findings in Table 4 have shown the standardized coefficients (β) of the direct path without fitting a SEM, with a path coefficient (β) = 0.552 (SS \rightarrow IN, $p < 0.000$), which significantly affects innovation pursuit. Thus, the estimated result supports *H2* at $p < 0.000$ level.

Mediated model

A mediating variable (MV) is an independent variable (IV) that significantly affects a dependent variable (DV) through another construct (Chou and Yeh 2013). Figure 3 shows the normally mediated relations in a structured model. The necessary condition for a mediation effect is a significant correlation with the DV, the IV, and the MV. Table 2 reveals significant correlations ($p < 0.00$) among all variables under consideration for mediation. Table 4 shows the direct path coefficient (β), which is 0.552 (SS \rightarrow IN) and significant at $p < 0.000$ before running MVs. Again, to ensure a mediation effect (sufficient conditions), first, the IV must affect the DV significantly. Second, the IV must affect the MV, and the MV must affect the DV significantly when the IV included. Finally, the significant regression effect between

the IV and DV must either disappear (full mediation) or be reduced (partial mediation) when the MV is added to the model (Chou and Yeh 2013; Chang et al. 2010; MacKinnon et al. 2012).

Table 5 (and Fig. 2) provides the direct, indirect, and total effects of the variables after the inclusion of the mediators. According to the reported results, it (*H3*) appears that the direct effect (c) before mediation, the direct effect (c'), the indirect effect (along with MV-CB), and the total effect of the SS-IN relationship after mediation are 0.552, 0.299, 0.106, and 0.405, respectively, when the mediator (CB) is added. The results show that the direct effect is still significant but reduced from 0.552 (c) to 0.299 (c') after the mediator variable is included, which supports *H3*, with CB partially mediating the SS-IN relationship (Hair Jr. et al. 2014a, b; Baron and Kenny 1986; Chou and Yeh 2013; Hayes 2013; MacKinnon et al. 2012). Following the recommendation of Hair Jr. et al. (2014a, b), we estimated variance accounted for (VAF) which is 0.262 included in the range of partial mediation (0.20 to 0.80). The findings for *H4* are conveyed as the direct effect before intervention, the direct effect, the indirect effect (along with MV-CR), and the total effect of mediation of 0.552, 0.299, 0.110, and 0.409, respectively. The significant reduced direct effect ($\beta = 0.299$, $p < 0.000$) after including the mediator variable (CR) with a VAF of 0.268 also strengthens the finding that creativity also partially mediates the relationship between SS and IN (Hair Jr. et al. 2014a, b; Baron and Kenny 1986; Chou and Yeh 2013; Hayes 2013; MacKinnon et al. 2012). Therefore, *H4* is accepted. We checked the mediated mediation effects of CB and CR, and the results ($c = 0.552$, significant $c' = 0.299$, indirect effect = 0.282, and the total effect = 0.581) support *H5* because there is a further partial mediated mediation effect of CB and CR on the SS-IN relationship.

Discussion and conclusions

Discussion

This comprehensive empirical study tested five different hypotheses regarding correlation, regression, mediation, and mediated mediation of the structured relationships among SS, CB, CR, and IN. The correlation matrix in Table 2 demonstrates that all the variables are significantly correlated. The self-reported data analysis provides empirical support for the structured relationships. Empirical studies signify that creativity has a significant ability to predict innovation pursuit (Amabile 1988; Bergendahl and Magnusson 2015; Meng 2016; Gu et al. 2017). The experimental results demonstrate that creativity significantly explains the innovativeness of supervised students. Numerous testimonies have found the same empirical relations (Agbor 2008; Cachia

Table 5 Result of mediated model

Hypothesis	Path	Mediator	Direct effect	Indirect effects	Total effects	VAF/comments	t-value (p-value)
H ₃	SS → IN (<i>c</i>)		0.552		0.405	0.262 Partial mediation	10.661 (<i>p</i> > 0.000)
	SS → CB (<i>a</i>)		0.523				10.139 (<i>p</i> > 0.000)
	CB → IN (<i>b</i>)		0.203				2.430 (<i>p</i> > 0.017)
H ₄	SS → IN (<i>c'</i>)	CB	0.299	0.106 ^a	0.409	0.268 Partial mediation	3.681 (<i>p</i> > 0.000)
	SS → IN (<i>c</i>)		0.552				10.661 (<i>p</i> > 0.000)
	SS → CR (<i>a</i>)		0.369	4.235 (<i>p</i> > 0.000)			
	CR → IN (<i>b</i>)		0.297	4.922 (<i>p</i> > 0.000)			
H ₅	SS → IN (<i>c'</i>)	CR	0.299	0.110	0.581	0.485 Partial mediation	3.681 (<i>p</i> > 0.000)
	SS → IN (<i>c</i>)		0.552				10.661 (<i>p</i> > 0.000)
	SS → CB (<i>a</i> ₁)		0.523	10.139 (<i>p</i> > 0.000)			
	SS → CR (<i>a</i> ₂)		0.369	4.235 (<i>p</i> > 0.000)			
	CB → IN (<i>b</i> ₁)		0.203	2.430 (<i>p</i> > 0.017)			
	CR → IN (<i>b</i> ₂)		0.297	4.922 (<i>p</i> > 0.000)			
	CB → CR (<i>d</i> ₂₁)		0.221	2.651 (<i>p</i> > 0.009)			
	SS → IN (<i>c'</i>)	CB and CR	0.299	0.282 ^b			3.681 (<i>p</i> > 0.000)

Total effect = direct effect (*c'*) + indirect effect; SN = significant

^a0.106 = path coefficient of (SS → CB times CB → IN) = > 0.523 × 0.203

^b0.282 = path coefficient of (SS → CB times CB → IN) + (SS → CR times CR → IN) + (SS → CB times CB → CR times CR → IN) = > (0.523 times 0.203) + (0.369 times 0.297) + (0.523 times 0.221 times 0.297)

et al. 2010). This study shows that Chinese supportive supervisors encourage international students' CB in China, which is consistent with the findings of Oplatka (2009). However, many studies find a supportive supervisor and subordinate CB relationships in non-academic fields (Gregory et al. 2013; Podsakoff et al. 1990; Suliman and Al Obaidli 2013). Supportive leaders or supervisors provide room for subordinates to work on their initiatives. In addition to socializing them with the contextual dynamics what have been illustrated by Weidman et al. (2001) and Tan and Weidman (2013), a supportive supervisor helps students come up with creative ideas and pave the way to putting those ideas into action as innovation pursuits.

The empirical findings also rejuvenate that a supportive supervisor predicts the innovation and creativity of the students they supervise. These findings are consistent with the results of Agbor (2008), Moos (2014), Slåtten and Mehmetoglu (2015), and Gumusluoglu and Ilsev (2009). Further, it was hypothesized that CB helps individual creativity and innovation. The empirical findings reveal that CB significantly predicts both creativity and innovativeness. It happens because assisting peers to and discussing with people who have a stake in similar matters stimulate creative ideas, and the implementation of those ideas spurs innovation. The SET uncovers the direct influence of supervisor on innovation pursuit and the indirect impact on the same through CB and CR. Students with perceived supports from supervisor tend to heavily engage

in independent research, and the team's creative efforts because they feel that their supervisor would tolerate them even if they fail. Thus, the psychological empowerment building on perceived supports exposes the students to the innovative pursuit.

The mediation analyses reveal that the IVs have significant direct and indirect (as well as mediating) effects on the DVs. Research shows that an organization that provides a supportive environment enhances the creativity and innovative skills of internal performers (Ekvall 1996). Supervisors can catalyze the creative and innovative efforts of his team by fostering OCB. If the supervisor transforms his team into a supportive and constructive environment, this can stimulate the entire team's creative and innovative outcomes through synergy (Nisula 2015). In line with SET, when international students observe that their Chinese supervisors are cooperative and helpful, it will drive them to engage in CB in and out their team setting being free from psychological worry losing their faces. The CB among the research students interact and cooperate with each other to construct the research problem and generate the attack the problem (creativity). Furthermore, supportive supervisor extends his/her commitment to a noble solution (innovation pursuit) to constructed research problem (creativity) through CB. Thus, supportive supervisor turns the creative students into innovative researchers through stimulating their CB and creative behavior.

Contributions

This empirical study contributes to existing knowledge in different ways. *First*, the literature review reveals the dearth of literature on the influence of supervisor on their international students' innovation pursuit that considers the developing country context. Although some investigations have been conducted in P.R. China on the relationship between supervisor and students' creativity in the similar setting, the research on other developing countries is not sufficient (Meng 2016). Therefore, this study enhances the strength of the literature considering the developing country and cross-national perspectives. *Second*, the extant research shows that globally, studies of the effects of the supervisor on peer CB, creativity, and innovation focus mostly on non-academic settings (Li et al. 2015; Meng 2016; Oplatka 2009). However, this study focuses on academic supervision and on improving the innovative skills and creativity of researchers. The results show that supportive supervision turns researchers' CB and creativity into innovative outcomes in the academic arena. This study provides empirical findings on the generalizability of the influence of supportive supervisor on innovation through the impact of CB and creativity in academia. *Third*, it generalizes our understanding of creativity, supervision, and CB, irrespective of the supervisor or the student's country of origin. More importantly, it envisages the applications of SET in a relationship between supervisor, and students' innovation pursuit. It sheds lights on the underlying social exchange mechanism in where the supports from supervisor give rise to the demonstration of the students' creative imagination and application in an academic setting based on cross-cultural relationships. Therefore, this study also improves the conceptualization of SET based on the fact that perceived support from the supervisor leads students to reciprocate in the form of CBs, creativity, and innovative outcomes in any setting (Blau 1964; Homans 1958; Eisenberger et al. 1986).

Implications

The empirical results of this study indicate that SS and CB have significant, positive effects on innovation pursuits. Moreover, SS positively affects CB and IN. Although this study of SS, IN, CB, and CR in academic research is relatively novel, as it aims to identify the impact of supervision and encouragement on the creativity and innovation of students, it has significant implications for knowledge creation in academic setting because innovation and creativity are purely dependent on the research outcomes of the researchers. Improvements in the light of innovation in the research outcomes stimulate progress in the world. This paper proposes that the supervisor must create a supportive organizational climate for researchers and encourage them to

help one another to enhance their creativity and innovative initiatives (Weidman and Stein 2003).

Being supervisory is essentially the most critical antecedent for the students to be autonomous learners and independent researchers (Meng et al. 2017), the dynamic relationships between the both should be engaged. Wisker et al. (2003) postulate that supervisor must be open in the initial stage to guard the frustration and also be nurturing to postgraduates in attitude and practice during situational ambiguities. Henceforth, the supervisor would shed light on collaborative supervision relationship in a way that all the parties will take other perspectives into their consideration for ensuring the quality supervision (Armstrong 2004). Importantly, the essence of collaborative supervision relationship stems from the mutual trust, mutual understanding and shared goals (Brodin 2018). In doing so, a good fit between the supervisor's personal and institutional support and students' autonomy. Notably, excessive support from supervisor gives weakening to the autonomous belief by increasing the followers' dependence. Autonomy support is meant for acknowledging students' perspective, appreciating their proactivity, collaborating to strengthen the rapport with the peers, and encouraging them to be open with their creative ideas and growth opportunities (Overall et al. 2011). Additionally, last but not the least, the concerned university might tie financial grants for the supervisor with their students' scholarly publications in indexed journals.

The literature review notes that creativity and innovation should not be limited to products. These research results may apply in other fields as well. To support innovation and creativity in any sector, SS and CB might be institutionalized. A good leader alone does not ensure more significant innovation. This study demonstrates that a supportive supervisor drives up innovation by 30.50%, and it rose to 41.80% when the model added CR and CB along the path model. Therefore, the empirical findings suggest that an organization with supportive supervisors also requires the CBs of his team members and creative subordinates to accelerate organizational innovation.

Limitations and future directions

Despite Chinese universities has become the home of so many international students, this study considers only three public universities in China in two cities, namely, Shanghai and Wuhan due to homogeneous respondents under relatively similar task settings. Although the model estimations, data quality, and other indicators authenticate the validity and reliability of the model, the sample size is not very high. The future researchers are suggested to select more universities from these cities, or selecting more schools from various cities, which might increase the generalizability of the findings. This study used SET

as the underlying theory for the research framework since we studied the research students' innovative potential through their supportive supervisor at the individual level. However, there are some concerns as to the suitability of a single theory or individual level analysis. Following the synthesis of Zennouche et al. (2014), innovation is perceived to be a complex landscape with multi-faceted phenomena which warrants a multi-level study using multiple theories.

Another limitation of this study is the countries of origin of the respondents. This research tries to determine the extent to which Chinese supervisors predict the CB, CR, and IN of international students who are from different continents, namely, Africa, America, Asia, and Europe. Therefore, respondents' behavioral patterns concerning their differences in attitude, responsibility, personality, country type, culture, and norms and values seem to be significantly different. The cross-cultural heterogeneity poses two evident complications. First, respondents are from diverse cultures and countries with different self-reference criteria might find it difficult to understand their supervisor completely. Second, this study's aim to determine the impact of Chinese supervisors on the CB, CR, and IN of respondents who are from entirely different cultures and ethnic groups might not accurately represent the object of the study. In the future, this issue might be resolved in several ways. Responses might be collected from Chinese research students in order to determine the external validity of the results to estimate whether there are any significant differences in the relationships between supervisor behavior and students' innovative behavior based on the country of origin. Researchers could control for cultural differences or influences in the statistical analysis. In this connection, the future researchers are recommended to study the direct effect or intervening effect of cultural beliefs and differences of the respondents on students' creativity and innovation potentials.

Finally, the usage of cross-sectional data prevents the result from drawing the causal inference, for example cause-and-effect relationship, on the generalizability of the study (Overall et al. 2011; Meng et al. 2017). The present study used causality-based model (structural equation model), which releases the intensities of this limitation (Chang et al. 2010). However, we urge the future researchers to apply longitudinal research design in place of cross-sectional data for ensuring the causality (Mahmood et al. 2018). Yet we took several attempts to check the response bias, the adoption of self-report measure inflated the results (Meng et al. 2017; Wisker et al. 2003). Therefore, the future research must consider both reports survey measures so as to keep bias issues in check.

Conclusion

The purpose of this study was, first, to determine the magnitudes of the associations among SS, CB, creativity, and innovation pursuit. The empirical research findings offer a fresh insight of supportive supervisor role on the students' innovation potentials through the enhancement of students' citizenship behavior and creativity. The result demonstrated that supportive supervisor significantly explains the citizenship behavior, creativity, and innovation pursuits of the researchers. Furthermore, an individual citizenship behavior is found to stimulate both creativity and innovation potentials among individuals. Second, the mediation analyses highlight that there are indirect effects of CB and CR, either alone or together, indicate that a supportive supervisor aided by CR and CB can drive IN a step further than can the supervisor alone. Henceforth, a supervisor must provide a positive appraisal of the autonomy to take their own decisions, encourage engaging in spontaneous, unplanned and extra-curricular activities, and to stimulate them to be open to engage in idea generation toward the innovative outcome. Eliciting the fullest benefit of the researchers' innovative outcome, the supervisor has to press on a revolutionary mechanism to redesign the activities in the creative process by building some collaborative rapport among the students. In that capacity, creative activities and citizenship behavior are to be taken care of and valued to enhance students' innovative initiatives.

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