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INTRINSIC MOTIVATION AND CREATIVITY: THE ROLE OF DIGITAL TECHNOLOGY AND KNOWLEDGE INTEGRATION ABILITY IN FACILITATING CREATIVITY

[1]Ahmad Adeel, [2]Samreen Batool & [3]Zain-ul-Abdeen Madni
[1]Department of Business Education
The University of Chenab, Gujrat, Punjab, Pakistan
[2&3]School of Management, Universiti Sains Malaysia

[1]Corresponding author: adeelleads@yahoo.com

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ABSTRACT

Creativity is a psychological phenomenon mainly affected by the motivation of employees. Nonetheless conflicting results can be found in the literature for the link between intrinsic motivation-creativity relationship. The purpose of this research is to reinvestigate this inconsistent relationship. We took a technological perspective to determine whether technology had an answer to this question. We conducted a laboratory experiment with 119 newly hired bankers of the same batch in four different training sessions to generate creative ideas to solve business problems. Here, intrinsic motivation and digital-technology-use were both manipulated, independently. For field study, data was collected from 467 employees and their respective 41 supervisors working at a software house in Pakistan. Using lab and field data in two studies, we analysed data with Mplus for random coefficient models. We also performed a satorra-bentler-difference test, using the log-likelihood method with scaling correction factor. Drawing on the motivation-opportunity-ability framework for intrinsic motivation-creativity relationship, we found that knowledge integration ability enhances the potential of employees to generate creative ideas. Based on a lab experiment and a field study, we found that creativity is contingent upon the technological opportunity provided to employees directly and indirectly by affecting their ability to integrate knowledge. Our research suggests that providing employees with relevant technological tools and ensuring utilisation of these technologies will fuel higher levels of employee creativity. Technological initiatives will help struggling economies to boost their creative potential. This research has made a significant contribution by bringing together creativity and digital technology literature.

Keywords: Motivation, creativity, technology, knowledge integration, communication technology.

INTRODUCTION

Creativity, the generation of novel and useful ideas (Amabile, 1988) by employees, has now become a basis of distinctive competitive advantage (George, 2007). These creative ideas spark in human minds (Ford, 1996) are fuelled largely by individuals' psychological states (Zhou, 2003). Understanding the linkage of intrinsic motivation as a psychological state for creative idea generation has remained a prime focus of creativity researchers (Elsbach & Hargadon, 2006). Intrinsic motivation of individuals develop their interest in activities, enhances their learning ability, and fuel their curiosity for higher creativity levels (Ryan & Deci, 2000; Zhou & Hoever, 2014).

Similarly, some researchers advocated finding a weak (Eisenberger & Aselage, 2009; Ma et al., 2021; Wu et al., 2021) or even insignificant association between intrinsic motivation and employee creativity

(George, 2007). Some researchers even advocated mixed results with causality issue between research variables; for example, due to high enjoyment and satisfaction with a task, employee output is characterised as creative (Amabile & Mueller, 2007; Lee et al., 2020). The majority of these research findings indicated that ideas are characterized as more creative when individuals also report high levels of intrinsic motivation (George, 2007; Wu et al., 2021). However, some researchers failed to find such results in laboratory experiments (Eisenberger & Aselage, 2009; Ma et al., 2021; Wu et al., 2021). These conflicting findings has called for a more in-depth investigation (George, 2007) using different theoretical perspectives to better understand the motivational process that fuel creativity (Shalley et al., 2004). Curiously, until now, there has been scant research to resolve these inconsistencies in creativity literature (Grant & Berry, 2011). In the same vein, contextual, individual, and psychological processes have been identified as moderators in the intrinsic motivation-creativity relationship (Ma et al., 2021). However, the technological perspective has been unable to garner researchers' interests in exploring intrinsic motivation-creativity relationship (Choi & Behm-Morawitz, 2020).

Based on the motivation-opportunity-ability framework and using the dimensions identified by Blumberg and Pringle (1982) in this study, digital technology is taken as opportunity and knowledge integration as the ability to affect intrinsic motivation-creativity relationship. When employees integrate knowledge, they are more likely to be creative (Axelson & Richtnér, 2017). Although learning, exploring, and curiosity will lead to creativity, digital-technology-use at work will enhance creative idea generation through individuals' ability to integrate knowledge. Digital-technology-use affects the knowledge integration of individuals that channel intrinsic motivation to drive higher levels of creativity. Specifically, in line with classic motivation-opportunity-ability theories, it is argued that none of the dimensions in theory can ensure high levels of creativity in isolation and that low values on any of the dimensions will lead to lower levels in outcome, i.e., creativity.

The major focus of this research is to integrate the digital technology perspective into the motivation-opportunity-ability framework (Blumberg & Pringle, 1982). By introducing a technological view to creativity literature, this research will contribute to the literature. Firstly, it is to answer calls from creativity researchers by identifying boundaries for intrinsic motivation-creativity relationship (Wu et al., 2021). Secondly, although employee performance has been the centre of attention for many business research scholars (El Ouirdi et al., 2016; Mastenbroek et al., 2014; Zhang et al., 2020), very few studies have tried to grasp this concept from the perspective of technology and creativity of employees (Jarvenpaa & Välikangas, 2020; Oldham & Da Silva, 2015). Therefore, in addition to the call for moderators, this research also attempts to respond to the call for further investigation to understand technology's role in creative idea generation (Oldham & Da Silva, 2015). In an Asian culture, this research will also help managers in fostering their understanding of motivating their employees, especially on what they need to do to make their employees more creative.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The motivation-opportunity-ability framework suggests that having only motivation cannot lead to behavioural outcomes without having the ability and the opportunity to perform (Blumberg & Pringle, 1982). Similarly, access to diverse knowledge resources will not assure the acquisition and provision of knowledge because only employees with adequate motivation will be able to obtain benefits (Bhatti et al., 2020; Chen, et al., 2020; Reinholt et al., 2011) in terms of higher creativity (Fleming et al., 2007) and productivity (Al Yami et al., 2021; Gardner et al., 2012). Blumberg and Pringle (1982) presented performance as the centre of the nexus between motivation, ability, and opportunity framework. Performance in the form of creativity and productivity is the outcome of the interaction between motivation, ability to perform, and opportunity availability.

Intrinsic Motivation and Creativity

Intrinsic motivation is defined as the desire to perform an activity based on activity's interest in enjoyment (Amabile, 1996; Ryan & Deci, 2000). It was conceptualised as individual-level psychological phenomena (Amabile, 1988; Zhou, 2003), which management scholars have long argued as an enabler of creative performance (Zhou & Hoever, 2014). The researchers have taken two main perspectives to understand the psychological mechanism through which intrinsic motivation stimulates creative performance. The first perspective focuses on the positive affect of employees (Silvia, 2008), while the second perspective has adopted the theories of self-determination to understand variations in employee creativity (Amabile, 1996; Gagné & Deci, 2005). Both of these perspectives suggest that persistence in an activity due to self-determination or emotion is the key to creativity. Persistency due to positive affect, psychological engagement, the reason for doing an activity, and sustaining efforts enhance individual ability and willingness to put more time and energy in affecting idea generation (Fredrickson, 1998). Similarly, persistence in challenging, complex, and new tasks and the concentration of individuals on tasks fuelled by intrinsic motivation foster creativity (Amabile, 1996; Gagné & Deci, 2005).

Although researchers have investigated the intrinsic motivation-creativity relationship in both lab experiments and field studies, mixed empirical findings were reported (George, 2007; Wu et al., 2021). The findings of field studies and lab experiments provided mixed results (Amabile et al., 1994; Dewett, 2003; Eisenberger & Aselage, 2009). Surprisingly, this relationship received less attention, both empirically and theoretically (Grant & Berry, 2011). Thus, the conflicting nature of intrinsic motivation-creativity relationship has called for a more thorough investigation of this phenomenon (Amabile & Mueller, 2007; George, 2007).

Moderating Role of Digital-Technology-Use

Digital-technology-use enables employees with exposure to diverse information that energizes individual combinatory processes for generating novel and useful ideas (Baer, 2010; Perry-Smith & Shalley, 2003; Rehman et al., 2021). The diverse information that individuals receive provide different perspectives and approaches to find solutions to problems that have not been tested and applied to work situations (Wu et al., 2021). This information might be coming from outside the boundaries of organisations; these outside packets of information bring new insights to organisations by affecting organisational members' creativity (Lee & Kim, 2021; Ohly et al., 2010). Similarly, motivation-opportunity-ability framework suggests that employees need to have access to resources, skills and ability, including a sufficient amount of desire (Blumberg & Pringle, 1982). We propose that digital-technology-use open doors to new and diverse information that direct employee ability to integrate knowledge from these diverse information sources, enhancing the positive effects of intrinsic motivation-creativity relationship.

Therefore, employees who use digital technology tools at work get more knowledge, information, and social resources to produce creative ideas at their workplace. Technology research also suggests that digital-technology-use enhances knowledge and information (Oldham & Da Silva, 2015) which may in turn enhance creativity (Hirudayaraj & Matić, 2021; Lee & Chen, 2015). Hence, it is proposed that digital-technology-use may enable employees to channel their intrinsic motivation towards the production of creative ideas. Thus, we propose that:

H_1 : Digital technology use strengthens the relationship between intrinsic motivation and creativity.

Mediating Role of Knowledge Integration Ability

Knowledge integration ability is a specific type of knowledge gathering technique in which individuals accumulate their knowledge base by blending newly learnt knowledge with their previous knowledge (Tiwana, 2008). Although employees can vary in their ability to integrate knowledge, research has shown that exposure to knowledge resources with a sufficient amount of motivation can affect employee ability to obtain and offer knowledge (Reinholt et al., 2011). The classic motivation-opportunity-ability framework (Blumberg & Pringle, 1982) provides the conceptual basis for the relationship between digital-technology-use and knowledge integration ability. When employees use digital technology, their knowledgeability increases because of the exposure to diverse knowledge resources (Oldham & Da Silva, 2015).

Research has shown that exposure to diverse knowledge and information resources can enhance the creativity of employees (Lee

& Chen, 2015; Oldham & Da Silva, 2015), sharing of knowledge (Anderson, 2008; Tsai, 2001), the extension of the flow of knowledge (Anderson, 2008), and the ability of individuals to absorb knowledge (Reinholt et al., 2011). To understand the underlying mechanism of the moderating effect of digital-technology-use on intrinsic motivation-creativity relationship, we propose that knowledge integration ability will mediate the moderation of digital-technology-use on intrinsic motivation-creativity relationship. As driven by digital-technology-use, knowledge integration ability enhances the effect of intrinsic motivation on creativity. Thus, we predict here that digital-technology-use at work will affect employee knowledge integration ability. Hence, the following hypothesis is proposed:

H_{2a}: Digital technology use is positively related to knowledge integration ability.

Building on the motivation-opportunity-ability framework (Blumberg & Pringle, 1982) and creativity literature, in addition, it is proposed that knowledge integration ability will strengthen intrinsic motivation-creativity relationship. Knowledge of individuals energize the combinatory process to generate novel and useful ideas (Baer, 2010; Perry-Smith, 2006). The diverse knowledge base of individuals enhance creativity by generating unique alternatives that have not been cultivated at the workplace and equip individuals to take diverse standpoints and approaches to integrate for the generation of fresh ideas and may contribute to organisational, creative inventory (Oldham & Da Silva, 2015). Psychological processes coupled with relevant knowledge for creativity, will enhance creativity (Amabile, 1996). Accordingly, we predict that the ability of individuals to integrate knowledge will enhance the impact of intrinsic motivation on creativity. Therefore, we propose:

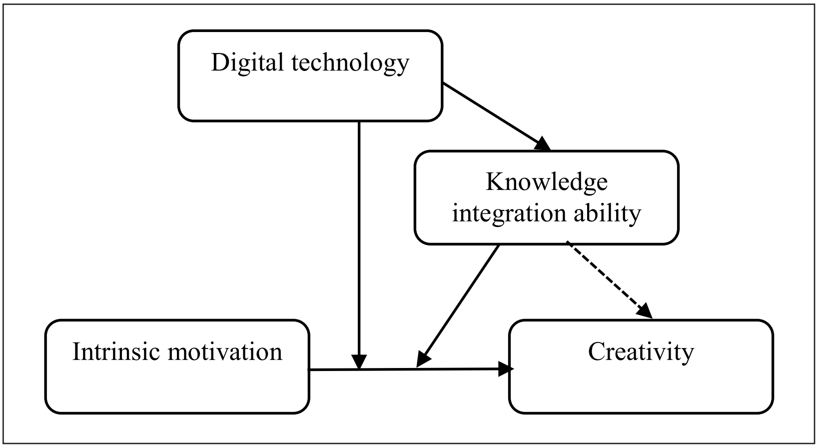
H_{2b}: Knowledge integration ability strengthens the relationship between intrinsic motivation and creativity.

The preceding hypotheses H_{2a} and H_{2b} posit that digital-technology-use increases the ability to integrate knowledge and in turn, knowledge integration ability enhances intrinsic motivation on creativity. Therefore, in order to check conditional indirect effects and an overall moderation of the proposed relationships, we put forward that knowledge integration ability mediate the moderating effect of digital-technology-use—indicating mediated-moderation (Edwards & Lambert, 2007). Accordingly, we predict that digital-technology-use strengthens this relationship. Hence, it is posited that:

H_{2c}: Knowledge integration ability mediates the moderating effect of digital technology use on the relationship between intrinsic motivation and creativity.

Figure 1

Research Model



METHODOLOGY AND DATA ANALYSIS

These hypothesised relationships are tested in two studies (laboratory experiment and field study). Hypothesis 1 was tested in Study1; however the full model as depicted in Figure 1 was tested in Study 2.

Study 1

Sample and Data Collection

We conducted a laboratory experiment with newly hired bankers at the training and development centre. A total of 119 bankers of the same batch in four different training sessions generated creative ideas to solve business problems. Intrinsic motivation and digital-technology-use, were both manipulated independently. Supervisors' biases for creativity rating were mitigated by an independent rater (i.e. training and development centre manager) who evaluated every creative business idea. The independent rater-training manager was blind to the characteristics of the participants of the study. Directly manipulating intrinsic motivation and digital-technology-use rule out the alternative explanation of other variables which may affect creativity namely, ability omitted knowledge and skills (Amabile & Mueller, 2007).

We approached the bank's higher management and discussed our study's purpose and implications in terms of motivation, technology, knowledge, and creativity. With the management's approval, all of the 119 bankers participated in the study as part of their training module, in which 66 percent were male while 34 percent were female. A computer-based approach was used to solve a business problem. The participants were informed that the aim of the study was to understand how people solve business problems at work. The problem they would solve was a real-time problem of certain business organisations. The software assigned random numbers to the participants, and the participants solved one of the four experimental conditions. Not all computer systems allowed access to the internet for any kind of support namely, communication, sharing, transfer, etc.

Situation and Measures

A message was displayed on computer screens to introduce the study.

You are about to participate in one of the studies which is intended to resolve the business problem of two local food chain brands. We asked past participants to rank the studies based on how interesting they found them, and we have already received feedback from previous participants about these studies. Although these studies will be assigned randomly to the participants, you still have a choice to choose from the options given as follows:

(a) A food chain study that has been rated as extremely interesting, with an average rating of 6.17 out of 7 points.

(b) A food preparation that has been rated as boring, with an average rating of 3.73 out of 7 points.

The names we gave to both of the studies, food chain study and food preparation, were selected to relate both options to the same business problem. The purpose of this method was to guide participants to select option-a: an interesting study. As planned, all of the participants selected option-a, which took them to a screen with an exclamatory message that said, “Thanks a lot for your selection of the food chain study”. The next instruction about the study was then displayed. The message was displayed for the participants to lead them to believe that they had selected an interesting study indicating free choice and task interest. In contrast, in the case of low intrinsic motivation, a message was displayed to the participants to inform them that the study they had selected was full. They were then directed to the food preparation study. The purpose of the message was to let the participants believe that they would solve a problem that was not interesting but rather boring, with low task interest and no free choice. Thus, we believe that participants’ free choice for the study gave them long-term intrinsic motivation as advocated by previous researchers (Hackman et al., 1978). In addition to the free choice, framing tasks affect short-lived task experience overriding the framing experience (Zalesny & Ford, 1990). In contrast, describing the task as interesting can have short-lived intrinsic motivation (Glynn, 1994; Zalesny & Ford, 1990).

Intrinsic motivation manipulation: It was achieved by varying the participants’ interest in the task and through the availability of free choice (Deci et al., 1999). For high and low intrinsic motivation, we allowed participants to choose from the tasks. The highly, intrinsically motivated participants selected a task from a choice of two, and that task was accepted as interesting. The same choice was provided for the low interest tasks, but we rejected the task that the participants selected to solve. In the first condition, the task was described as interesting, and in the second condition, the task was described as boring for supporting and undermining self-determination. In both situations, the participants solved the same business problem; the only difference was that we allowed them to select a task that was framed as interesting in the first situation. In the second situation, participants were prevented from performing tasks framed as interesting and instead confined to performing tasks that were framed as boring. To prepare participants for the study and manipulations, we chose to select based on the previous participants’ ratings (fake ratings).

Digital-technology-use manipulation: It was achieved by providing and restricting access to digital technology to solve business problems. Participants were informed of all the conditions required to generate a business idea that could increase the food chain's revenue. Not all computer systems allowed access to the internet for support: communication, sharing, transfer, etc. We provided a scenario to the participants about a business problem. "Food chain brand is looking for ideas to boost their revenues. In the last two years, the food chain has seen a drop of 13 percent in its sales volume. As one of the leading food chain owners said, it used to be that we served food to our customers, now it's time to find additional ways to enhance revenue at restaurants."

In all scenarios, participants were supposed to generate new ideas to boost revenue for the business problem stated with or without digital technology support: communication, sharing, transfer, etc. (as allowed or restricted by the system assigned to them). Additionally, we also restricted the use of mobile phones or any digital tool during the data collection process. It was also revealed to the participants that their generated ideas would be sent to the food chain band for further consideration. Finally, after the participants generated ideas with and without the support of digital technology, an independent rater (training and development centre manager) rated the creativity of the participants' generated ideas.

Creativity: An independent rater (i.e. training and development centre manager) rated the creativity of the participants' ideas as an expert. The training manager experienced designing and managing training programs for the participants to boost employee productivity and performance at work. Creative thinking, decision-making, and problem-solving are endogenous to such training programs. Therefore, the training manager served the purpose of an expert for this study. Although the rater had creative ideas, we provided a creativity definition indicating two important dimensions of creative ideas: novelty and usefulness (Amabile, 1996). We asked the rater to evaluate each of the ideas on a creativity scale ranging from 1 = "not at all creative" to 5= "very creative."

Manipulation checks: To make certain our manipulations' effectiveness, we asked the respondents to respond to the scale measuring intrinsic motivation and digital-technology-use. To access intrinsic motivation that an individual is experiencing, open-choice and self-reported task interest should be measured (Deci et al., 1999). For the scale measuring intrinsic motivation, both task interest and free choice were controlled. Task interest was measured with a seven-item, seven-point Likert scale (Ryan et al., 1991). Sample items for the scale included, "I enjoyed doing this task very much" and "This task was fun to do" ($\alpha = 0.91$). The participants' free choice perception was measured with a seven-item, seven-point Likert scale of perceived choice (Ryan et al., 1991). Sample items for the scale included, "I did this activity because I wanted to" and "I believe I had some choice in doing this activity" ($\alpha = 0.90$). Finally, we also controlled for gender and the sources of experience of the bankers i.e., in terms of years of experience in their professional life.

Testing of Hypotheses

The mean, standard deviation, and zero-order Pearson correlations of all study variables are presented in Table 1. For hypotheses testing, we used Mplus 7.0. Although the bankers in this study were fresh graduates, they were attending general bankers' training at the banks' training and development centre at the time of the study. However, at the same time, they were also involved in specialised training (e.g., operations, trade, credits, etc.). Therefore, due to the sample's nested nature, using a simple regression technique could underestimate standard error. Thus, we used multilevel modelling based on Scherbaum and Ferreter's (2009) recommendation with a single level analyses technique. As the output produced by multilevel analysis could not be used directly without further analyses (Muthén & Muthén, 2017), we had to calculate chi-square difference testing. We also had to perform a test: satorra-bentler-difference using the log-likelihood method with scaling correction factor. We grand-mean centred all the variables including main variables and interaction terms (Hofmann & Gavin, 1998).

We followed a three-step procedure of moderated regression analyses (Aiken et al., 1991) with random coefficients. Step-1 all control variables (gender, professional experience, task interest, and free choice) regressed on creativity; step-2 all control variables with intrinsic motivation and digital-technology-use regressed on creativity, and in step-3 all control variables with intrinsic motivation, digital-technology-use, and interaction of intrinsic motivation and digital technology regressed on creativity.

Table 1

Study 1 - Mean, Standard Deviation, and Correlation among Study Variables

Variable	Mean	SD	1	2	3	4	5	6
Gender	0.84	0.36						
Professional experience	6.11	2.18	-0.008					
Task interest	3.36	0.62	-0.022	-0.062				
Free choice	2.82	0.89	0.099	0.023	0.371**			
Intrinsic motivation	3.50	0.93	-0.082	-0.020	-0.143	-0.021		
Digital technology use	4.16	1.64	-0.001	-0.114	-0.064	-0.063	0.074	
Individual creativity	3.64	0.83	-0.046	-0.022	-0.191*	-0.391**	0.434**	0.241**

Note: *N* = 119. Gender coded as 0 = female, 1 = male. Level of education as 1= College graduate, 2 = Bachelor's degree, 3=Master's degree, 4=Doctoral degree. Professional experience as measured in years.
*$p < 0.05$. **$p < 0.01$

The results of moderated regression analyses with random coefficient are depicted in Table 2. About the moderating effect of digital-technology-use on intrinsic motivation-creativity relationship, as shown in Table 2 model 2, intrinsic motivation as an independent predictor was significantly related to creativity ($\beta = 0.242$, $p \leq 0.05$), but digital-technology-use as an independent predictor was not significantly related to creativity ($\beta = 0.146$, $p \geq 0.10$). However, as shown in Table 2 model 3, the interaction of digital technology and intrinsic motivation use emerged as a positive predictor of the intrinsic motivation-creativity relationship ($\beta = 0.068$, $p \leq 0.05$).

The moderating effect is also shown in Study-1 Figure 2. The graph shows that in the case of a high level of digital-technology-use, intrinsic motivation was positively related to creativity but not in the case when digital technology use was low. The participants with a high level of intrinsic motivation who used digital technology to generate business ideas were rated high for their creative ideas by independent raters.

Table 2

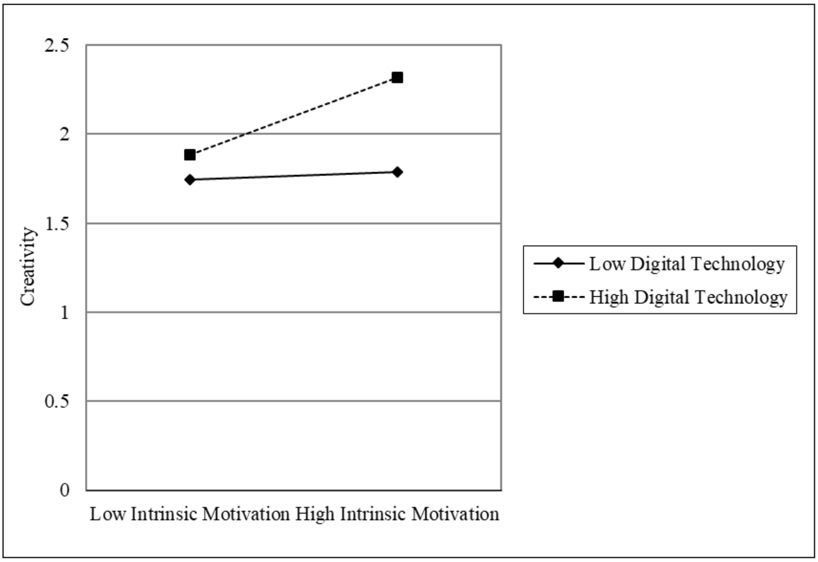
Study 1- Regression Analyses

Predictor	Model 1 Creativity		Model 2 Creativity		Model 3 Creativity	
	Estimate	SE	Estimate	SE	Estimate	SE
Gender	0.043	0.084	0.147	0.094	0.129	0.091
Professional experience	-0.039	0.052	-0.021	0.031	-0.020	0.032
Psychological safety	0.007	0.127	0.094	0.173	0.155	0.177
Autonomy	-0.163	0.109	-0.179**	0.084	-0.197**	0.080
Intrinsic motivation			0.242**	0.116	-0.142**	0.018
Digital technology			0.146	0.091	-0.123	0.174
Intrinsic motivation X Digital technology					0.063**	0.029
$\Delta \chi 2$ (Δdf)	3.04 (3)		14.15(5)**		21.76(4)***	
ΔR^2	0.41		0.54		0.59	

Note: N =119.
$*p < 0.10$ $**p < 0.05$ $***p < 0.01$

Figure 2

Study 1: Simple Slopes



Study 2

Sample and Data Collection

To strengthen our confidence in the results, we conducted a field study in the software industry. For this study, we collected data from IT specialists (software engineers and developers) working at a Pakistan software house. The study's purpose and implications were discussed with the management of the software house. Formal approval was obtained for data collection, which was temporally divided into two points in time (time 1 & 2).

Before starting the data collection process, we assigned dummy codes to subordinates, supervisors, and their teams to identify individual responses with their supervisors. The IT specialists were responsible for developing software, measuring the quality of developed software, efficient database management, software problem solutions, etc. We sent e-mails to 537 IT specialists and their 41 direct supervisors to participate in a survey related to employee motivation and productivity at work. A total of 491 IT specialist and all 41 of their supervisors indicated their interest in the study by way of a return e-mail.

We then sent questionnaires on intrinsic motivation and their ability to integrate knowledge to the subordinates. Responses were received from 467 employees and after three weeks, we sent again the questionnaires to the 467 employees and asked about their use of digital technology at work. Finally, we sent questionnaires related to the creativity of employees to their respective supervisors (altogether 41 of them). The subordinates and their respective supervisors sent their responses for time 1 and time 2 to one of the researchers in this study. We focused mainly on the matched data of the subordinates' and supervisors' response to the final data set.

The final data set yielded a response of 407 subordinate records with 41 supervisors. This final sample was used in all of the analyses and model test of this study. In the qualified final sample, 84 percent were male, and 16 per cent were female; the average age of subordinates was 36.9 years; the average total working experience with software industry was 11.2 years; average working experience with the current organisation was 6.91 years; 31.8 percent had a bachelor's degree, and 68.2 per cent were master's degree holders. For this study, we used the maximum likelihood method for missing value treatment, which is a more robust technique when compared to other alternatives such as list-wise deletion, pairwise deletion, mean replacement, or multiple imputation methods (Arbuckle, 1996; Bollen & Curran, 2006; Little & Rubin, 2002).

Measures

For this study, we used Likert scales in which subordinates provided their response on their intrinsic motivation, knowledge integration ability, and digital-technology-use at work. While, supervisors provided their response for each of their direct subordinate on creativity.

Intrinsic motivation: We measured the intrinsic motivation of subordinates with a four-item, seven-point Likert scale (Grant & Sumanth, 2009) ranging from 1 = "strongly disagree" to 7 = "strongly agree". We asked the respondents, "Why are you motivated to do your work?" The respondents rated their intrinsic motivation and provided their level of response. Sample items for intrinsic motivation included, "Because I enjoy the work itself" and "Because it's fun" ($\alpha = 0.93$).

Digital-technology-use: This variable was constructed by using a 15-item, seven-point Likert scale that formed a reasonable scale. The 15 items' score was added, creating a scale that ranged from 1 = "strongly disagree" to 7 = "strongly agree". Digital technology includes any tool or technology that may be available to employees in contemporary organisations. These include communication tools, electronic conferencing tools, collaborative work management tools, and social networking tools (Oldham & Da Silva, 2015). We asked the respondents, "Do you use digital technology tools when performing your job at work?" and the respondents responded by rating the communication tools with five items (e-mail, instant messaging, voice mail, faxing, and paging), electronic conferencing tools with five items (data conferencing, voice conferencing, video conferencing, discussion forums, and chat systems), collaborative work management tools with two items (file sharing, and group calendars), and social networking tools with three items (Facebook, LinkedIn, and Twitter) (α = 0.96).

Knowledge integration ability: Knowledge integration ability was measured by adopting a three-item, seven-point Likert scale related to knowledge integration ability (Tiwana, 2008) and developed two new items. Knowledge integration ability scale was developed to capture team ability to integrate knowledge (Tiwana, 2008). In this study, we were interested in measuring individual-level knowledge integration ability; therefore, we used "I" instead of "in my team" and developed two more items for individual-level knowledge integration ability. A sample item for adopted knowledge integration ability scale states, "I have good ability to span several areas of expertise to generate new ideas", and two newly developed items include, "I know a lot of experts in my field and am well connected" and "I exchange knowledge and information with experts in my field" (α = 0.95).

Creative idea generation: Others perceive creative idea generation as the most common method of measuring individual creativity (Zhou, 2003). In this study, supervisors' ratings were used to measure the creativity of employees. Although this method is vulnerable to several weaknesses (Shalley et al., 2004), such as, supervisors may not observe creativity; supervisors may not be an expert on creativity as well as the halo effect on supervisors' rating of employees. Despite its weaknesses, this is the most commonly used method to measure employee creativity (George & Zhou, 2002; Grant & Berry, 2011).

Therefore, following previous literature, we measured the creativity of focal employees as rated by immediate supervisors on a 13-item, five-point Likert scale (Zhou & George, 2001). We defined creativity, including originality or novelty and usefulness, to all of the supervisors and asked them to rate each of their subordinates on a creativity scale. A sample item included, "This employee suggests new ways to achieve goals or objectives" ranging from 1 = "not at all" to 5= "very likely" (α = 0.95).

Control variables: In this study, we controlled for contextual and individual-level factors that may affect employee motivation and creativity. From the demographic standpoint, we controlled for gender and the professional experience of employees. For job characteristics, we controlled for autonomy which may affect the creativity and motivation of employees (Elsbach & Hargadon, 2006); therefore, we measured autonomy at work with an already developed scale (Morgeson & Humphrey, 2006) ($\alpha = 0.73$). We also controlled for psychological safety, which affect the intrinsic motivation and creativity of employees, with a seven-item, seven-point Likert scale (Edmondson, 1999) ($\alpha = 0.85$). For a more robust test of moderation of digital-technology-use, we also controlled for prosocial motivation and extrinsic motivation, affecting employee motivation and creativity (Grant & Berry, 2011). The extrinsic motivation was measured with external, introjected, and identified motivation. Each type of motivation was measured with an adapted four-item, seven-point Likert scale (Grant & Berry, 2011) from the original scale of Ryan and Connell (1989) ($\alpha = 0.97$), ($\alpha = 0.73$) and ($\alpha = 0.78$), respectively. The prosocial motivation was measured with a five-item, seven-point Likert scale (Grant & Sumanth, 2009) ($\alpha = 0.98$).

Descriptive Statistics

The mean, standard deviation, and zero-order Pearson correlations of all the study variables are presented in Table 3. Before testing our study's hypotheses, we conducted a confirmatory factor analysis to confirm the validity and statistical discrimination among the key variables using Mplus 7.0, which showed that our study variable represented a separate construct. Digital-technology-use: communication tools, electronic conferencing tools, collaborative work management tools, and social networking tools served as indicators of the latent construct. For the measurement model, $\chi^2 = 700.864$, 86, N=407, $p < 0.001$, CFI = 0.921, TLI 0.904, and RMSEA = 0.001 with a construct reliability of 0.77 for average variance extracted (AVE) indicated a good fit of model for the data. All the factors also showed significant results, 0.63 to 0.97 for digital-technology-use items. Furthermore, knowledge integration ability, measurement model, $\chi^2 = 135.491$, 5, N=407, $p < 0.001$, CFI = 0.941, TLI 0.881, and RMSEA = 0.001 with a construct reliability of 0.71 for average variance extracted (AVE) indicated a good fit of model for the data. All the factors also showed significant results ranging from 0.81 to 0.93 for knowledge integration ability items. CFI value fell below .95, which might be an artefact of sample size and scale length; an over-identified variable for digital-technology-use (Little et al., 2002).

Table 3

Study 2- Mean, Standard Deviation, and Correlation among Study Variables

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
Gender	0.84	0.37											
Professional experience	6.91	2.35	-0.031										
Psychological safety	3.05	0.46	0.017	-0.156**									
Autonomy	2.54	0.75	-0.002	-0.184**	0.239**								
External motivation	4.23	0.42	0.019	0.021	-0.036	-0.072							
Introjected motivation	3.21	0.57	0.056	0.031	0.001	0.009	0.104*						
Identified motivation	4.00	1.13	-0.023	0.043	-0.108*	-0.063	-0.216**	-0.040					
Prosocial motivation	3.98	1.02	0.044	-0.115*	-0.029	-0.004	-0.177**	-0.028	0.534**				
Intrinsic motivation	3.26	1.07	0.032	-0.053	-0.060	-0.048	-0.062	-0.044	-0.007	-0.052			
Digital technology use	3.50	0.97	0.082	0.054	-0.140**	-0.001	-0.004	-0.001	-0.020	-0.154**	0.266**		
Knowledge integration	3.51	1.46	-0.050	0.003	-0.012	0.135**	0.014	-0.148**	-0.017	0.032	-0.010	0.153**	
Individual creativity	2.83	0.98	0.000	-0.058	-0.026	-0.031	-0.034	-0.103*	-0.076	-0.009	0.272**	0.228**	0.092

Note. N=407. Gender coded as 0 = female, 1 = male. Age as measured in years. Level of education coded as 1= College graduate, 2 = Bachelor's degree, 3=Master's degree, 4=Doctoral degree. Professional experience as measured in years.
$^{*}p < 0.05$. $^{**}p < 0.01$

Test of Hypotheses

Mplus 7.0 was used to test the hypotheses of this study. Employees of the software house were nested into different teams working on different projects, simultaneously; therefore, simple linear regression could underestimate standard error; previous literature suggested multilevel modelling in such situations (Scherbaum & Ferreter, 2009). Therefore, to eliminate chances of standard error underestimation and potential interdependence among variables of our study; in multilevel analyses, random coefficient single-level analyses was used with Mplus 7.0. Although this technique is best suited for the model and data of this study, the output produced by Mplus for chi-square difference testing with these types of analyses cannot be used directly in a regular way; therefore, as recommended by Muthén and Muthén (1998–2010), we also performed satorra-bentler difference test using the log-likelihood method with scaling correction factor. Researchers have already used this method with a sample of similar characteristics (Adeel et al., 2019).

Before conducting any analyses of this study, all main variables were grand mean centred (Hofmann & Gavin, 1998), and all of the interaction terms of this study including the interactions of extrinsic motivation (external, introjected, and identified) and prosocial motivation which were used as control of this study. This reduced chances of multicollinearity for interaction variables (Aiken et al., 1991). We followed a three-step moderated regression (Aiken et al., 1991) with random coefficients. In step 1, all control variables were regressed on creativity. In step 2, intrinsic motivation and digital-technology-use were regressed on creativity. In step 3, the interaction of intrinsic motivation and digital technology was regressed in the presence of all control variables, intrinsic motivation, and digital-technology-use. We used gender, professional experience, psychological safety, and autonomy to control this moderated regression.

Moderated regression analyses with random coefficient results are depicted in Table 4. Our core hypothesis about the moderating effect of digital-technology-use on intrinsic motivation-creativity relationship, Table 4 model 2, intrinsic motivation as an independent predictor was significant with creativity ($\beta = 0.075$, $p \leq 0.05$), but not digital-technology-use. However, the interaction of intrinsic motivation and digital-technology-use emerged as a positive predictor of creativity (β = 0.068, $p \leq 0.05$) in Table2-B model 3.

Table 4

Study 2- Regression Analyses

Predictor	Model 1 Creativity		Model 2 Creativity		Model 3 Creativity	
	Estimate	SE	Estimate	SE	Estimate	SE
Gender	-0.025	0.065	-0.045	0.062	-0.071	0.059
Professional experience	0.020	0.019	0.017	0.017	0.017	0.018
Psychological safety	0.091	0.098	0.095	0.093	0.095	0.092
Autonomy	0.047	0.071	0.032	0.070	0.039	0.071
Intrinsic motivation			0.075**	0.035	-0.157	0.099
Digital technology			0.108	0.059	-0.099	0.109
Intrinsic motivation X Digital technology					0.068**	0.029
$\Delta \chi 2$ (Δdf)	2.57 (3)		13.23(5)**		18.34(4)***	
ΔR^2	0.022		0.11		0.14	

Note: N = 407.

**p* < 0.10 ***p* < 0.05 ****p* < 0.01

The moderating effect is also shown in Study-2, Figure 3. The results showed that intrinsic motivation was positively related to creativity when digital-technology-use was high, but not when digital technology was low. Employees with a high level of intrinsic motivation were likely to be rated high by their respective supervisors when using digital technology at work.

For more robust results of digital-technology-use with intrinsic motivation, we took a step further and controlled for prosocial and extrinsic motivation-external, introjected, and identified motivation along with the interactions of external, introjected, identified, and prosocial motivation with intrinsic motivation and tested Hypothesis 1 again with the same moderated regression technique (Aiken et al., 1991). Even after we included all of this study's control variables (Table 5), the results were again replicated indicating the significantly positive effects of intrinsic motivation and digital-technology-use to predict employee creativity as perceived by the superv isors (β = 0.072, $p \leq 0.05$).

Figure 3

Study 2: Simple Slopes

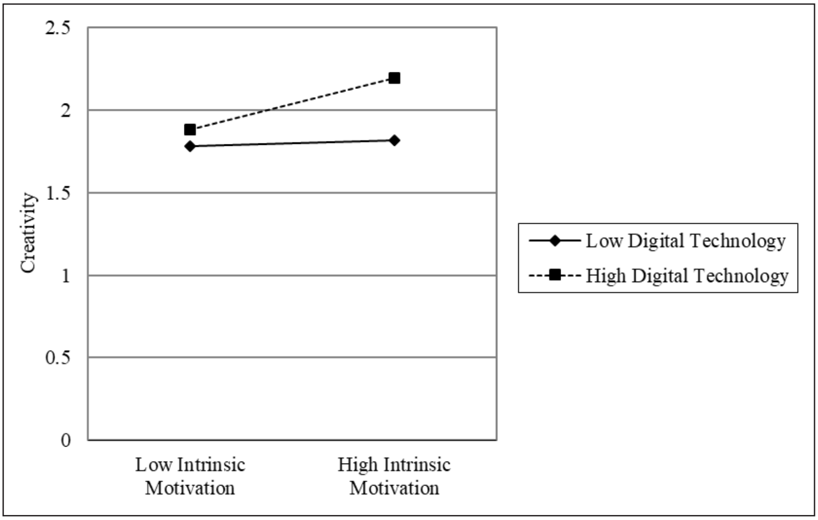
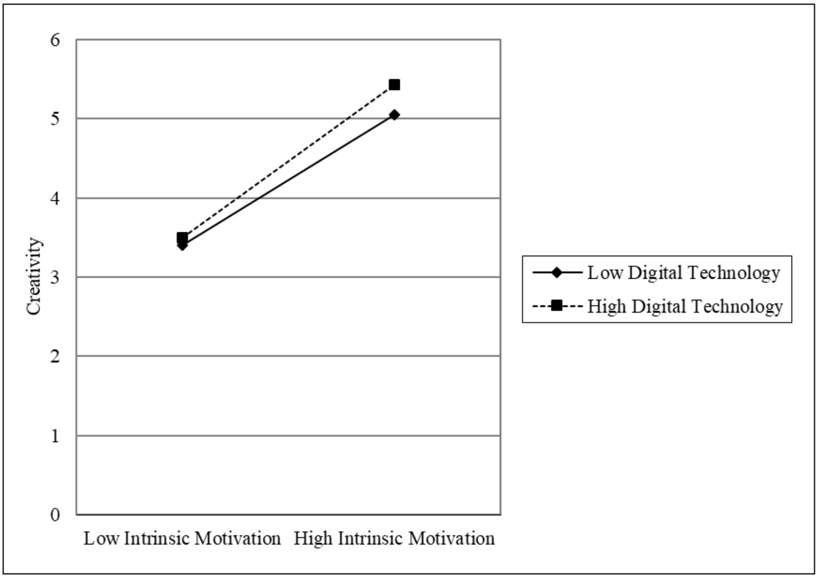


Figure 4

Study 2: Simple Slopes

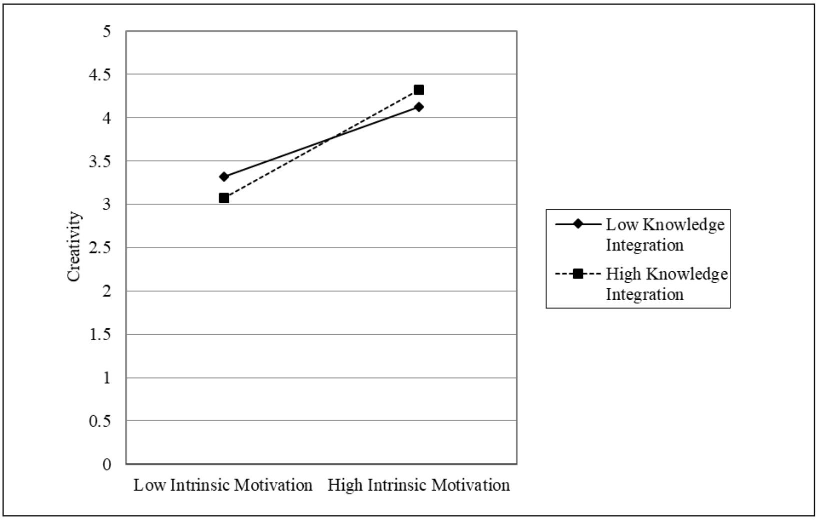


The moderating effect is also shown in Study-2, Figure 4. The results showed that digital-technology-use strengthened intrinsic motivation-creativity relationship, supporting hypothesis 1 of this study. Therefore, digital-technology-use once again strengthened intrinsic motivation-creativity relationship.

In addition to the above and to rule out any alternative explanation of the moderating effect of digital-technology-use, we still had to test the mediating role of knowledge integration ability as having a proposed moderating role for digital-technology-use. We followed a three-step procedure (Baron & Kenny, 1986) to confirm the mediating role of knowledge integration ability for the moderating effect of digital-technology-use on intrinsic motivation-creativity relationship. We followed this procedure as the bootstrap option for indirect effect could not be used with random coefficient analysis. In all of our study analyses, we consciously eliminated the chances of standard error underestimation, as detailed in our aforementioned explanation.

Figure 5

Study 2: Simple Slopes



We tested other hypotheses; as shown in Table 5 – Model 1 digital technology was positively associated with knowledge integration ability (β = 0.641, $p \leq 0.05$); furthermore, we confirmed that the moderated regression analysis, as shown in Table 3-Model 3, knowledge integration ability and intrinsic motivation interacted to predict creativity as perceived by the supervisors (β = 0.072, $p \leq 0.01$). The moderating effect is also shown in Study-2, Figure 5. The results showed that the moderation of knowledge integration ability mirrored the moderating effect of digital-technology-use further, as shown in Table 5 - Models 2 and 3, that when we included the interaction term representing the moderating effect of knowledge integration ability, the moderating effect of digital-technology-use was reduced to non-significance (β = 0.072, $p \leq 0.05$) to (β = 0.054, $p \geq 0.05$).

Table 5

Study 2- Regression Analyses

Predictor	Model 1 Knowledge integration		Model 2 Creativity		Model 3 Creativity	
	Estimate	SE	Estimate	SE	Estimate	SE
Gender	-0.198	0.227	-0.073	0.057	-0.110	0.059
Professional experience	0.015	0.030	0.016	0.016	0.015	0.015
Psychological safety	-0.149	0.192	0.084	0.093	0.061	0.084
Autonomy	0.234	0.120	0.045	0.070	0.033	0.067
External motivation	-0.009	0.397	0.083	0.225	0.037	0.224
Introjected motivation	-0.723	0.412	0.471***	0.180	0.367**	0.163
Identified motivation	0.196	0.315	0.113	0.159	0.129	0.157
Prosocial motivation	-0.257	0.234	-0.007	0.111	-0.038	0.111
Intrinsic motivation X External motivation	0.041	0.109	-0.047	0.062	-0.034	0.061
Intrinsic motivation X Introjected motivation	0.115	0.111	-0.121**	0.054	-0.089	0.050
Intrinsic motivation X Identified motivation	-0.093	0.084	-0.041	0.043	-0.045	0.042
Intrinsic motivation X Prosocial motivation	0.126**	0.059	0.000	0.028	0.007	0.028
Intrinsic motivation	-0.286	0.721	0.580	0.378	0.226	0.406
Digital technology	0.641**	0.280	-0.111	0.103	-0.041	0.105
Intrinsic motivation X Digital technology	-0.128	0.078	0.072**	0.028	0.054	0.029
Knowledge integration					-0.245***	0.089
Intrinsic motivation X Knowledge integration					0.072***	0.027
$\Delta \chi 2$ (Δdf)	34.12 (14)***		32.04 (14)***		42.58(16)***	
ΔR^2	0.191		0.113		0.182	

Note: N = 407.

*$p < 0.10$ **$p < 0.05$ ***$p < 0.01$

These analyses supported Hypothesis 2a, Hypothesis 2b, and Hypothesis 2c of our study. The support for hypotheses 2a, 2b, and 2c demonstrated that the knowledge integration ability mediated the moderating effect of digital-technology-use on the intrinsic motivation-creativity relationship. These results constructively supported all hypotheses of our study. Although not hypothesised, we used the same three-step procedure (Baron & Kenny, 1986) to confirm the mediating role of knowledge integration ability on the direct effect of digital-technology-use on creativity as perceived by the supervisors. Although, when we regressed knowledge integration ability on digital-technology-use, we found a significant coefficient ($\beta = 0.641$, $p \leq 0.05$) also shown in Table 5 - Model 1, we failed to find any direct relationship between digital-technology-use and creativity as perceived by the supervisors ($\beta = 0.103$, SE = 0.058, $p \geq 0.10$).

With this study results, we found that digital-technology-use enhances intrinsic motivation-creativity relationship and that knowledge integration ability mediated this moderating effect. The results were replicated even when we went further to control for prosocial and extrinsic motivation-external, introjected, and identified motivation along with the interactions of external, introjected, identified, and prosocial motivation with intrinsic motivation as shown in Table 4 and Table 5. Although not hypothesised, we tried to test for a possible direct and indirect effect of digital-technology-use on creativity through knowledge integration ability. Nonetheless, we still failed to find any direct relationship between digital-technology-use and creativity.

THEORETICAL CONTRIBUTIONS

Leaving aside the conventional ways of understanding creativity (i.e., via psychological, sociological, and structural perspectives), this research has made a significant contribution by bringing together creativity and digital technology literature. Using the motivation-opportunity-ability framework in this research, we tested a holistic model that uniquely integrates creativity, digital and information technology literature.

Taking a technological perspective to resolve the controversy, it was found that intrinsic motivation-creativity relationship is contingent upon digital-technology-use i.e., intrinsic motivation is associated with a high level of creativity when employees use digital-technology to enhance their knowledge integration ability. This study has revealed that knowledge integration ability, as enabled by digital-technology-use strengthens intrinsic motivation-creativity relationship. Management scholars, as well as information and digital technology scientists, have acknowledged direct digital-technology-use influence on performance (Basaglia et al., 2010) or as a catalyst that transforms knowledge into action by facilitating employees to integrate their knowledge (Armour, 2001) which may have a more positive effect on performance (Basaglia et al., 2010). However, none of the studies has developed or empirically tested the effect of digital-technology-use and knowledge integration ability in intrinsic motivation-creativity relationship. This research has identified knowledge integration ability as an underlying mechanism for explaining the moderating effect of digital-technology-use on intrinsic motivation-creativity relationship.

Limited research on technology and creative linkage has shown that technology can affect creativity (Bonnardel & Zenasni, 2010; Oldham & Da Silva, 2015; Wheeler et al., 2002). In line with previous research, we have also documented the importance of individual-level knowledge integration ability as a knowledge benefit of technology in facilitating creativity. Finally, consistent with the motivation-opportunity-ability framework (Blumberg & Pringle, 1982), we also found that none of the dimensions (motivation, opportunity or ability) can ensure high levels of creativity in isolation and that a low level of any of the stated dimensions will lead to lower levels of creativity.

PRACTICAL CONTRIBUTIONS

Organisations rely on their employees' creativity; therefore, managers are found seeking to stimulate the creative potential of their subordinates by providing necessary conditions to motivate individuals intrinsically by way of designing task complexity, autonomy, support and empowerment, etc. Our research suggests that these initiatives will boost individuals' intrinsic motivation for creativity. Still, in this contemporary world, proper management and utilisation of technology at the individual level of the organisation, which enables knowledge integration ability, will bring higher levels of individual creativity. Therefore, we suggest that providing employees with relevant technological tools and ensuring the utilisation of these technologies will fuel higher levels of employee creativity. For example, managers could ensure the proper utilisation of technology through formal and informal training programs, by establishing an environment where employees could properly utilise technology to access diverse and useful information; an environment where they could get the support of digital technology for the generation of creative ideas; an environment where they could use digital tools to communicate with each other, and an environment where they could receive sponsorship from others by using digital technology tools. These conditions could enhance the utilisation of technology and individual capacity to integrate knowledge for creativity, which would ultimately benefit the organisation.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Although this research has made some valuable contribution, it should also be considered in light of its limitations. First, a basic limitation of this research lies in its research design; the correlational design of the research makes it vulnerable to alternative explanations. A combination of correlational and experimental design with different research variables' operationalisation could lend more strength to causal inferences. Besides that, the supervisors' ratings for creativity are vulnerable to different weaknesses (Shalley et al., 2004) in terms of business, domain expertise, and the opportunity to observe employee creativity. To rule out the possibility of alternative explanations, we recommend the separation of individuals who generate creative ideas from the independent rating of actual ideas.

Second, the benefits of digital-technology-use and knowledge integration ability may be circumscribed to situations when the beneficiaries receive new and diverse information in a specific domain where an employee is expected to produce creativity. We argue that knowledge integration ability strengthens intrinsic motivation-creativity relationship. However, having access to more and more redundant knowledge may affect individual ability to integrate knowledge as digital technology users are also subject to information overload. Although devices provide an opportunity to gain exposure to new and diverse information that may be combined and integrated for the production of novel and useful creative ideas, there is a possibility that individuals accessing and using digital technology devote much of their time and energy in collecting information which may result in a large pool of too many perspectives and ultimately affect the ability to combine and integrate for the production of ideas.

Furthermore, digital technology is subject to an increase in stress (MacCormick et al., 2012) and, in turn, lowered creativity (Byron et al., 2010). Nevertheless, digital technology promotes autonomy and control over tasks by facilitating flexible arrangements at work via long distance video/audio calls, file/folder sharing, etc., which may contribute to a higher level of creativity. But these beneficial arrangements of technology may also result in enhanced psychological stress, which could reduce focus on tasks and, subsequently, creativity. It is also possible that large quantities of information acquired via technology are so unique that individuals face difficulty combining and integrating knowledge when generating creative ideas. Therefore, based on the discussions, a potential area for future research could be addressing individual resources and creativity. More specifically, we recommend research addressing the negative side of digital technology for creativity.

In sum, we exclusively focused on the contingent effect of digital technology in intrinsic motivation-creativity relationship. We also analysed and found support for the role of knowledge integration ability in this moderated relationship. However, we failed to find any direct relationship between digital-technology-use and creativity. Although the results are consistent with studies that failed to find any direct positive relationship between digital technology and creativity (Byron et al., 2010; Huber, 2000), we recommend for future research to replicate this study with data collected from a different industry, such as the financial or manufacturing sector for evidence of the relationship between digital technology and creativity.

CONCLUSION

Despite the limitations, our research results have provided new insight into intrinsic motivation-creativity relationship, digital-technology-use, knowledge integration ability, and the joint effect of intrinsic motivation and digital-technology-use as well as intrinsic motivation and knowledge integration ability on creativity. We have identified digital-technology-use and knowledge integration ability as important contingencies that strengthen intrinsic motivation-creativity relationship in this research. Knowledge integration ability has also emerged as a clarification mechanism for the contingency of digital-technology-use that strengthens the intrinsic motivation-creativity relationship. However, we failed to find any direct relationship between digital-technology-use and creativity. Based on this research results, we have resolved the literature's controversies about the influence of intrinsic motivation on creativity by providing digital-technology-use and knowledge integration as explanation.

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