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Employee creativity in a digital era: the mediating role of social media

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Abstract

Purpose – The purpose of this paper is to investigate how the use of social media can facilitate employee creativity. Departing from theories on social capital and knowledge management, this study examines the relationship among individual characteristics, the use of social technologies and employee creativity. The main hypothesis of the study is that online social networking mediates the relationship between personal innovativeness and creativity.

Design/methodology/approach – Data were obtained through an online survey of 80 engineers and 12 managers working in a large IT company listed by the Fortune 500 ($n1 = 80, n2 = 12$). The empirical strategy relies on fixed-effects structural equation modeling and confirmatory factor analysis with a quasi-experimental design to study the structural relationship among creativity, online social connectivity (OSC) and personal innovativeness.

Findings – The study provides three major findings. First, the results show that personal innovativeness regarding new technologies is positively associated with creativity. Second, 18 percent of the association between personal innovativeness and creativity is explained by the latent mediator OSC (a construct of online networking and knowledge management). More specifically, the partial mediation is driven by online networking, specifically establishing new connections. Finally, contrary to the expectations, there is no significant evidence that the relationship between creativity and personal innovativeness is mediated by online social knowledge management.

Practical implications – Understanding the ways in which online connections and online knowledge management as well as personal innovativeness are related to employee creativity helps in building innovative organizations. This study may facilitate recruitment and selection strategies and encourage organizations to implement platforms with user-friendly functionalities of connecting with other employees and searching data.

Originality/value – The main question of this study is whether all features related to social technologies make people more creative. Evidence is still scarce, but there are hints that creativity is not only an innate personal feature but also a social phenomenon. This study explains the benefits of OSC for enhancing employee creativity.

Keywords Creativity, Social media, Online networking

Paper type Research paper

Introduction

In a world of rapid technological change and increasing business complexity, understanding how employee creativity develops in increasingly digital settings is very important for organizations (Arthur, 2014). Employees' creativity in the workplace is one of the key drivers of organizational innovation (Amabile *et al.*, 1996; Gong *et al.*, 2013; Ramalingam *et al.*, 2015; Liu *et al.*, 2017). The drivers of creativity (at both the individual and organizational levels) are well-identified and documented. But we still do not know much about how technology helps creativity in the digital era.

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Individual creativity is relevant for business, as its effect on organizational innovation has been found in many studies (Peng *et al.*, 2014). Creativity is associated with several factors, including knowledge sharing activity (Giustiniano *et al.*, 2016) and social networking (Andersen and Kragh, 2015). However, former studies have overlooked the role of online social technologies in creativity. This paper fills this gap. Now that online social networks have infiltrated people's lives, the question is whether (and how) they can improve creativity.

There is a gap between using online social networking tools and becoming more creative that depends on how people use certain technology features and people's individual characteristics. That is why we propose that online social connectivity (OSC) has an indirect effect on creativity by enhancing personal innovativeness (defined as a willingness to use new technologies).

Two aspects of OSC are: online social knowledge management (OSKM), which is related to a persistent profile of visibility for obtaining, sharing and organizing information, content and ideas and then converting information into organizational knowledge (Alavi and Leidner, 2001; Černe *et al.*, 2014); and online social networking, which is linked to the capacity to connect to other people more easily, and thus strengthen the "social" side of creativity (Fischer *et al.*, 2007).

Unlike previous literature on creativity, we do not ask questions about the strength of the tie (Perry-Smith and Shalley, 2003; Sosa, 2011), number of connections (Zhou *et al.*, 2009), topic of communication (Gilson and Shalley, 2004) and network structure (Burt, 1992). Our study instead shifts the attention to communication pattern, i.e., how to network through social technologies to get better creative outcomes.

We identify two theoretical approaches to hypothesize the relationship between social technologies and creativity through personal innovativeness. One is related to social capital. Social capital is a resource that facilitates organizational and individual activities (Tsai and Ghoshal, 1998), which we split in two arguments. The structural argument is that the expansion (and changing nature) of the social network, which could occur with social technologies, would foster the exchange of information, create peer effects (such as inspiration from the actions of new contacts) and even promote pro-social behavior (e.g. help people in need of information). The relational argument is that social technologies would strengthen trust, team familiarity and organizational values (Huy and Shipilov, 2012), which can facilitate knowledge sharing and enhance the sense of organizational direction.

The second approach emphasizes the usefulness of social technologies for knowledge management in the organization. There are two necessary conditions for the technology–creativity link to happen. First, in order for social technologies to make an impact, people have to use them. The first question is the extent to which people like using technology. Second, we have to make sense of all the additional information coming from the use of technology, and thus converting the information into organizational knowledge (Alavi and Leidner, 2001; Černe *et al.*, 2014).

Theoretical background

Creativity should be described as having multiple contextual levels (Fischer *et al.*, 2005; Schilling and Phelps, 2007), including different levels of aggregation (personal level, team level, organizational level) and also different processes that drive it. In this paper, we placed emphasis on personal innovativeness as the main driver of creativity, more specifically, the role of OSC in fostering the link between personal innovativeness and creativity.

Personal innovativeness and creativity

The obvious point to start analyzing creativity is at the level of people's personality. Early studies have applied different types of creative personality scales to examine the influence

of individual characteristics on creative outcomes (Gough, 1979). Such studies have continue to show, in more recent papers, an interdependence between creativity and emotional states (Baas *et al.*, 2008; Davis, 2009), proactive personality (Gong *et al.*, 2012) and openness to experience (Scratchley and Hakstian, 2001).

Personal Innovativeness on Information Technology (PIIT) serves as a domain-specific derivate of an individual's broad personality trait "openness to experience" (Powell, 2013) that increases the willingness to change and to take risks (Hurt *et al.*, 1977). Former studies have indicated that innovative individuals are often considered to be the "early adopters" of new technologies, to demonstrate a positive approach to novel technologies, and to undertake an innovative behavior (Agarwal, 2000; Agarwal and Prasad, 1998, 1999). Users high with PIIT develop positive perceptions of a technology's usefulness (Agarwal and Prasad, 1998; Jackson *et al.*, 2013; Yi *et al.*, 2006). Moreover, PIIT promotes novel and innovative usage of technology (Wang *et al.*, 2013) where people apply a higher number of new features (Davis and Mun, 2012; Magni *et al.*, 2010; Sun, 2012). Furthermore, Li *et al.* (2013) showed how PIIT moderates employees' intrinsic motivations and their innovative use of information systems.

OSC and creativity: networking

OSC has two distinct areas: networking (establishing new connections or re-connecting with peers) and knowledge management (organizing, sharing and accessing information). We focus on the first aspect and lean on social network theory to explain the link between networking and creativity. Theories explaining creativity as a social process started to appear a few decades ago (Amabile, 1983), and the most important insights to date have been generated by social networks theory.

Scholars have, over the years, focused on different aspects of social networks. Some of them have put an emphasis on the tie's strength. Perry-Smith and Shalley (2003) stated that weak ties (defined as relationships between people who do not know each other well) may have more a positive influence on creative outcomes than strong ties (closely tied relationships, such as friends). They explained this influence of weak ties arguing that it is more likely that non-redundant components of information come from distant relationships. Baer (2010) added to this concept that weaker ties are not enough to enable exposure to diverse viewpoints. However, there are also social creativity studies that underline the role of stronger ties. Sosa (2011) argued that strong ties help generate creative outcomes when they are related to individuals willing to cooperate with each other. Some studies have indicated that strong ties may cause the opposite effect, i.e., they can constrain creativity when individuals receive distinct information (facts or data) compared to distinct frames (interpretations) (Perry-Smith, 2014; Perry-Smith and Mannucci, 2017).

Another network and creativity-related issue studied by researchers is the number of connections. Zhou *et al.* (2009) discovered an interdependence between personal creativity and the number of weak ties. The authors observed that individuals whose number of weak connections was higher distinguished themselves with a greater creativity than individuals with a number of connections at lower levels. Scholars have also studied the topic of communication. For example, Gilson and Shalley (2004) stated that the level of creativity in a team depends how much team members socialize with each other.

Finally, many scholars have studied network structure. Burt (2004) argued that creative ideas are brought by people whose networks span gaps between actors, as these people operate in highly diversified environments with access to novel information. Kidane and Gloor (2007) discovered a positive interdependence between creativity and adjustments related to betweenness centrality. Hirst *et al.* (2015) focused on non-redundancy in terms of interconnections, which turned out to be positively associated with individual creativity.

Online social networking as a mediator of personal innovativeness and creativity. Networking through online social technologies can enable access to diverse sources of information. Moreover, because social interactions in online communities ensure a dynamic flow of resources and ideas that may be developed independently from their authors, knowledge is also being generated (Faraj *et al.* (2011). Social technologies can also facilitate passive transfer of information between linked actors as well as information flow among actors who do not stay in any relationship (Kane *et al.*, 2014). These technologies contain many useful tools that were developed to search for individuals with a certain expertise (Piskorski, 2011), and in this way they may support a change in network structure that brings positive outcomes in terms of information diversity (Wu, 2013). In contrast with online technologies, offline settings are related to some traits and past experiences that limit possibilities in change of social networks (Powell *et al.*, 2005).

Beyond information diversity, social technologies increase social communication (Wu, 2013). Thanks to abilities such as instant messaging or following (Panahi *et al.*, 2012), new information can now make more sense. This is particularly important for capturing tacit knowledge that resides in individuals' minds.

Finally, pro-social behavior can be a vehicle by which individuals react to the needs and business problems of other teams, and social technologies facilitate allocating attention. Researchers have indicated that allocation attention might be driven by attention allocation, which is driven by the knowledge provider–seeker relationships (Constant *et al.*, 1996) and knowledge provider-problem matches (Haas *et al.*, 2015):

H1. OSC positively mediates the relationship between personal innovativeness and creativity.

H1a. Online social networking (acquiring new connections and re-connecting) through online social technologies positively mediates the relationship between personal innovativeness and creativity.

OSC and creativity: knowledge management

Research has shown that the transfer of knowledge between employees may bring many positive outcomes, such as innovation (Hargadon and Sutton, 1997; Obstfeld, 2005) and organizational creativity (Giustiniano *et al.*, 2016). We hypothesize that social technologies have "knowledge management" affordances that make individuals more likely to make sense of information and thus become more creative. As proposed by Nonaka's framework, knowledge creation always involves a process of "socialization," which allows transforming tacit knowledge into condified one and then recombining it with other sources of knowledge to generate new ideas (Nonaka and Von Krogh, 2009).

OSKM as a mediator of personal innovativeness and creativity. Knowledge is good for creativity and firm innovation. Yet, information and knowledge are usually costly to transfer and remain "sticky" within organizations (Von Hippel, 1994; Szulanski, 1996). Even if information does flow freely, when it comes from different organizational units (or outside of it) it remains underused to the extent to which people do not understand it or are unable to see their relevance to their own work (Dougherty, 1992; Nonaka and Von Krogh, 2009). The interaction between processes associated with knowledge management and social processes matter. The knowledge creation process involves making sense of information, a process which is always discursive and therefore in some respect social (Berente *et al.*, 2011). As previously mentioned, the social and knowledge management processes are connected. Knowledge is created when individuals exchange information among each other (Tsoukas, 2009) and when they undertake social interaction (Inkpen and Tsang, 2005; Obstfeld, 2005). It is only then that these individuals are able to produce creative outcomes. Tacit knowledge,

in particular, is exchanged informally thanks to socialization (Swap *et al.*, 2001) because dynamic and unstructured processes are difficult to be defined and codified.

It is known that the process of making sense of information is important for becoming creative in projects with high complexity and long-term horizons (Drazin *et al.*, 1999). The process of sense-making is determined by how information is interpreted (storytelling and narrative) and on organizational memory to facilitate a course of action.

We hypothesize that social technologies have the potential to create narratives around knowledge through contextual details. Narratives positively influence shared understanding among people (i.e. common goals, organizational culture and organizational identity) and help achieve a sense of direction. This inspires individuals to create new ideas (Fenton and Langley, 2011) and allows to use knowledge to solve problems and innovate.

We also hypothesize that social technologies can facilitate organizational memory by tracking ideas (Tippins and Sohi, 2003). Organizational memory was already discussed by Alavi and Leidner (2001) in their discussion related to knowledge management systems but social technologies can improve the cognitive aspect by leveraging single events of personal innovativeness, that are rather difficult buy the traditional work settings which do not store memory of such moments:

H1b. OSKM positively mediates the relationship between personal innovativeness and creativity.

Other factors (controls) and creativity

Creativity is also driven by the intrinsic motivation of the person, such as the willingness to engage in analytical thinking (Zhang and Bartol, 2010). Intrinsic motivation refers to behaviors that are driven by internal factors (Ryan and Deci, 2000). Such motivation facilitates individuals' tendency to be risk taking, curious and, as a result, more creative (Utman, 1997).

Some other personal characteristics are related to how people work. Individual differences in creative outcomes are often driven by the employee's cognitive style, including things like how they approach complex problems and the type of information they consulted (Amabile, 1983; Amabile *et al.*, 1996; Masten and Caldwell-Colbert, 1987). On the one hand, "adaptors" operate within specific frameworks without questioning their effectiveness; innovators, on the other hand, a take more risky and new ideas. Innovators break the typical way of thinking (Kirton and De Ciantis, 1986) and approach problems from a different perspective than others (Singer, 1990).

Methodology and measurements

The theoretical discussion above leads to the model in Figure 1. We propose using a latent variable to capture OSC composed of the ability to use online social technologies to improve social networks in organizations and the ability to use online social technologies to improve searching and organizing information (i.e. to improve knowledge management by finding information more quickly by capturing tacit knowledge, etc.). The circles in the figure represent latent variables and the rectangles represent measurement variables.

Sampling and data collection

In this study, a questionnaire was sent to 475 engineers to measure the use of digital technologies and work practices. These are highly qualified and trained staff working for a multinational company in Europe. Engineers particularly fit into the empirical design of this study as they are the source of creativity (Tan and Chang, 2015), and the importance of research on the influence of new technologies on engineers' creativity was stated a few decades ago (Azani and Khorramshahgol, 1991).

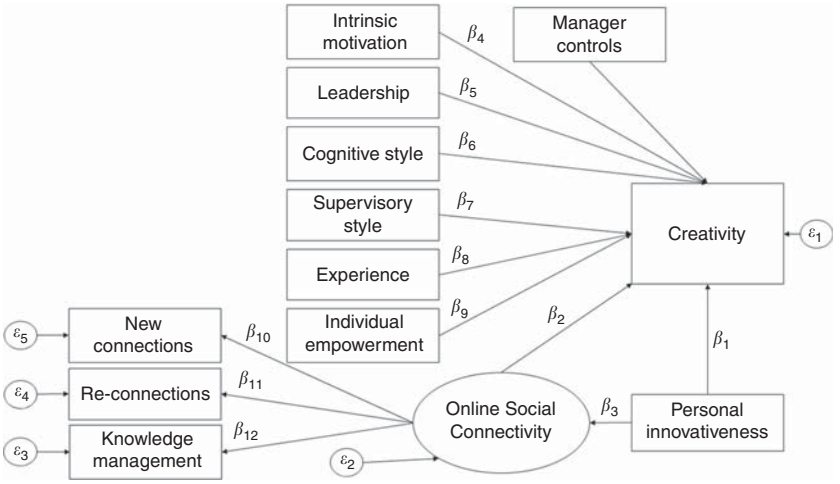

Figure 1.
The model

To measure creativity in the workplace, 30 managers were asked to evaluate engineers who on their teams in terms of creativity performance. Each individual in the sample received an online survey. The research team obtained separate questionnaires from 140 engineers and 12 managers. The response rate is 30 percent for engineers and 67 percent for managers. After matching the responses from engineers and managers, we had to drop 40 engineers who had not been evaluated by a manager. We dropped 20 additional cases due to excessive missing data. Therefore, the final sample consists of 80 engineers evaluated by 12 managers. Sample demographics are shown in Table I, descriptive statistics and sources are presented in Table II, and a correlation matrix is in Table III.

Measurement design

A multiple-item, seven-point Likert-type scale (1 = strongly disagree; 7 = strongly agree) was applied for all constructs except for the creativity score. Each manager referred to four statements on the creative performance of each individual on his or her team from 1 to 10 (1 – not at all creative performance; 10 – very creative performance). The managers replied to the creativity questionnaire and the engineers to all other questionnaires. The creativity scale was adapted from Perry-Smith (2006). Cronbach's α for creativity was 0.97. To rule out any bias stemming from heterogeneity in different managers' assessments, we used the creativity score relative to the mean of each team:

$$\text{relative}_{\text{creativity}_j} = \frac{\text{creativity}_j}{\sum_{i=1}^{i=N} \text{creativity}_i / N},$$

	Mean	SD	Max.	Min.
Age	37.67089	9.483753	65	23
Working years	3.240625	3.476286	17	1
Gender (1 = male)[a]	1.075	0.2650531	2	1
n	80			

Note: [a]Six females in total

Table I.
Demographics

		Type and source	Cronbach's α	Mean	SD	Max.	Min.
Creativity	Dependent variable	7-point Likert (Perry-Smith (2006)	0.97	1	0.284	2.042	0.134
Personal Innovativeness	Predictor	7-point Likert (Agarwal and Prasad (1998)		5.34	0.995	6.833	2.167
New connections	Mediator	7-point Likert *ad hoc*	0.82	3.654	1.693	7	1
Re-connections	Mediator	7-point Likert *ad hoc*	0.83	3.661	1.690	7	1
Online social knowledge management (OSKM)	Mediator	7-point Likert *ad hoc*	0.94	4.575	2.048	7	1
Intrinsic motivation	Control	7-point Likert *ad hoc*	0.76	6.006	0.841	7	4
Creative process engagement	Control	7-point Likert (Zhang and Bartol, 2010)	0.88	5.640	0.817	7	3
log(experience)	Control	Log of years		1.228	0.604	2.890372	0.693
Leadership	Control	7-point Likert (Ahearne *et al.* (2005)	0.90				
Individual empowerment	Control	7-point Likert (Zhang and Bartol (2010)	0.61	4.76	0.990	6.8	1.8
Supervisory Style	Control	7-point Likert (Oldham and Cummings (1996)	0.69	3.118	0.923	7	1

Table II.
Descriptive statistics and sources

where the relative creativity for engineer j is calculated dividing his/her creativity score ($creativity_j$) by the average score of the team graded by the same manager. Our dependent variable measures the creativity of engineers with respect to their peers within the same team.

We used a scale developed by Agarwal and Prasad (1998) to obtain personal innovativeness. The Cronbach's α for personal innovativeness was 0.83.

OSC was validated with a confirmatory factor analysis. The measurement variables used are getting new connections (Cronbach's α: 0.82), which consists of six items; re-connecting with other users (Cronbach's α: 0.83), with six items as well; and OSKM, which consists of seven items measuring how engineers manage the knowledge through social media in relation to issues such as time, usefulness, diversity, tacitness, motivation and connections (both new and re-connections) which appeared in previous knowledge management studies (Offsey, 1997; Lewis *et al.*, 2003; Hult *et al.*, 2006; Acar *et al.*, 2017) (Cronbach's α: 0.94).

Control variables, including intrinsic motivation, were measured with four items capturing the enjoyment in the tasks related to the work description. Cronbach's α for intrinsic motivation was 0.76. We measured creative process engagement with 11-item scale concerning problem identification, information searching, and idea generation (Zhang and Bartol, 2010); (Cronbach's α: 0.88).

Leadership, supervisory style, individual empowerment and experience were included as control variables, as they may affect the engineers' creativity assessments (Khalili, 2016). We measured leadership with nine items that give a measure of leadership role of the engineer within their team (Ahearne *et al.*, 2005; Cronbach's α: 0.90). Supervisory style was measured with four items, which measures supervisors' micro-management style (Oldham and Cummings, 1996; Cronbach's α: 0.69). Individual empowerment was measured with five items related to the control of an engineer's job-related tasks and responsibilities (Zhang and Bartol, 2010; Cronbach's α: 0.61). We measured experience with the log of years because

Table III.
Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Creativity	1									
2. P. Innovativeness	0.220	1								
3. New connections	0.230*	0.318**	1							
4. Re-connections	0.181	0.257*	0.869***	1						
5. OSKM	0.193	0.222*	0.823***	0.828***	1					
6. Intrinsic motivation	−0.114	0.245*	0.101	0.149	0.138	1				
7. Leadership	0.0779	0.209	0.135	0.0988	0.197	0.326**	1			
8. Creative proc. eng.	−0.045	0.363***	0.163	0.168	0.268*	0.574***	0.467***	1		
9. Ind. empowerment	0.0853	0.169	0.0762	0.0789	0.113	0.0747	0.0611	0.275*	1	
10. Supervisory Style	0.0641	0.0381	0.188	0.138	0.256*	0.117	0.155	0.249*	0.0904	1
11. Log Experience	0.136	−0.165	−0.191	−0.165	−0.160	0.0328	−0.223*	−0.153	0.0973	−0.210

Notes: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

each employee is enrolled in the firm. We controlled for experience because more experienced employees may have acquired abilities that rank them higher in their creativity assessment. All these control variables where measured using a seven-point Likert scale. The details of the construct are shown in the Appendix.

Empirical strategy

Our empirical strategy relies on fixed-effects structural equation modeling with a quasi-experimental design. An appropriate empirical strategy is required to obtain appropriate internal validity inferences in our cross-section non-special purpose setting. Stone-Romero and Rosopa (2008) documented how an inappropriate research design biases estimates of mediation models. Our approach is to use one quasi-experiment to test our assumed causal model. Our empirical design goes beyond the standard two non-random group design. In particular, we grouped the engineers according to their manager, with 12 groups in total. We then introduced a fixed-effects regression (one dummy per manger). Thus, we controlled statistically for any unobservable cofounds that might affect measurement at the manager-group level (Allison, 2009). However, this method presents a drawback that stems from the fact that our variable of interest is sampled at the engineer level, but measured at a higher level (i.e. manager) (Moulton, 1990). To minimize the effect of serial correlation among groups, we used clustered robust standard errors (Cameron and Miller, 2011).

To calculate direct, indirect and total effects of mediation, we followed Baron and Kenny (1986), who divided the total effect of a mediated variable as the sum of the direct effect β_1 and the indirect effect ($\beta_2 \times \beta_3$). To test for the significance of the indirect effect, we used a Sobel (1986) test. When the indirect effect is significant, we can compute the relative importance of the mediator by:

$$\%\ \text{Indirect effect} = \frac{(\beta_2 \times \beta_3)}{(\beta_2 \times \beta_3) + \beta_1}.$$

Empirical results

We began by estimating the full model, which includes a set of control variables (intrinsic motivation, leadership, creative process engagement, supervisory style, experience and individual empowerment) along with a set of manager dummy variables. Additionally, we used robust standard errors clustered by manager.

The model fit indices lie within acceptable boundaries. The root mean squared error of approximation is 0.04, which is sufficiently close to 0, assuring that the population co-variances are consistent. The Bentler comparative fit index is close to 1, meaning that there is a good fit of our target model vs the independent model (where co-variances are zero). The standardized root mean squared residual is 0.057, and thus we do not have to worry excessively about correlated residuals. Overall, these values suggest a good fit between the model and the observed data.

The reliability of the measurement variables in relation to the latent OSC construct is reported in the third column of Table IV. These squared multiple correlations suggest that the construct OSC accounts for around 15 percent of the variance in each measurement variable.

Most of the control variables reported in Table IV have expected signs. Leadership (β_5), supervisory style (β_7) and experience (β_8) are significantly and positively associated with creativity. The results suggest that more experienced individuals with leadership attributes with a non-micro manager tend to be more creative on their job. We found no significant evidence that intrinsic motivation (β_4), creative process engagement (β_6) or individual empowerment (β_9) had an effect on creativity.

	Direct effect on creativity	Direct effect on OSC	OSC measurement (latent)
Personal Innovativeness (β_1)	0.075** (0.03)		
Online Social Connectivity (β_2)	0.005* (0.00)		
P. Innovativeness- > OSC (β_3)		3.269*** (1.25)	
Intrinsic motivation (β_4)	−0.076 (0.05)		
Leadership (β_5)	0.076* (0.04)		
Creative proc. eng. (β_6)	−0.055 (0.05)		
Supervisory Style (β_7)	0.022* (0.01)		
log(expereince) (β_8)	0.159*** (0.06)		
Individual empowerment (β_9)	0.017 (0.03)		
New connections (β_9)			0.140*** (0.01)
RE-connections (β_{10})			0.150*** (0.01)
Knowledge Management (β_{11})			0.150*** (0.01)

Notes: Observations: 80; root mean squared error of approximation (RSMEA): 0.04; comparative fit index (CFI): 0.977; standardized root mean squared residual (SRMR): 0.057; robust standard errors in parentheses, clustered by manager; manager dummies included but not reported. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table IV. SEM mediating effect of latent online social connectivity

Focusing on our variables of interest, we found positive and significant evidence that personal innovativeness (β_1) ($p < 0.05$) and connectivity (β_2) ($p < 0.1$) had a significant positive direct effect on creativity. In line with our theoretical arguments, these results confirm that more innovative people show higher levels of creativity.

However, it is not the direct effect of OSC that we interested in, but rather the indirect effect that accounts for OSC's enhancing effect of personal innovativeness on creativity. To correctly test our hypothesis, we computed the indirect and total effects in the first row of Table IV. The indirect effects of OSC is positive (0.017) and significant ($p < 0.10$). The total effect is the statistical sum of both direct and indirect effects, which are positive (0.093) and significant ($p < 0.01$). Therefore, 18 percent of the association between personal innovativeness and creativity is explained by OSC.

To detangle the individual effects of networking and knowledge management, we have estimated a model on the manifest level, examining the mediating role of new connections, re-connections and knowledge management independently. The results of the direct effect, indirect effect and total effect are reported in rows 2, 3 and 4 for new connections, re-connections and knowledge management, respectively. It is readily seen that the only significant, indirect effect is that of new connections. In this model, 21 percent of the total effect of personal innovativeness on creativity is explained by new connections. For coherence, we have calculated the percentage of the indirect effect of re-connections (14 percent) and knowledge management (13 percent). However, these values should be interpreted with caution, as the indirect effect of these variables was not statistically significant (Table V).

	Direct effect β_1	Indirect effect $(\beta_2 \times \beta_3)$	Total effect $(\beta_2 \times \beta_3) + \beta_1$	% Indirect effect $(\beta_2 \times \beta_3)/((\beta_2 \times \beta_3) + \beta_1)$
Personal innovativeness (β_1) mediated by OSC (latent)	0.075**	0.017*	0.093***	18
Personal innovativeness (β_1) mediated by new connections	0.071**	0.019*	0.090***	21
Personal Innovativeness (β_1) mediated by re-connections	0.081**	0.013	0.093***	14
Personal innovativeness (β_1) mediated by knowledge management	0.083**	0.012	0.095***	13

Notes: *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table V. SEM mediating effect of the individual factors online social connectivity

Conclusions

As individuals increasingly use external online social technologies such as Twitter or LinkedIn and internal ones such as Yammer or Chatter for work-related purposes, it is crucial for organizations to understand to whom they should assign these technologies and how to use them in order to generate new ideas, which are the basis for innovation and competitive advantage (Sadowski, 1995). Our study reveals several insights that might be useful for current organizations in terms of increasing employee on-the-job creativity.

First, our results show that being innovative with new technologies is positively associated with engineers' creativity. This finding relates to the most recent study performed by Parise *et al.* (2015). They stated that just participating in diverse networks does not suffice for enhancing creative outcomes because additional capabilities, such as ability to identify and exploit new ideas, are needed. Moreover, similarly to research examining the link between creativity and individual features, such as employee engagement in cognitive processes (Zhang and Bartol, 2010), personality (Mumford and Gustafson, 1988; Zhou, 2003), or intrinsic motivation (Grant and Berry, 2011), our study demonstrates that these engineers who distinguished themselves in a willingness to play with new technology were evaluated as being more creative.

Kobe and Goller (2009), who studied the creativity of engineers, examined the prerequisites of creative outcomes, such as expertise, cognitive abilities and, motivation. In the category of personality traits, Malakate *et al.* (2007) related features such as risk taking and self-confidence to personal innovativeness.

Second, our study suggests that OSC mediates the effect of personal innovativeness on creativity. That is, being innovative with new technologies enhances the positive association of personal innovativeness and engineers' creativity.

This result relates to studies supporting positive perceptions of the technology's usefulness by users high in PIIT (Agarwal and Prasad, 1998; Jackson *et al.*, 2013; Yi *et al.*, 2006) as well as studies indicating benefits, such as diversity and social communication, of online social networks that influence positively creative outcomes (Wu, 2013). In our study, OSC consists of making new connections, re-connecting through social media and OSKM. We found that innovative engineers tend to be more creative if they use social media to find and contact engineers who do not belong to their connections, but not if they renew their relationships with previously acquainted engineers.

Third, we found no evidence that the interdependence between creativity and personal innovativeness is significantly mediated by OSKM, which is explianed as the ability to use online social technologies to improve searching and organizing information. In the study undertaken by Giustiniano *et al.* (2016), heavy use of online communication technologies negatively moderated the interdependence between knowledge collection and organizational creativity. To explain this finding, the authors indicated that creativity is related to tacit knowledge, which is not easily transferred through communication technologies. Similarly, in our study, engineers achieved better creative outcomes from social interactions with people than interactions with data.

Theoretical implications

Precious research has examined the role of the strength of the tie (Perry-Smith and Shalley, 2003; Sosa, 2011), number of connections (Zhou *et al.*, 2009), topic of communication (Gilson and Shalley, 2004) and network structure (Burt, 1992). Our study shifts the focus to a communication pattern, i.e., whether getting new connections or r-econnecting brings better creative outcomes. Research related to communication patterns has already captured the attention of some scholars. For example, Madjar *et al.* (2002) indicated that work-related (coworkers and supervisors) and non-work (friends and family members) support positively influenced creative performance. Andersen and Kragh (2015) argued that supervisors need to

define the creative space and act in the creative space. Our study suggests that communication patterns, especially with that use of networking platforms, need further analysis.

Our results also show that in a digital age some individual characteristics such as personal innovativeness matter more than others in terms of creative outcomes. Moreover, another theoretical implication is that personal innovativeness is mediated by connectivity, consisting of making new connections, re-connecting through social media and OSKM. Therefore, our contribution is to see how the use of social technologies disrupts current wisdom. Social technologies would affect creativity by exacerbating (or possibly reducing) the effects of the conventional creativity drivers, such as the creative process engagement or the intrinsic motivation of each person. For instance, for people who tend to approach problems with a data-driven analytical mindset (which in itself would be good for creativity), the additional information coming from their use of social networks would facilitate their creative output as they produce innovative ideas or new solutions to business problems.

Practical implications

Organizations may use the findings of our study in their employee selection procedures. This suggestion has already appeared in other studies (Walley *et al.*, 2017). However, relationships between personal innovativeness and creative outcomes have not been discussed. According to our study, an assessment of personal innovativeness in the case of engineers may bring advantages in attaining higher levels of creativity.

Another important implication concerns how employees should use social media to facilitate their creativity. It is not enough simply to register on internal or external social media to enhance creative performance. Additional networking activities such as connecting to new employees through social media, connecting to new people working for partner companies, or connecting to new external professionals are needed to ensure better connectivity throughout an organization.

Drawing on the concept of organizational memory developed by Alavi and Leidner (2001), our study reveals that online social technologies can improve the cognitive aspect by leveraging spontaneous moments of personal innovativeness. Companies willing to improve their employee creativity should implement platforms with user-friendly functionalities of storing and searching data (Olszak *et al.*, 2018). This way, organizations may encourage employees to use these platforms to find information more quickly and capture tacit knowledge.

Limitations

As a closing remark, this study presents certain limitations. We surveyed a particular type of employees, i.e. engineers. We decided to examine individuals in engineering positions because they often serve as entrepreneurs in organizations (Menzel *et al.*, 2007). However, another studies are needed to examine online social technologies and creativity for other positions.

Moreover, our study was conducted in the USA, where online social networking technologies were born. The influence of OSC and OSKM on creativity might be different in European countries.

Additionally, our research design has certain caveats. Our fixed-effects clustered SEM analysis allows us to have moderate internal validity inferences. Therefore, we cannot completely rule out alternative co-founding factors that were not included in our model to explain our statistically significant results.

Finally, data were obtained from engineers working for a large IT company on the Fortune 500 list. Future research could examine whether results for small and medium enterprises reflect the findings from this study.

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Appendix

Online Social Connectivity

New Connections

(1) Level of agreement: social media has helped me connect to ABC employees I did not know before.

(2) Level of agreement: social media has helped me connect to people working for our partner companies I did not know before.

(3) Level of agreement: social media has helped me connect to external professionals (i.e. experts not working neither at ABC nor in partner companies) I did not know before.

Re-connections

(1) Level of agreement: using social media has helped me communicate with more colleagues from other ABC divisions with which I would have not communicated otherwise.

(2) Level of agreement: using social media has helped me communicate with employees of our partner companies (e.g. Cisco, Microsoft etc.) with which I would have not communicated otherwise.

(3) Level of agreement: using social media has helped me communicate with more experts and peers outside ABC and ABC's partners (e.g. other engineers, etc.) with which I would have not communicated otherwise.

Online social knowledge management

(1) Level of agreement: social media has allowed me find information more quickly.

(2) Level of agreement: social media has allowed me obtain useful information for my work I was not actively searching.

(3) Level of agreement: social media has allowed me access more diverse perspectives about current work issues.

(4) Level of agreement: social media has allowed me access capturing tacit knowledge (aspects of tasks, routines, and know-how in ABC) more easily.

(5) Level of agreement: social media has given me the motivation to share information I would not share otherwise.

(6) Level of agreement: social media has helped me find people with professional interests close to those of mine.

(7) Level of agreement: social media encourages me to explore new connections.

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