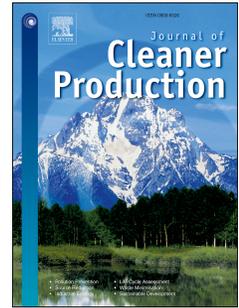


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Unlocking employees' green creativity: The effects of green transformational leadership, green intrinsic, and extrinsic motivation

Li Wenjing, Tahseen Ahmed Bhutto, Wang Xuhui, Qamaruddin Maitlo, Abaid Ullah Zafar, Niaz Bhutto



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Unlocking employees' green creativity: the effects of green transformational leadership, green intrinsic motivation, and green extrinsic motivation

**1<sup>st</sup> Author**

**Li, Wenjing**

She is a director of case study and research center at the School of Business Administration, Dongbei University of Finance and Economics, Dalian, China. She obtained her Ph.D. in the year 2009. Her main research fields are leadership, creativity, and innovation. She helped during the revision process, formal analysis, and in facilitating resources.

**2<sup>nd</sup> Author**

**Tahseen Ahmed Bhutto**

He is currently a Ph.D. student at the School of Business Administration, Dongbei University of Finance and Economics, Dalian, China. His areas of interest are green leadership, green creativity, and sustainable innovation. He conceptualized the main idea and prepared the draft of the paper.

**3<sup>rd</sup> Author**

**Wang, Xuhui**

He is a Full Professor and Professor and Associate Dean in the School of Business Administration, Dongbei University of Finance, and Economics. He did his in Marketing from Dongbei University of Finance and Economics, Dalian, China. Wang Xuhui is the corresponding author and helped in the data collection and methodology section.

**4<sup>th</sup> Author**

**Qamaruddin Maitlo**

He is currently a Ph.D. student at Wuhan University, Wuhan, China. His areas of interest are green leadership, conflict management, and creativity. He helped in preparing the first draft of the paper drawing, visualization, and English editing.

**5<sup>th</sup> Author**

**Abaid Ullah Zafar,**

He is currently a Ph.D. student at the School of Economics and Management, Dalian University of Technology, China. He helped in the revision of the paper and methodology section.

**6<sup>th</sup> Author**

**Dr. Niaz Bhutto**

Dr. Niaz Ahmed Bhutto is Professor and Head of the Business Administration Department at Sukkur Institute of Business Administration, Sindh. He did his Post-Doctorate from Edward J Bloustein School of planning and Public Policy, Rutgers the State University of New Jersey USA in 2013 under Fulbright Scholarship Program. He helped in the revision of the paper and methodology section.

Unlocking employees' green creativity: the effects of green transformational leadership, green intrinsic motivation, and green extrinsic motivation

**Main Author**

**1<sup>st</sup> Author**

**Li, Wenjing**

[carolli2005@163.com](mailto:carolli2005@163.com)

School of Business Administration, Dongbei University of Finance and Economics,  
Dalian, China

**Corresponding Authors (\*)**

**2<sup>nd</sup> Author**

**Tahseen Ahmed Bhutto\***

[Tahseen\\_a\\_bhutto@yahoo.com](mailto:Tahseen_a_bhutto@yahoo.com)

School of Business Administration  
Dongbei University of Finance and Economics, Dalian, China  
Shaheed Benazir Bhutto University, Nawab Shah, Sindh, Pakistan

**3<sup>rd</sup> Author**

**Wang, Xuhui\***

[Xhwang666@126.com](mailto:Xhwang666@126.com)

School of Business Administration, Dongbei University of Finance and Economics,  
Dalian, China

**Co-Authors**

**4<sup>th</sup> Author**

**Qamaruddin Maitlo**

Department of Business Administration, Sukkur IBA University, Sukkur, Sindh, Pakistan  
[qamar.maitlo@iba-suk.edu.pk](mailto:qamar.maitlo@iba-suk.edu.pk)

**5<sup>th</sup> Author**

**Abaid Ullah Zafar,**

[aabibizz@mail.dlut.edu.cn](mailto:aabibizz@mail.dlut.edu.cn),

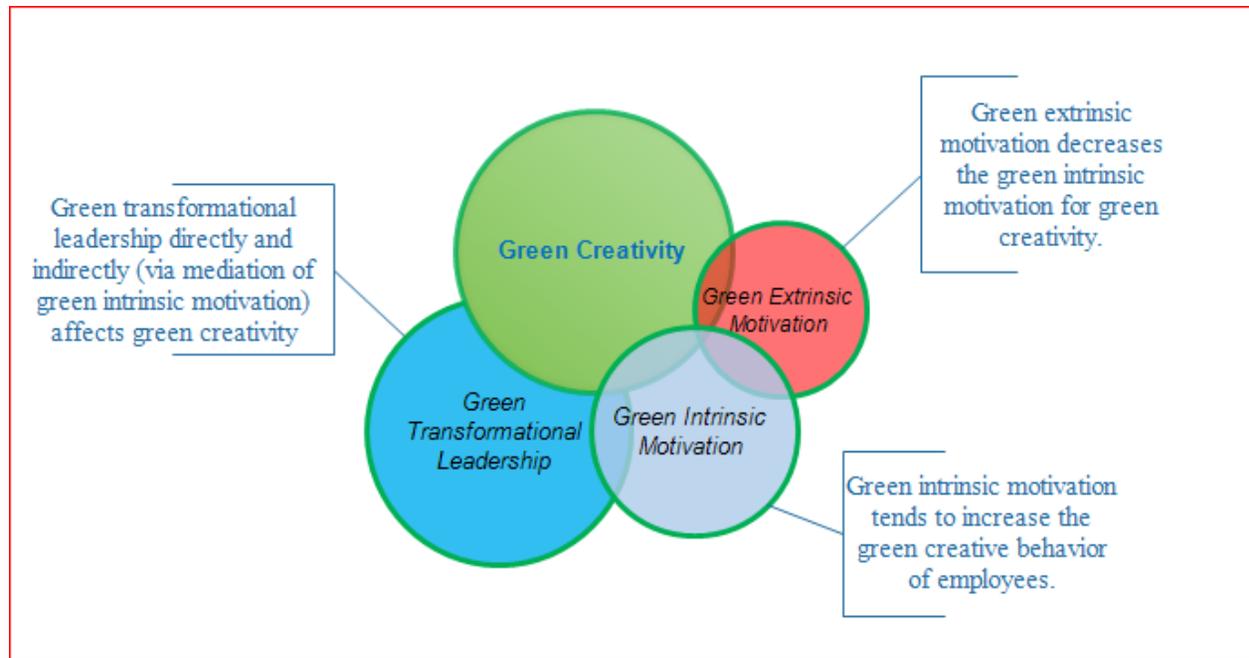
School of Economics and Management, Dalian University of Technology, 116024, China

**6<sup>th</sup> Author**

**Dr. Niaz Bhutto**

[Niaz@iba-suk.edu.pk](mailto:Niaz@iba-suk.edu.pk)

Department of Business Administration, Sukkur IBA University, Sukkur, Sindh, Pakistan





1 by incorporating green creativity into the agenda, companies can gain a green competitive edge  
2 over others in an increasingly innovative environment (Chen, 2008).

3 Green creativity refers to the development of original and useful green ideas about green  
4 products, practices, or services (Chen and Chang, 2013; Eide et al., 2020; Song and Yu, 2017),  
5 and it depends on different organizational and individual antecedents. For instance, Chen and  
6 Chang (2013), revealed that green creative thinking depends on leadership and organizational  
7 attitude towards ecological concerns. In another study, Mittal and Dhar (2016) argued that green  
8 transformational leadership promotes green creative behavior of employees which may help to  
9 reduce paper and water usage and improve the recycling of water for sanitation purposes to  
10 conserve the environment. The above empirical studies endorse the arguments that nurturing  
11 green creative behavior is a function of green leadership and other factors (Jia et al., 2018; Singh  
12 et al., 2020; Tuan, 2019). Although green transformational leadership is a prime organizational  
13 component, individual antecedents such as green intrinsic and extrinsic motivation are crucial  
14 but absent in the extant literature (see Appendix 1).

15 Green intrinsic motivation is the motivation that engages in a green behavior that arises from  
16 within the individual because it is naturally gratifying to you. Drawing on the arguments given  
17 by Deci, (2015) we postulate that green intrinsic motivation is operative when people or  
18 employees perceive their locus of causality to be internal. For instance, love for the environment  
19 and green production tends to drive employees to create products and services that save and  
20 conserve the environment from the damage caused by their actions, policies, or organizations.  
21 Ojo, Raman, and Downe (2019) maintained that greening the information technology (GIT)  
22 would ensure sustainable production, utilization, and disposal of information technology devices

1 for which we argue that employees need green intrinsic motivation. Here, employees with  
2 internal drive and love for nature preserve the environment from the hazards caused by I.T  
3 production, excessive use of carbon-based products, energy usage, and other waste. Thus, this  
4 motivation involves love and passion for preserving and taking care of the environment. For  
5 example, when engineers work on waste batteries recycling innovation that could lead to the  
6 minimization of waste discharged and contamination problems, they require intrinsic drive for  
7 environment-friendly and sustainable innovation. Thus, love and passion for the environment is a  
8 natural phenomenon and an essential ingredient of green intrinsic motivation, and employees  
9 may have more green creative ideas when they have a higher green intrinsic motivation to  
10 innovate green and clean products.

11 The green creative behavior of employees can be extrinsically regulated with green extrinsic  
12 motivation. Green extrinsic motivation refers to doing a pro-environmental act in order to reduce  
13 waste, increase efficiency, and conserve the environment because this behavior may lead to some  
14 separate outcomes such as a reward, approval from others, or the avoidance of punishment.  
15 Green extrinsic motivation can be operative when employees do a pro-environmental activity for  
16 external benefits; for instance, in order to create sustainable design, manufacture, and dispose of  
17 the I.T devices with minimum effect on the environment, scientists may desire to have green  
18 rewards in shape of monetary bonuses, incentives, or a pat on the back. Nevertheless, these  
19 extrinsic stimuluses might reduce self-determining behavior to be innovative, as revealed in the  
20 conventional literature (Deci and Ryan, 2015; Hughes et al., 2018). Therefore, this study aims to  
21 evaluate the impact of green extrinsic motivation on green creativity in the context of the I.T  
22 industry.

1        Thus, this study offers two novel constructs: green intrinsic motivation and green extrinsic  
2 motivation. Further, the authors aim to build a conceptual framework where green  
3 transformational leadership may directly influence the green creativity of employees and  
4 indirectly through the mediation of green intrinsic motivation. Lastly, the authors aim to explore  
5 how green extrinsic motivation may impact the relationship between green intrinsic motivation  
6 and green creativity through moderation. We believe this study makes a novel contribution to the  
7 literature of green creativity.

## 8        **2. Theoretical Foundation and Hypotheses Development**

### 9        *2.1 Componential Theory of Creativity*

10            Creativity refers to novel and useful ideas by people or a small group of people  
11 working together (Amabile, 1988); these ideas can be anything: new products, services,  
12 processes, or practices. According to the componential theory of individual creativity, “all  
13 humans with normal capacities are able to produce at least moderately creative work in some  
14 domain, some of the time — and that the social environment (the work environment) can  
15 influence both the level and the frequency of creative behavior” (Amabile, 1997, p. 42).  
16 Moreover, creativity is the comprehensive model of social and psychological components that  
17 are necessary for a creative response. Three of the four components pertain to the individual  
18 domain: domain-relevant skills, creativity-relevant processes, and intrinsic task motivation. The  
19 fourth component is the social environment in which the individual is working.

20            Creativity increases when employees enhance their knowledge, technical skills, expertise,  
21 and talent in a particular domain (The first component, domain-relevant skills). The second

1 component, creativity-relevant processes, include personality characteristics, risk-taking ability,  
2 cognitive style, and divergent thinking which help to develop creative thinking (Amabile, 2012;  
3 Fürst and Grin, 2018). The third component is intrinsic task motivation, for which approximately  
4 forty percent of scientists believed as the core reason behind their creative behavior (Amabile,  
5 1997). Amabile maintained that intrinsic task motivation is the central tenet of creativity;  
6 employees become more creative when they feel that the task is exciting, engaging, and  
7 challenging (Amabile, 2012). The fourth component is the social environment which represents  
8 the social or work environment; she called it the outside factor including extrinsic motivators that  
9 may foster or undermine the intrinsic motivation and creativity (Amabile, 2012). Various prior  
10 studies have revealed several external factors such as leadership, innovation climate, and  
11 management support that foster the creativity of individuals (Jaiswal and Dhar, 2015; Tung,  
12 2016; Wang et al., 2013).

### 13 *2.2 Green Transformational Leadership and Green Creativity*

14 Transformational leadership is defined as a leadership structure where leaders discern a  
15 desired change and guide employees through inspiration and motivation to achieve a vision  
16 (Avolio et al., 1999). They inspire the team members and promote the awareness of subordinates  
17 through higher ideals such as fairness, justice, and freedom (Woods, 2007). These peculiar  
18 attributes play a crucial role in employees' creativity and converge into four dimensions:  
19 inspirational motivation, intellectual stimulation, charisma, and individualized consideration  
20 (Avolio et al., 1999). Through inspirational motivation, leaders inspire and raise the enthusiasm  
21 of followers to think creatively (Avolio et al., 1999); intellectual stimulation helps employees to  
22 perceive things from different paradigms, gather information, and solve the problems (Khalili,

1 2016). Leaders with charisma and individualized consideration understand employees' unique  
2 needs and motivations; they show them a clear vision to raise their commitment to the  
3 organizational goals (Li et al., 2018).

4 Green transformational leadership refers to "the behaviors of leaders who motivate  
5 followers to achieve environmental goals and inspire them to perform beyond expected levels of  
6 environmental performance" (Chen and Chang, 2013, p. 109). This green leadership motivates  
7 employees to value organizational goals over personal goals and guides employees in all  
8 situations, assists them wherever needed, and instills enthusiasm into employees to generate  
9 novel ideas for the environment (Mittal & Dhar, 2016). Amabile and Pillemer, (2012) argued  
10 that management and leadership which fall in the fourth component of creativity could serve as  
11 the stimulus to creativity; she maintained that when supervisors motivate and encourage the  
12 novel ideas, provide a sense of positive challenge, and articulate innovative vision, consequently,  
13 employees tend to be more creative and innovative. Therefore, GTRFL has the responsibility to  
14 guide and motivate their employees to practice green creativity (Chen & Chang, 2013; Zhou et  
15 al., 2018).

16 Green creativity refers to "the development of new ideas about green products, green  
17 services, green processes, or green practices that are judged to be original, novel, and useful"  
18 (Chen and Chang, 2013, p .109). This leadership, by understanding employees' needs, abilities,  
19 and motivations, guides employees to contribute green ideas for the future. In fact, GTRFL  
20 allows their subordinates to think creatively, examine problems from different angles, and  
21 explore new solutions for environmental issues (Chen & Chang, 2013). Consequently,  
22 employees seek new and fresh approaches to their green tasks and ecological problems. For

1 instance, one study revealed GTRFL tends to increase the green creativity of employees in the  
2 tourism industry in India (Mittal and Dhar, 2016). Another study found that GTRFL promotes  
3 green creativity and green product development performance in the electronics industry in  
4 Taiwan (Chen and Chang, 2013). From the discussion above, we formulate the following  
5 hypothesis:

6 H1: Green transformational leadership positively associates with employees' green creativity.

### 7 *2.3 Green Transformational Leadership and Green Intrinsic Motivation*

8 Intrinsic motivation (IM) is a state in which people are driven by love and passion for  
9 performing the tasks rather than external rewards or benefits (Deci & Ryan, 1985). Amabile et al.  
10 (1994), maintained that people, with their passionate interest, curiosity, and love for their work,  
11 feel exciting, engaging, and satisfying; she further explained that IM is the central element of  
12 creativity which keeps employees attached with their jobs, increases their focus, and as a result,  
13 employees experiment and manifest more creative behavior (Gumusluoglu & Ilsev, 2009). For  
14 instance, people often enjoy gardening, bargaining, playing golf, etc. (Deci & States, 2017).  
15 Because, by doing so, they feel enjoyment, happiness, and intrinsic motivation (Amabile, 1997).  
16 We offer a novel notion by extending the scope of intrinsic motivation to green intrinsic  
17 motivation. We define green intrinsic motivation as “the love, passion or interest for green and  
18 pro-environmental behavior that is driven by internal drive or rewards” (Amabile et al., 1994;  
19 Deci and Ryan, 1985).

20 Green motivation of employees is the main focus of green transformational leaders  
21 through professional development and a shared vision (Chen et al., 2015; Mittal and Dhar, 2016).

1 This idiosyncratic leadership style helps to develop a fair environment which can increase green  
2 intrinsic motivation. For instance, green transformational leadership instills values, beliefs,  
3 capabilities into employees, and in quid pro quo, employees raise their commitment and  
4 motivation resulting in higher green performance and innovation (Chen and Chang, 2013; Zhou  
5 et al., 2018). However, prior studies have only focused on the connection between conventional  
6 constructs of transformational leadership and intrinsic motivation and have revealed a positive  
7 relationship between the two (Chua & Ayoko, 2019; Bilal et al., 2014).

8 The authors in this study explicate that employees under GTRFL will be intrinsically  
9 motivated for green tasks and pro-environmental behavior. GTRFL, through vision, charisma,  
10 and inspirational motivation, provide meaning for environmental tasks (Chen & Chang, 2013).  
11 For instance, encouragement and recognition by leaders increase the interest and eagerness to  
12 focus on their green assignments (Chen & Chang, 2013), and through intellectual stimulation,  
13 leaders raise the curiosity level of the subordinates to explore various dimensions of  
14 environmental issues with more zeal (Mittal and Dhar, 2016). Thus, these leadership factors  
15 enhance employees' love and green interest in projects and environmental issues. Therefore, we  
16 formulate the following hypothesis:

17 H2: Green transformational leadership increases employees' green intrinsic motivation.

#### 18 *2.4 Green Intrinsic Motivation and Green Creativity*

19 People differ in their motivational orientation towards their job (Amabile et al., 1994).  
20 For instance, sometimes, people are strongly intrinsically motivated, and they may find work  
21 assignments interesting. For doing those assignments, they may develop their new skills, and

1 become deeply involved in their jobs. On the contrary, those people who are extrinsically  
2 motivated may look for occupations where extrinsic rewards are salient (Amabile et al., 1994).  
3 The intrinsic motivation (IM) for the creative task increases when an employee finds the task  
4 appealing, positively challenging, enjoyable, and interesting (Amabile & Pillemer, 2012). A  
5 growing body of empirical studies supports the hypothesis that IM is positively associated with  
6 creativity (Hur et al., 2018; Kong et al., 2019; Zhang & Bartol, 2010). However, empirical  
7 studies on green intrinsic motivation are absent. Therefore, we strongly endorse the argument  
8 that GIM is pivotal for green creativity across various contexts and industries.

9 Drawing on the motivation and creativity theories perspective, the authors argue that  
10 employees' green creativity increases when they have higher motivation for green tasks and the  
11 environment. For instance, employees who lack enthusiasm, passion, and interest to perform  
12 green creative assignments, they may not yield expected outcomes (Amabile, 1997; Deci, 2015).  
13 Green intrinsic motivation (GIM) can be operative only when employees are interested in  
14 environmental issues. It can be possible that some employees may have the higher love and  
15 passion for the green environment, and they may enjoy more working on green assignments and  
16 projects. For instance, some people love to do green work, nurture green plants, and create a  
17 green natural environment (Ulrich et al., 1991). Based on the above discussion, we formulate the  
18 following hypothesis:

19 H3: Green intrinsic motivation has a positive relationship with green creativity.

20 Supportive leadership is a nontrivial determinant that enhances green intrinsic motivation  
21 (IM) and creativity at work. Leaders who show care for employees' needs and feelings, help in

1 the development of their skills, confide in them are likely to increase their interest in their job  
2 (Oldham & Cummings, 2017). According to Mittal and Dhar (2016), trust and confidence by  
3 leadership in employees yield motivation and stimulate critical thinking to take risks for the  
4 completion of green tasks at an office setting. The theory of creativity illustrates that in a work  
5 environment where leadership supports employees who feel that tasks are motivating, enjoying,  
6 exciting, and challenging, they become more creative (Amabile, 2012).

7 The authors argue that when employees in environmental, R&D, and marketing  
8 departments want to innovate products, services, or processes considering ecological problems,  
9 they require green motivation and love for the environment. Therefore, using the framework of  
10 the componential theory of creativity, we maintain that leadership has the responsibility to  
11 generate green motivation which promotes green creative thinking in an organization (Amabile  
12 and Pillemer, 2012). For instance, a study done in the I.T industry in China revealed that  
13 leadership influences the intrinsic motivation of employees, which in turn has a positive effect on  
14 creativity (Zhang and Bartol, 2010). Another study found that intrinsic motivation partially  
15 mediates between transformational leadership and employees' creativity (Shin & Zhou, 2003).  
16 Against the background, the authors presume that when firms adopt GTRFL, it enhances  
17 employees' GIM which consequently enhances green creativity.

18 H4: Green intrinsic motivation mediates the relationship between green transformational  
19 leadership and green creativity.

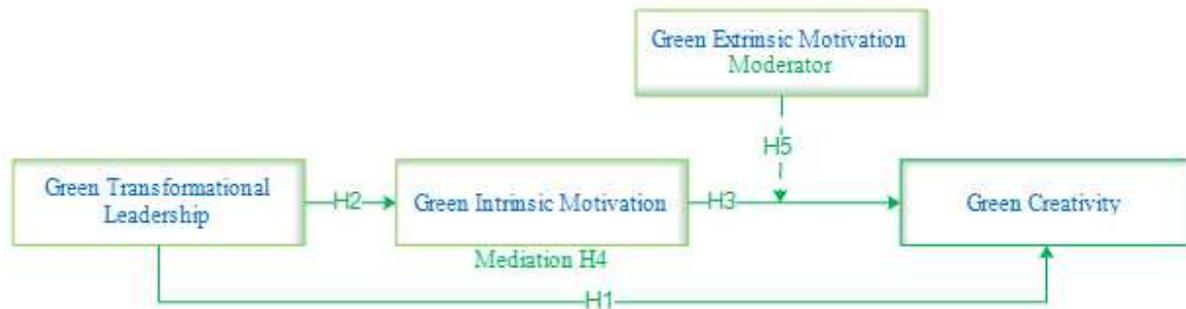
## 20 *2.5 Green Extrinsic Motivation as a Moderator*

1           Extrinsic motivation is operative when employees perform a task to have monetary and  
2 non-monetary benefits in organizational settings. Selart et al. (2008) posited that performance-  
3 contingent rewards lessen the intrinsic interest of people due to its controlling component to  
4 perform a creative activity. In another study, it is uncovered that employees' motivation may  
5 diminish when their innovative work is regulated by extrinsic means (Hammond et al., 2011).  
6 They elaborated that the more a task is controlled or regulated with rewards, the less the intrinsic  
7 motivation becomes to perform that task. Byron and Khazanchi (2012), shared findings in a  
8 meta-analysis that creative behavior of employees tends to diminish slightly when performance-  
9 contingent rewards control employees' motivation.

10           We present a novel notion, 'green extrinsic motivation' and refer to Amabile et al., (1994)  
11 and Deci and Ryan, (2015) to define it as "the green and pro-environmental behavior that is  
12 driven by external rewards such as fame, praise, money, and grades." Individuals who have  
13 higher green intrinsic motivation (GIM) tend to exhibit pro-environmental behavior; they may  
14 feel pride, happiness, and enjoyment in doing environmental tasks. However, extrinsic rewards  
15 against the pro-environmental activities may decrease that the GIM of employees. For instance,  
16 in the componential theory of creativity, Amabile, (1997) maintained that many of the external  
17 factors such as tangible rewards, deadlines, punishments, or negative feedback, decrease  
18 motivation to be creative. A recent review study also revealed that extrinsic motivation tends to  
19 diminish self-determination and motivation for creative behavior due to the excessive controlling  
20 factor (Hughes et al., 2018). Therefore, based on the discussion mentioned above, we  
21 hypothesize:

22

1 H5: Green extrinsic motivation moderates the effect of green intrinsic motivation on employee  
 2 green creativity such that the relationship diminishes when green extrinsic motivation is high  
 3 rather than low.



4  
 5 *Figure 1 Conceptual model*

### 7 3. Research Method

#### 8 3.1 Sampling and Data Collection

9 In this investigation, the authors collected data from the I.T. industry located in the  
 10 Technology Zone, Dalian Software Park, and Dalian Hi-Tech Zone in Dalian, China. The first  
 11 reason to collect data from the I.T. industry is that the short lifespan of I.T devices, disposal  
 12 activities, and the carbon footprint of I.T devices have led to concerns and worries regarding  
 13 environmental pollution and hazards to public health (Perkins et al., 2014). Second, the  
 14 increasing reliance and usage of I.T devices in China have raised the need for sustainable  
 15 production and consumption (Ojo et al., 2019). Third, technology can significantly help to  
 16 control pollution and waste through green production and green services. Last, its fastest growth  
 17 and development have also contributed immensely to environmental problems. Therefore, the  
 18 government and environmental agencies have urged technology-based firms to be

1 environmentally friendly and design green products and services. Thus, it is essential to  
2 investigate green creativity, motivation, and leadership in such a context.

3         The authors developed the questionnaire in English. However, for collecting data from  
4 Chinese respondents, questionnaires were translated into the Chinese language using the back-  
5 translation technique. For ensuring the conversion quality, services of two bilingual experts were  
6 availed (Brislin, 1970). The sample of our investigation is comprised of R&D, marketing and  
7 environmental department heads, leaders, and employees who involve actively in creative and  
8 innovative work. To highlight the significance of the study, the authors explained the purpose of  
9 the research and the questionnaire contents to management, and after approval, they initiated the  
10 process of data collection which lasted two months.

### 11 *3.2 The Measurement of the Constructs*

12         The authors used a five-point Likert scale for all four constructs ranging from one to five.  
13 1 indicated strong disagreement, and 5 showed strong agreement. Further details of the  
14 constructs are given below.

#### 16 *3.2.1 Green Creativity*

17         The six measures of green creativity proposed by Chen and Chang, (2013) were adopted  
18 which were carefully altered after the pretest. All the items indicate green creative behavior of  
19 employees rated by their colleagues. This scale in the past is validated and widely used to  
20 measure GCRT ( $\alpha = 0.892$ ). The items include, “(1) He/she suggests new ways to achieve  
21 environmental goals; (2) He/she proposes new green ideas to improve environmental

1 performance; (3) He/she promotes and champions new green ideas to others; (4) He/she develops  
2 adequate plans for the implementation of new green ideas; (5) He/she would rethink new green  
3 ideas; (6) He/she would find out creative solutions to environmental problems.”

#### 4 *3.2.2 Green Transformational Leadership*

5 The paper adopted the six-item scale of green transformational leadership (GTRFL)  
6 developed by Chen and Chang (2013). The scale of GTRFL is widely used and validated in past  
7 studies ( $\alpha = 0.869$ ). The items are “(1) The leader provides a clear environmental vision for the  
8 employees to follow; (2) The leader inspires employees with the environmental plans; (3) The  
9 leader gets the employees to work together for the same environmental goals; (4) The leader  
10 encourages employees to achieve the environmental goals; (5) The leader acts by considering  
11 environmental beliefs of the employees; (6) The leader stimulates employees to think about  
12 green ideas.”

#### 13 *3.2.3 Green Intrinsic Motivation*

14 We have proposed a novel and original idea, green intrinsic motivation, and refer to  
15 Amabile et al., (1994) and Deci, (1972) and posit that a human is intrinsically motivated if he/she  
16 performs a task, not for extrinsic rewards but the activity itself and intrinsic drive. Already  
17 established and validated items are adopted from Amabile et al., (1994) and modified in the  
18 green intrinsic motivation context: “(1) He/she enjoys coming up with new green ideas; (2)  
19 He/she enjoys trying to solve environmental tasks on job; (3) He/she enjoys tackling with  
20 environmental tasks that are completely new; (4) He/she enjoys improving existing green ideas  
21 at his/her job; (5) He/she feels excited when he/she has new green ideas; (6) He/she feels like

1 becoming further engaged in the development of green ideas.” The reliability value for green  
2 intrinsic motivation construct is 0.865.

### 3 3.2.4 Green Extrinsic Motivation

4

5 A person is extrinsically motivated when he/she performs a task because it may lead to  
6 external rewards (e.g., approval, recognition, status, passing grades) (Amabile et al., 1994; Deci,  
7 1972; Deci & Ryan, 2015). Green extrinsic motivation (GEM) is an original notion proposed  
8 only in this study. The items are adopted from Amabile et al., (1994) and modified into the  
9 context of green extrinsic motivation: “(1) I am strongly motivated by the recognition I can earn  
10 from my organization for environmental tasks; (2) I often think about rewards, salary, or  
11 promotion for my environmental tasks; (3) I want other people to find out how good I really can  
12 be at my environmental tasks; (4) I have to feel that I am earning something for my  
13 environmental tasks; (5) I’m concerned about how other people are going to react to my  
14 environmental ideas.” The Cronbach’s alpha value for GEM is 0.749.

15 To avoid common method variance (CMV), the authors approached employees (A) to fill  
16 in the questionnaire regarding GTRFL and GEM (Questionnaire A). Then other employees (B)  
17 responded about the GCRT and GIM (Questionnaire B) of their colleagues who first filled in the  
18 survey of GTRFL and GEM, so that data could be appropriately corroborated and merged for  
19 analysis. Socially desirable responding (SDR) refers to the tendency of respondents to fill in the  
20 survey in a way that respondents may compromise the validity of the questionnaire (Nederhof,  
21 1985). Besides assuring the academic purpose of the study, the authors also promised secrecy to  
22 employees regarding their data. Moreover, respondents were requested to fill in the survey

1 honestly, as it reduces the chances of SDR presence in the study (Phillips and Clancy, 1972).  
2 Eight hundred respondents from the selected companies supplied the survey (400 for GTRFL  
3 and GEM and 400 for GIM and GCRT). 400 employees who filled up the survey (Questionnaire  
4 A) covered 88 leaders. However, out of 400 questionnaires (combined) only 298 (74.5%) valid  
5 questionnaires were found to be used for the purpose of analysis.

6 The authors employed a structural equation modeling technique (variance-based) to  
7 analyze the hypotheses using SmartPLS version 3.2.8 (Hair et al., 2014). SmartPLS software  
8 assesses the reliability and validity of the items of theoretical constructs (measurement model)  
9 and estimates the relationship among latent constructs (structural model) at the same time (Hair  
10 et al., 2013). Due to following reasons, SmartPLS software was employed: (1) it is better at  
11 predicting endogenous constructs (Albort-Morant et al., 2016); (2) this software can handle small  
12 size sample (Hair et al., 2014); (3) it has ability to measure reflective items with complex models  
13 and relationships and (4) it provides a better predictive relevance (Yong et al., 2019).

### 14 *3.3 Control Variables*

15 Demographic variables such as educational level (1 = diploma, 2 = undergraduate, 3 =  
16 postgraduates, and 4 = doctorate), gender, age (1 = up to 25 years, 2 = 26 to 35 years, 3 = 36 to  
17 45 years, 4 = 46 years or above) and experience (in years) are employed as control variables in  
18 our study. Amabile (1997), in creativity theory, maintained that skills, expertise, and educational  
19 level impact creative thinking of employees in an organization. Moreover, following a study, we  
20 also controlled for company tenure (in years) in testing the hypotheses (Gong et al., 2009).

21

1

2

3 **4. Results**4 *4.1 Measurement Model*

5 Correlation Table 1 indicates the relationship among the four variables: green creativity  
 6 (GCRT), green transformational leadership (GTRFL), green intrinsic motivation (GIM), and  
 7 green extrinsic motivation (GEM). All exogenous constructs show reflective nature and  
 8 significantly correlate to each other. The authors also conducted a confirmatory factor analysis  
 9 using SPSS software. Every construct has a percentage of explained variance above 50% which  
 10 should range from 40 to 70% forming one factor (Chen & Chang, 2013), as shown in Table 2.

11 **Table 1**

12 Means, standard deviations, and correlations of the constructs

|                  | Mean  | Std. Deviation | 1     | 2     | 3      | 4       | 5      | 6      | 7      | 8 |
|------------------|-------|----------------|-------|-------|--------|---------|--------|--------|--------|---|
| 1 Sex            | 1.53  | 0.539          | 1     |       |        |         |        |        |        |   |
| 2 Age            | 2.40  | 0.543          | -.065 | 1     |        |         |        |        |        |   |
| 3 Experience     | 3.17  | 2.318          | -.063 | .053  | 1      |         |        |        |        |   |
| 4 Company tenure | 7.406 | 3.867          | -.005 | -.112 | -.096  | 1       |        |        |        |   |
| 5 GCRT           | 3.121 | 0.994          | .003  | .127* | .103   | -.168** | 1      |        |        |   |
| 6 GTRFL          | 2.982 | 0.979          | -.027 | .034  | .187** | -.105   | .579** | 1      |        |   |
| 7 GIM            | 3.096 | 0.918          | -.028 | .025  | .097   | -.034   | .479** | .333** | 1      |   |
| 8 GEM            | 3.249 | 0.795          | .048  | .006  | .034   | -.079   | .387** | .264** | .186** | 1 |

13 N = 298 \*  $p < 0.05$  \*\*  $p < 0.01$ ; Std. Dev = Standard deviation, GCRT = Green creativity, GTRFL = Green  
 14 transformational leadership, GIM = Green intrinsic motivation, GEM = Green extrinsic motivation Note: Data  
 15 regarding gender, educational level and experience pertain to employees whose green creative behavior is under  
 16 study.

17 **Table 2**

18 Factor analysis of the constructs

| Constructs                        | Number of items | Number of factors | Accumulated percentage of explained variance |
|-----------------------------------|-----------------|-------------------|--|
| Green Creativity                  | 6               | 1                 | 65.270                                       |
| Green Transformational Leadership | 6               | 1                 | 60.403                                       |
| Green Intrinsic Motivation        | 6               | 1                 | 60.478                                       |
| Green Extrinsic Motivation        | 5               | 1                 | 50.894                                       |

19

1           Moreover, the measurement model is evaluated using factor loading, reliability, and  
 2   validity. Hair et al., (2013) prescribed that reliability (Cronbach alpha) value should be above 0.7,  
 3   and the average variance extracted (AVE) which measures convergent validity should be above  
 4   0.5. Our results indicate that all constructs have higher reliability and convergent validity  
 5   (GTRFL  $\alpha = 0.869$ , AVE = 0.604), (GCRT  $\alpha = 0.892$ , AVE = 0.652), (GIM  $\alpha = 0.865$ , AVE =  
 6   0.597), and (GEM  $\alpha = 0.749$ , AVE = 0.502) as shown in Table 3. Furthermore, for discriminant  
 7   validity, rule of thumb is that Heterotrait–Monotrait (HTMT) values should be below 0.95 (Hair  
 8   et al., 2014). In our study, all constructs (GTRFL, GCRT, GIM, and GEM) have HTMT values  
 9   below 0.655. Therefore, based on the above values, reliability, discriminant validity, and  
 10   convergent validity are established.

11

12 **Table 3**

13 Constructs with items showing reliability, factor loading, and convergent validity values

| Items  | Constructs                                | $\alpha$ /CR | AVE   | Factor loading |
|--------|---|--------------|-------|----------------|
| GCRT   | Green creativity (GCRT)                   | 0.892/0.918  | 0.652 |                |
| GCRT1  |   |              |       | 0.728          |
| GCRT2  |   |              |       | 0.859          |
| GCRT3  |   |              |       | 0.844          |
| GCRT4  |   |              |       | 0.802          |
| GCRT5  |   |              |       | 0.761          |
| GCRT6  |   |              |       | 0.841          |
| GTRFL  | Green transformational leadership (GTRFL) | 0.869/0.902  | 0.604 |                |
| GTRFL1 |   |              |       | 0.715          |
| GTRFL2 |   |              |       | 0.768          |
| GTRFL3 |   |              |       | 0.794          |
| GTRFL4 |   |              |       | 0.788          |
| GTRFL5 |   |              |       | 0.793          |
| GTRFL6 |   |              |       | 0.802          |
| GIM    | Green intrinsic motivation (GIM)          | 0.865/0.898  | 0.597 |                |
| GIM1   |   |              |       | 0.639          |
| GIM2   |   |              |       | 0.780          |
| GIM3   |   |              |       | 0.825          |
| GIM4   |   |              |       | 0.825          |
| GIM5   |   |              |       | 0.792          |
| GIM6   |   |              |       | 0.762          |
| GEM    | Green extrinsic motivation (GEM)          | 0.749/0.834  | 0.502 |                |
| GEM1   |   |              |       | 0.610          |
| GEM2   |   |              |       | 0.767          |
| GEM3   |   |              |       | 0.812          |
| GEM4   |   |              |       | 0.758          |
| GEM5   |   |              |       | 0.562          |

1  $\alpha$  = Cronbach's alpha, CR = Composite reliability, AVE = Average variance extracted

2

### 3 *4.2 Structural Model*

4 The study used bootstrapping (5000 resamples) to generate t- and significance values of  
5 the path coefficients. As shown in Table 4, our all hypotheses are supported. Model 1 indicates  
6 that GTRFL has substantial direct impact on GCRT ( $\beta = 0.579$ ,  $p < 0.000$ ,  $t\text{-value} = 9.501$ ).  
7 However, model 2 shows after entering mediator (GIM), the effect of GTRFL on GCRT  
8 diminishes ( $\beta = 0.465$ ,  $p < 0.000$ ,  $t\text{-value} = 6.637$ ) and green intrinsic motivation has moderate  
9 impact on green creativity ( $\beta = 0.337$ ,  $p < 0.000$ ,  $t\text{-value} = 4.950$ ). Table 4, model 3 indicates  
10 when moderator (GEM) is entered into the model, the effect of GTRFL on green creativity  
11 further decreases ( $\beta = 0.395$ ,  $p < 0.000$ ) and green intrinsic motivation (GIM) effect on green  
12 creativity also diminishes ( $\beta = 0.307$ ,  $p < 0.000$ ).

### 13 *4.3 Mediation and Moderation Analysis*

14

15 A mediator is the third variable that affects the relationship between two related  
16 constructs (Hair, Hult, Ringle, & Sarstedt, 2017, p. 52). In our study, the authors propose that  
17 green intrinsic motivation (GIM) mediates the relationship between GTRFL and GCRT. Table 4  
18 indicates that the relationship between GTRFL and GCRT is significant, complying with the first  
19 requirement of mediation (Hair et al., 2014). Then indirect effect of GTRFL ( $\beta = 0.105$ ,  $p <$   
20  $0.000$ ) is also significant (second step). The last step of the mediation process is checking VAF  
21 which can be calculated by the indirect effect divided by total effect (Hair et al., 2017). In our  
22 study, VAF is 21% showing partial mediation of GIM between the constructs GTRFL and  
23 GCRT (Hair et al., 2013).

24

1 Moderator GEM negatively impacts the relationship between GIM and GCRT ( $\beta = -$   
 2 0.136,  $p < 0.064$ ,  $t\text{-value} = 1.851$ ). After evaluating the interaction effect (see Figure 2), the  
 3 findings revealed that high GEM leads to a lower level of GCRT when GIM is high. Further, it is  
 4 inferred that when the GEM of employees is low, higher GIM leads to higher green creativity of  
 5 employees working in the I.T industry. Therefore, leadership in the I.T industry should be careful  
 6 because micromanagement and external means to generate motivation can dampen the creative  
 7 behavior of employees.

8  $R^2$  value (0.493) of green creativity in (final) model 3 shows 49% variance being  
 9 explained by all other exogenous constructs which is encouraged in management science studies  
 10 (Hair et al., 2014; Li et al., 2018).  $F^2$  values for all constructs are above 0 in the study showing  
 11 the effect size of exogenous constructs ( $GTRFL = 0.258$ ,  $GIM = 0.164$ ) on endogenous  
 12 construct green creativity (Hair et al., 2014).

13 **Table 4**  
 14 Structural model results

|                                   | Relationship                                    | Path Value | P Value | T Value | $R^2$ Value | $F^2$ Value |
|-----------------------------------|---|------------|---------|---------|-------------|-------------|
| Model # 1 without mediation       | GTRFL→GCRT                                      | 0.579      | 0.000   | 9.501   | 0.336       | 0.505       |
| Model # 2 (with mediation of GIM) | GTRFL→GIM                                       | 0.336      | 0.000   | 5.100   | 0.112       | 0.128       |
|                                   | GTRFL→ GCRT (Direct effect)                     | 0.465      | 0.000   | 6.637   | 0.435       | 0.339       |
|                                   | GTRFL→ GCRT (Indirect effect)                   | 0.113      | 0.000   | 3.657   |             |             |
|                                   | GIM→GCRT  | 0.337      | 0.000   | 4.950   |             | 0.179       |
| Model # 3 with moderation of GEM  | GTRFL→GCRT (H1)                                 | 0.395      | 0.000   | 5.804   | 0.493       | 0.258       |
|                                   | GTRFL→GIM (H2)                                  | 0.336      | 0.000   | 5.101   | 0.113       | 0.128       |
|                                   | GIM→ GCRT (H3)                                  | 0.307      | 0.000   | 4.913   |             | 0.164       |
|                                   | GTRFL→GCRT (H4) (Indirect effect)               | 0.105      | 0.000   | 3.601   |             |             |
|                                   | Moderation of GEM on GIM-GCRT relationship (H5) | -0.136     | 0.064   | 1.851   |             | 0.037       |

15 GCRT = Green creativity, GTRFL = Green transformational leadership, GIM = Green intrinsic motivation, GEM =  
 16 Green extrinsic motivation

17

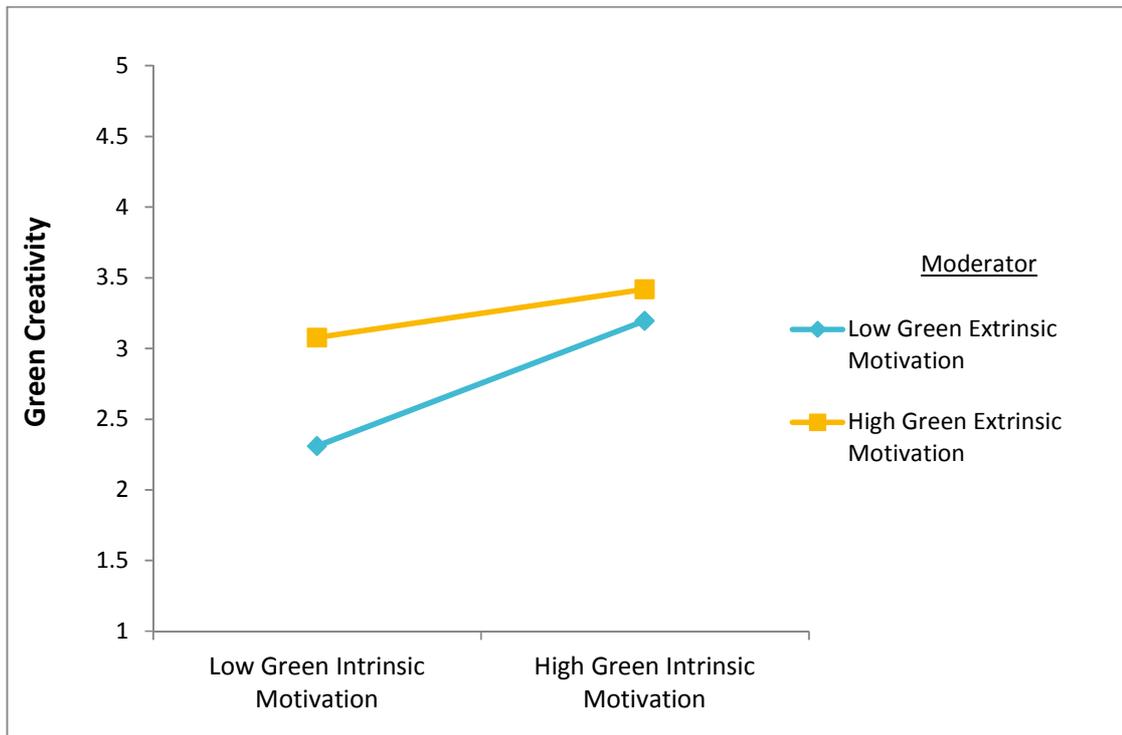


Figure II Moderating effect of green extrinsic motivation on the relationship between green intrinsic motivation and green creativity

## 5. Discussion

This study is the first to introduce the concept of green intrinsic motivation (GIM) and green extrinsic motivation (GEM). Moreover, it intended to evaluate the role of green intrinsic motivation between green transformational leadership and green creativity in the I.T industry. This study also aimed to explore the moderating impact of green extrinsic motivation on the relationship between green intrinsic motivation and green creativity. These findings are valuable because previous research has ignored the role of GIM in employees' green creative behavior.

1       The findings provide evidence that green creative behavior of subordinates is related to green  
2 transformational leadership in the I.T industry which means that high-quality leadership may  
3 provide inspiration, vision, and motivation to employees for green creativity to emerge as  
4 reported in a few recent studies in Taiwan and India (Chen and Chang, 2013; Mittal and Dhar,  
5 2016). Moreover, our study provides empirical support to prior findings revealed in the  
6 conventional settings that leaders, in collectivist cultures like China, are able to provide support,  
7 attention, and suggestions for green creativity when employees seek from their leaders  
8 (Gumusluoglu and Ilsev, 2009; Qu et al., 2015). Another alternative meaning of this finding can  
9 be established that followers through a personalized relationship with the leaders, who share the  
10 green and pro-environmental objectives, demonstrate obedience and deference. Because this  
11 leadership not only exercises authority but also understands employees' needs, such as training  
12 to coach employees which as a result extracts green creative performance in a collective setting  
13 (Jia et al., 2018).

14       Although this study cannot establish causality, the positive relationship between green  
15 transformational leadership and green intrinsic motivation suggests that green transformational  
16 leadership is critically essential for green intrinsic motivation. This finding is in line with the  
17 componential and investment theories of creativity on the crucial role of leadership and social  
18 factors impacting task motivation (Amabile, 2012; Sternberg and Todd I. Lubart, 1991) as well  
19 as prior established literature in a conventional setting (Chua and Ayoko, 2019; Woods, 2007). It  
20 implies that supervisors who were high in green transformational leadership articulated strong  
21 pro-environmental values, green and efficient production vision and goals, and enhanced

1 motivation level of employees; as a result, subordinates internalized those values, goals, and  
2 objectives which increased their green intrinsic motivation for green creative outcomes.

3 Results revealed that GIM has a positive and substantial impact on GCRT; the findings are  
4 consistent with investment and componential theories of creativity literature (Amabile, 1997;  
5 Deci and Ryan, 2015; Sternberg and Todd I. Lubart, 1991) which suggests that employees must  
6 have the motivation to use skills, knowledge, and intellectual ability in order to perform  
7 creatively. The green intrinsic motivation reflects employees' underlying values, passion, and  
8 interest, which may lead employees to experience green creativity to conserve the environment  
9 from resource depletion, equipment contamination, and wastage. The authors infer that  
10 employees may experience higher green creativity when they have higher green intrinsic  
11 motivation due to love, interest, and enjoyment in tasks. Thus, employees may view green  
12 creativity as an expression of their true selves due to the feeling of engagement and interest  
13 which may be crucial when the tasks are pro-environmental and green in nature. Therefore, the  
14 study establishes that green intrinsic motivation is critically essential in a pro-environmental and  
15 cleaner production context.

16 This study offers another pivotal contribution that extends conventional findings (Shin and  
17 Zhou, 2003), and theoretical literature on creativity and self-determination (Amabile, 1988; Deci  
18 and Ryan, 2015) by examining the green intrinsic motivation as a mediator between green  
19 transformational leadership and green creativity. The study shows reliability with conventional  
20 literature and qualitative studies on creativity which supports the notion that green intrinsic  
21 motivation is the mechanism by which other contextual factors such as green transformational  
22 leadership influence the green creativity of employees (Amabile, 2012; Zhou, 1998). One

1 potential explanation of partial mediation is that when employees are high in green intrinsic  
2 motivation, the influence of green transformational leadership becomes multiplied on green  
3 creative outcomes of employees. Hence, the contribution of this study becomes important by  
4 including leadership (social or work environment component) and green intrinsic motivation  
5 (task motivation component) in a sustainable and cleaner production context which is absent in  
6 the previous research.

7 The moderating impact of green extrinsic motivation, on the other hand, is significant;  
8 however, the effect is smaller and negative on the relationship between green intrinsic motivation  
9 and green creativity which is consistent with the literature of the investment theory of creativity  
10 (Sternberg and Todd I. Lubart, 1991). This finding is another essential contribution to the  
11 literature of creativity which revealed that extrinsic rewards diminish the impact of intrinsic  
12 motivation on employees' creativity (Amabile et al., 1994; Deci and Ryan, 1985). The reason  
13 might be that rewards given against green creativity might reduce interest, enjoyment, and  
14 passion for thinking with autonomy for environmental tasks; employees may feel their creative  
15 behavior is controlled by external rewards which lessen their green intrinsic motivation that is  
16 also discussed in the meta-analysis and theory of self-determination (Deci, 2015; Eisenberger,  
17 2003; Hughes et al., 2018). We argue that extrinsic factors such as monetary rewards, money, the  
18 threat of punishment, competition against each other, and negative feedback might reduce the  
19 green intrinsic motivation of employees for green creative performance which indicates  
20 conformity with the literature on creativity theory (Amabile, 2012). Therefore, to draw a more  
21 precise conclusion, care must be taken while rewarding the employees against green creative

1 performance which is aimed to reduce environmental hazards, and contamination caused by  
2 industry and production.

### 3 *5.1. Practical and Policy Implications*

4 We noticed that there is growing attention given to greening the management in green  
5 and cleaner production context in China due to increasing electronic waste and pollution. Our  
6 findings endorse the applicability of green leadership and motivational perspectives and suggest  
7 that green transformational leaders, together with employees' green intrinsic motivation, predict  
8 green creativity which will foster environment-friendly innovation in the I.T industry. Thus, an  
9 organization and its management should instill green motivation into employees and promote  
10 green management philosophy at an organizational level so that production should be  
11 transformed from conventional production to efficient, sustainable, and cleaner production.  
12 Companies, specifically I.T-based firms, should be cautious and careful about extrinsic rewards,  
13 controls, and other means which may slightly reduce employees' green intrinsic motivation to  
14 innovate green and clean products and services. Moreover, we suggest that specific measures  
15 should be taken to craft green policies that should be implemented to foster the development of  
16 green information technology in order to mitigate products' and organizations' negative impacts  
17 on the environment (Ojo et al., 2019).

18

### 19 *5.2. Theoretical Implications*

20 This study offers various theoretical contributions. It explains how GTRFL influences GCRT  
21 directly and indirectly through the partial mediation of GIM in the context of the I.T. industry. In

1 addition, the current study contributes to the creativity literature by examining the GIM and  
2 GCRT relationship. By doing so, the research advances our understanding of green motivation in  
3 a cleaner production context. This study also analyzed the moderating impact of GEM on the  
4 relationship between GIM and GCRT.

5 The findings of the study reveal that developing GTRFL enhances GCRT of employees in  
6 I.T. firms. Second, it also confirms the indirect effect of GTRFL for promoting GCRT through  
7 partial mediation of GIM. Another significant contribution of the study is that green intrinsic  
8 motivation has a substantial impact on the green creative performance of employees in a cleaner  
9 production context. As anticipated theoretically, our findings confirmed that green extrinsic  
10 motivation dampens the link between GIM and GCRT; the results not only support previous  
11 theoretical and experimental studies (Amabile, 1988; Deci and Ryan, 2015) but also indicate  
12 caution for leadership to using external controls to promote green creative performance; thus,  
13 future scholars interested in green motivation should consider these differential results. Lastly,  
14 our findings support prior studies undertaken on green leadership and creativity in the electronics  
15 and tourism industry (Chen and Chang, 2013; Mittal and Dhar, 2016) as well as the applicability  
16 of creativity and innovation theory in the cleaner production context (Amabile, 1988).

### 17 5.3. Limitations and Future Research

18 The study has various limitations which need to be considered when interpreting the findings.  
19 First, the research is a survey-based cross-sectional study; thus, its design is a limitation, and it  
20 may not provide a causal association between constructs. A longitudinal or experimental design  
21 may offer a better and in-depth understanding of the relationships. Second, this study is

1 conducted in the I.T. industry located in Dalian, China. Future studies may validate and test the  
2 findings of green creativity and motivation in other industries, especially the automotive industry  
3 which is going through green-radical innovation due to the electrification of four-wheelers in  
4 China. Moreover, the measures of green intrinsic motivation and green extrinsic motivation  
5 might be useful in industries where green-radical innovation is higher. Third, while conducting  
6 the study, the cultural factors were ignored for examining the relationship between green  
7 leadership structure and green creativity due to limited time and resources; however, future  
8 research in western (individualistic) cultures may provide new insights and findings. Therefore,  
9 caution should be taken while generalizing our findings in other contexts and cultures. Finally,  
10 our study only investigated the green transformational leadership style; however, the green  
11 transactional leadership style may have an impact on the green creativity of employees which  
12 needs to be considered for future research.

## 13 **6. Conclusion**

14 Business sustainability and growth can no longer be achieved through mass production  
15 and stable financial status. Going green is the right and only choice for companies under the  
16 Kyoto protocol, Paris agreement, and other environmental accords. Therefore, companies must  
17 innovate green and environment-friendly products and services. Accordingly, this study proposes  
18 that green transformational leadership directly enhances green creativity and indirectly via partial  
19 mediation of green intrinsic motivation. Further, this study reveals that green extrinsic  
20 motivation lessens employees' green intrinsic motivation for their creative behavior. Thus, firms,  
21 management, and leadership should counsel and motivate their employees to develop  
22 environmental performance through green and cleaner production.

1  
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3

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Journal Pre-proof

## Highlights

- This study offered two novel constructs: Green intrinsic motivation and green extrinsic motivation.
- Green transformational leadership and green intrinsic motivation are essential for achieving green creativity in the technology industry.
- Componential theory of creativity is used as a theoretical foundation.
- Green intrinsic motivation partially mediates between green transformational leadership and green creativity.
- Green extrinsic motivation slightly reduces green intrinsic motivation for green creative behavior.

**Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Author Wenjing Li declares that she has no conflict of interest.

Author Tahseen Ahmed Bhutto declares that he has no conflict of interest.

Author Wang Xu Hui declares that he has no conflict of interest.

Author Qamaruddin Maitlo declares that he has no conflict of interest.

Author Abaid Ullah Zafar declares that he has no conflict of interest.

Author Niaz Ahmed Bhutto declares that he has no conflict of interest.