Bulding ambidexterity through creativity mechanisms: contextual drivers of innovation success

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Abstract

Do creativity methods consistently produce a significant net effect on innovation? Are the impacts of creativity methods related to operating context? Based on an ambidexterity perspective, we examine the effectiveness of different creativity methods on overcoming the tensions of the innovation process at individual and team levels. Drawing on European Union Community Innovation Survey (CIS2010) data collected from 23,537 firms, we estimate causal effects of creativity on innovation through a multivalued treatment effect methodology. Our results show that implementing ambidexterity in creativity methods increases the firm´s propensity to innovate and to introduce a market novelty.

Keywords: creativity, innovation, ambidexterity

Introduction

Current research on innovation puts creativity at the heart of business (Amabile and Khaire, 2008; Sarooghi et al., 2015). The success of new product development efforts, for example, depends to a great extent on the creativity of the underlying ideas (Scanlon and Jana, 2007). Creativity is commonly defined as the production of ideas that are both original and useful (Amabile, 1996; Runco, 1997; Smith et al., 1995; Sternberg, 1999), and innovation is the implementation of these ideas into new products and processes (Sarooghi et al., 2015). Hence, creativity is viewed as the first stage of an innovation process, followed by implementation.

Previous research has consistently documented that the production of ideas is a positive predictor of idea implementation (Axtell et al., 2000; Axtell et al., 2006). However, the correlation between creativity and innovation needs clarification (Baer, 2012) because it is characterized by tensions (Lewis et al., 2002), paradoxes (Miron et al., 2004), contradictions (King, 1991), and dilemmas (Benner and Tushman, 2003). Basically, idea generation emphasizes exploration and divergent thinking. Idea implementation does the opposite, emphasizing exploitation and convergent thinking. In light of the need to deal with generating new ideas (exploration) and implementing those ideas (exploitation) during the innovation process, scholars suggest that creativity and innovation could be complementary activities (Bledow et al., 2009). From this integrative perspective, creativity does not act only as an input (independent process) for innovation;

instead, creative ideas interact with implementation through an intertwined and mutually dependent process (Bledow et al., 2009). Accordingly some authors (Bledow, 2009; Saroogui et al., 2015) emphasize the need to adopt an ambidexterity perspective, arguing that organizations should be able to overcome conflict and maintain a balance between exploration and exploitation as key to the success of an innovation process.

Additional research suggests that aspects which facilitate exploration are likely to inhibit exploitation (He and Wong, 2004) but this tension may be exacerbated or mitigated by mechanisms to encourage creativity. Some of these methods, like job rotation and team work, focus on promoting convergent thinking and the ability to discuss conflicting ideas (idea implementation); other methods, like brainstorming and creativity training, might do the same with divergent thinking (idea generation).

Our study aims to explain the heterogeneity of relationships that creativity mechanisms have with innovation. Based on the ambidexterity literature (Bledow et al, 2009; Rosing, et al., 2011; Sarooghi et al., 2015), we make two main points. First, we argue that the traditionally studied mechanisms to promote creativity are too broad in nature, as they might either foster or hinder innovation. Second, given the complexity of the innovation process, we propose that a combination of different creativity mechanisms is more effective to promote innovation than a single creativity method.

Our research directly answers two different research questions. First, do creativity methods consistently produce a significant net effect on innovation? Idea generation and idea implementation remain doggedly disconnected (Anderson et al., 2014), but by applying an ambidexterity perspective to creativity mechanisms, we integrate two phenomena that have clear overlaps.

Our second research question is: are the impacts of creative methods related to operating context? As the adoption of techniques dedicated to creativity has grown to include a wider scope of businesses, researchers have begun to question the applicability and effectiveness of creativity in certain contexts. Although an extensive review of literature shows a variety of factors that individually affect creativity (Chua et al., 2015) or innovation (Camisón-Zornoza et al., 2004), there is a need for more research analyzing the factors that shape the creativity-innovation link (Baer, 2012; Sarooghi et al., 2015; Perry-Smith and Mannucci, 2017). This research contributes to the literature by indentifying conditions under which creativity methods may be more or less effective in terms of innovation. Our examination of these factors suggests how to capitalize on creative efforts.

Using European Union Community Innovation Survey (CIS2010) data collected from 23,537 firms, we address the foregoing questions, estimating causal effects of creativity on innovation success through a multivalued treatment effect methodology. This methodology rethinks usual causal relations in a counterfactual stance and corrects the bias of traditional regression models to address causal inference in observational studies (Nichols, 2007). More precisely, treatment effects methodology focuses the analysis on the parameters of the distribution that the outcome variable (innovation success) would have had under each level of treatment (creative method) (Cattaneo et al., 2013).

Conceptual background and hypothesis

Creativity—the production of ideas that are simultaneously novel and useful (Amabile, 1996)—is intimately linked to innovation, which entails the conversion of ideas into new products, services, or ways of doing things (e.g. Kanter, 1988; West, 2002). Most studies on innovation differentiate at least two activities in the innovation process: idea generation and idea implementation (e.g. Amabile, 1988; Bledow et al., 2009; Saroogui

et al., 2015). These two activities are potentially conflicting and put inconsistent psychological demands on individuals, teams, and organizations (Smith and Thusman, 2005). Idea generation is exploratory in nature, but idea implementation is exploitative (March, 1991). In his seminal work, March (1991) acknowledged the inherent trade-off between exploration and exploitation, noting that exploration involves "search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation" and exploitation involves "refinement, choice, production, efficiency, selection, implementation and execution" (p. 71). Based on these definitions, we highlight how exploration helps renew and expand a firm's knowledge base and how exploitation enables firms to convert existing knowledge into new products or services.

Idea generation and idea implementation are very different in nature, but some scholars have suggested that these conflicting forces can be handled and integrated into successful innovation (Smith and Tushman, 2005; Bledow et al., 2009). Scholars suggest that ambidexterity theory is useful for managing conflicting demands at multiple organizational levels in the context of innovation in organizations (He and Wong, 2004; O'Reilly and Tushman, 2008; Bledow et al., 2009). Ambidexterity is the ability to manage tasks that imply some form of trade-off. It means that an organization should devote sufficient attention to manage and reduce the tensions that arise between exploration to ensure future viability (e.g., idea generation) and exploitation to ensure current viability (idea implementation) (Levinthal and March, 1993).

Managing Ambidexterity through Creativity Mechanisms

One approach to reconciling these conflicting findings is to apply the concept of ambidexterity to creativity methods. Recent research has demonstrated that ambidextrous idea generation has a positive impact on innovation (Gurtner and Reinhardt, 2016). Thus, we suggest that a combination of creativity methods is necessary for an effective innovation process. That is, creative methods need to foster both divergent and convergent thinking and be able to flexibly switch between them. Because tensions between creativity and innovation span all levels of an organization, this research examines, separately, the trade-offs between opposing logics underlying the innovative process at individual and team levels. We focus on these two levels for the sake of illustration and brevity, although arguments at the organizational level also could be made.

At the individual level, creativity can be elicited many ways. Burroughs and colleagues (2011) identify individual training and rewards as key facilitators in relationships with creativity. Such elements clearly improve performance for creativity at the individual level, but the innovation process is not solely a matter of divergent thinking. It also requires convergent thinking skills that allow implementation. To achieve ambidexterity, individuals must deal with the tensions created by engaging in high-creativity breakthrough activities (divergent thinking) along with detailed aspects of subsequently converting ideas into innovations (convergent thinking) and integrate both kind of activities towards successfull innovation through expertise in the problem solving domain.

Job rotation can help individuals act as problem solvers and become ambidextrous on the job. Because it is impossible to innovate unless individuals have knowledge and experience in the domain upon which they can later reflect to solve problems more creatively (Amabile, 1988), job rotation gives individuals relevant technical skills and special talent in the domain in question, providing a set of cognitive pathways for solving organizational problems. The role of expertise in managing trade-offs includes attention to detail (Miron et al., 2004), prevention focus (Forsteret al., 2003), goal oriented (Hacker,

2003) as well as systematic versus intuitive problem solving style (Scott and Bruce, 1994). Empirical research has shown that the effect of expertise is so strong that overwhelmes the trade-offs between exploration and exploitation at individual level (Taylor and Greve, 2006).

Thus, providing individuals with creativity-relevant skills and/or extrinsic rewards to use those skills is not a fully sufficient basis for becoming ambidextrous. Creativity mechanisms operating on an individual level may be less effective in terms of innovation if not accompanied by profound and diverse experience in the problem-solving domain. In so doing, job rotation enables individuals to become ambidextrous in successfully performing both explorative (idea generation) and exploitative (idea implementation) activities to such an extent that the tension between the two activities dissolves.

Hypothesis 1. The effect of creativity on innovation is positively associated with the ambidexterity of the creativity mechanisms at the individual level.

In team settings, group versus individual creativity depends on individuals working together in a complex social system (Woodman et al., 1993). Work-related communication and interpersonal interaction within the team comprise the raw materials upon which the individual can draw throughout the creative process. This social view presumes that team members have access to a broad range of perspectives, skills, and information that they can use to generate new ideas (Tesluk, et al., 1997). But team members are required not only to use divergent thinking to generate ideas; they also have to aggregate their individual ideas into the group's innovative outputs through a convergent process such as conformity and consensus seeking (George and Zhou, 2007). This yields a useful dichotomy between the exploration of new ideas and the alignment of team members toward the common goal of innovation (Miron et al., 2004).

At the team level, ambidexterity requires variability of individuals in terms of cognitive style, skills, expertise, and personality, as well as the integration of those variables into innovative outputs to achieve other performance criteria such as quality and efficiency (Bledow et al., 2009). This differs from brainstorming in which the goal is the individual production of multiple new ideas or divergent thinking. Brainstorming is clearly relevant for idea generation, but this tool is of little value if it is not turned into an innovative output—a finished product, service, or process (Gobble, 2014; Basadur et al., 2012). Previous research suggests that when there is a high level of interaction, discussion, and constructive debate, teams facilitate the development and refinement of ideas (e.g., Perry-Smith and Shalley, 2003), factors that the empirical literature has shown to be central to conversion of ideas into innovations. Thus, at the team level innovation succeeds not only because members stimulate divergent new ideas, but because they excel at implementation of new ideas. Accordingly, this research posits that multidisciplinary teams are able to use ambidexterity, combining performance episodes in which individual team members work alone and together (Bledow et al., 2009). Multidisciplinary teams are particularly effective if they value diversity in terms of experience and cognitive styles and offer flexibility to creators to generate ideas that later are shared and discussed, connecting individual contributions to the problem at hand. The necessity to shape a team supportive of exploration and exploitation generates our following hypothesis.

Hypothesis 2: The effect of creativity on innovation is positively associated with the ambidexterity of the creativity mechanisms at team level.

Contextual Drivers of Creative Mechanisms

Our final research questions address potential relations between the impact of creative mechanisms on innovation and the operating context of implementation. A variety of moderating factors may affect the creativity-innovation relationship, but Saroogui et al. (2015) highlight in their meta-analysis these areas as especially relevant: organization size, R&D budget, and type of industry.

Firm size is strongly indicative of the availability and diversity of resources a firm possesses at its immediate disposal and is recognized as a necessary condition to implement complex, ambidextrous strategies and realize the benefits of ambidexterity (Cao et al., 2009; Voss and Voss, 2013). Conceptual arguments indicate that the simultaneous pursuit of exploration and exploitation is both possible and desirable for firms that have access to sufficient resources and capabilities (Cao et al., 2009). Larger firms have greater slack in using resources to stimulate creativity (Damanpour, 1991; Voss et al., 2008) even as they maintain established routines to internalize the variation-selection-retention process (Burgelman, 1991; Cao et al., 2009; Voss and Voss, 2013) associated with innovation. Likewise, larger firms provide more fertile ground (e.g., more financial slack, relevant market or product experience) for the development of detailed implementation plans for innovation. In contrast, smaller firms may lack the resources, capabilities, and experience required to manage the two conflicting knowledge-related activities during the innovation process. We posit:

> *Hypothesis 3: The positive effect of creativity on innovation is stronger for larger firms than for smaller firms.*

Firms invest in R&D to improve performance via innovation. Investment in R&D gives firms the skills and abilities to identify, assimilate, and exploit various resources and knowledge and to absorb new expertise (Cohen and Levinthal, 1990). Previous research also demonstrates that R&D investment encourages creative ideas and activities (Zhou et al., 2005) that help a firm identify new opportunities for technological development and discovery of new products. This enhances the breadth and depth of relevant knowledge available to the firm and increases the firm's willingness to explore new ideas and develop new products (Lavie and Rosenkopf, 2006). Therefore, R&D investment exerts a positive impact on both exploration and exploitation (Zhou and Wu, 2010), which is required from an ambidexterity perspective. Thus:

> *Hypothesis 4. The effect of creativity on innovation is positively associated with the firm's R&D investment.*

Interestingly, the influence of ambidexterity on performance differs across industries (Blindenbach-Driessen and Ende, 2014). Research has found that ambidexterity exerted a positive influence in manufacturing, scientific, and technical service but not in other industries (Derbyshire, 2014), providing evidence that the external environment can influence the innovation process. Three characteristics make services innovation significantly different from manufacturing innovation: intangibility, co-terminality, and human resources intensity (Miles, 2005). As a consequence, the conversion of creative ideas into repeatable new services might suffer knowledge transfer issues which are much more challenging given the cost of coordination and communication. In addition, service firms are more resistant to innovation because of the higher personal involvement of workers (Swink and Jacobs, 2012). Thus, we predict that successful implementation of ambidexterity would be minimized for these firms.

Hypothesis 5: The positive effect of creativity on innovation is stronger for manufacturing firms than for service firms.

Research Method

Sample collection and description

This study draws upon the 2010 Community Innovation Survey (CIS2010) from eleven European countries, including Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Lithuania, Norway, Portugal, Romania, Slovakia, and Slovenia. Specifically, our data include 23,537 firms with more than 10 employees that implemented methods to foster creativity. 7,564 (32.2%) of those firms introduced at least one product or process innovation during 2008 to 2010, whereas 15,973 (67.8%) did not introduce any. Only firms that were engaged in product innovation activity (5,524; 23.5%) were required to answer questions regarding the details of their innovation activities, including direct measures of innovation performance and a variety of factors influencing innovation, such as R&D expenditures or the existence of cooperation partners.

Empirical methodology

Empirically our goal is to estimate the causal effect of creative mechanisms on innovation success. Therefore, we are in the framework of treatment effect models where the treatments are the creative methods implemented by the firm at team and individual levels and the outcome is the innovation success.

In CIS2010 the use and scope of creativity methods are addressed by a question on whether firms used certain creativity and idea generation methods among their staff. In particular the question includes two team methods (brainstorming sessions and multidisciplinary or cross-functional work teams) and four individual techniques (job rotation, financial incentives for employees to develop new ideas, non-financial incentives such as free time or public recognition, and training for employees on how to develop new ideas or creativity).

From this question we formulated two different treatment variables for individual and team levels. Individual mechanisms for idea generation were considered as follows. Divergent options were coded with Value 1 and Value 2. Value 1 indicates whether the firm used creative training, and Value 2 indicates whether the company used financial or non-financial incentives. Value 3 reflects use of the convergent method (job rotation of the staff). Finally, to reflect ambidexterity combinations, Value 4 represents training and job rotation and Value 5 incentives and job rotation.

The variable for team mechanisms for idea generation was coded as follows. Value 1 indicates use of the the divergent method (brainstorming session), Value 2 the use of the convergent mechanism (multidisciplinary teams), and Value 3 the use of the ambidexterity mechanism (combined brainstorming and multidisciplinary teams).

We analyzed the effect of individual and team creativity mechanisms on innovation success by means of three outcome variables. The first variable is the propensity to innovate, which is measured by a binary (1,0) variable indicating whether or not the firm introduced at least one product or process innovation during 2008-2010. To focus on innovation success for product innovators we used two additional outcome variables: a binary (1,0) variable indicating the answer to the CIS question of whether or not the firm introduced a new or significantly improved product onto its market before its competitors, and an innovation-performance variable measured by the percentage of total firm sales revenues in 2010 that derived from the sales of new products introduced during 2008-2010.

As mentioned earlier, this study works with three contextual variables. First, we took into account the potential effect of *firm size*, measured as a binary variable coded 1 to large firms (250 or more employees) and 0 to small and medium firms (fewer than 250 employees). Second, R&D intensity was measured by the ratio of total R&D expenditure to total turnover, as a proxy for R&D investment.Third, we considered the potential impact of industry characteristics by controlling for the firm's *industry of operation*: manufacture versus services.

Results

Table 1 reports the estimated potential mean of the three outcome variables for each level of treatment (creativity method) and comparisons between them (i.e., the population-averaged treatment effects (ATE) of getting one of the treatments instead of another one). Results indicate that using ambidexterity combinations of individual creativity methods does increase a firm's propensity to innovate. Regarding team creativity methods (lower part of Table 1), we found that the ambidexterity option (brainstorming plus multidisciplinary teams) increases a firm's propensity to innovate.

Table 1-Average Treatment Effect Estimates[(a)]

	Outcome 1		Outcome 2		Outcome 3	
	Propensity to Innovate (1=Innovator/0=Not innovator)		Propensity to Introduce Market Novelty (1=New-to-Market Innovator/0=Not New-to-Market Innovator)		Share Innovation Sales in Turnover	
Individual Creativity Mechanism	Potential Means	s.e[(b)]	Potential Means	s.e	Potential Means	s.e
1. Training	0.24	0.02	0.44	0.02	0.32	0.01
2. Incentives	0.27	0.01	0.36	0.04	0.27	0.02
3. Job Rotation	0.25	0.01	0.46	0.04	0.30	0.02
4. Training*Job Rotation	0.30	0.01	0.63	0.02	0.34	0.05
5. Incentive*Job Rotation	0.34	0.01	0.82	0.02	0.56	0.02
	Average Treatment Effect	s.e	Average Treatment Effect	s.e	Average Treatment Effect	s.e
4 vs 1	0.06***	0.02	0.19***	0.03	0.02	0.06
4 vs 3	0.05***	0.01	0.16***	0.05	0.04	0.06
5 vs 2	0.07***	0.01	0.46***	0.04	0.28***	0.03
5 vs 3	0.09***	0.02	0.35***	0.05	0.26***	0.03
Team Creativity Mechanism	Potential Means	s.e	Potential Means	s.e	Potential Means	s.e
1. Brainstorming	0.38	0.01	0.67	0.01	0.29	0.01
2. Multidisciplinary Teams	0.39	0.01	0.65	0.01	0.24	0.02
3. Brainstorming*Multidisciplinary Teams	0.44	0.01	0.72	0.00	0.35	0.01
	Average Treatment Effect	s.e	Average Treatment Effect	s.e	Average Treatment Effect	s.e
3 vs 1	0.06***	0.01	0.05***	0.01	0.05***	0.02
3 vs 2	0.05***	0.01	0.07***	0.01	0.11***	0.02

[(a)]AIPW estimators controlling for firms' differences in organizational autonomy, market orientation , size, industry of operation, quality of human capital, and location. Outcomes 2 and 3 also control for R&D intensity and cooperative engagement.
[(b)]s.e: robust standard errors.
* significant at 10%, **significant at 5%, ***significant at 1%.

Our moderating analysis also offers insights for the literature on creativity and innovation[1]. First, our analysis of size suggests that large firms compared to small firms may be advantaged in achieving ambidexterity at both individual and team levels and, consistent with our theoretical argument, thus exhibit a stronger creativity-innovation correlation. Second, our results clearly indicate that high levels of R&D investment, compared with low levels, increase both the association between creativity and innovation and the positive effect related to ambidexterity of creativity mechanisms at both individual and team levels. Finally, our results clearly show that efficiencies gained from the ambidexterity of creative mechanisms at individual and team levels, compared to non-

[1] Tables are available upon request.

ambidextrous mechanisms, are reflected more strongly in manufacturing than in the services sector.

Discussion

This research makes several theoretical contributions. (1) In responding to calls in the literature for a stronger integration between creativity and innovation (Baer, 2012; Anderson et al., 2014), we bring to the fore the theoretical importance of considering opposing force when promoting creativity in the innovation context. In so doing, we also contribute to ambidexterity theory. Currently, the literature shows seemingly contradictory results when encouraging creativity (Burroughs et al., 2011; Gobble,2014; Basadur et al., 2012). This study suggests that contradictions can be resolved with an ambidextrous combination of creative methods. (2) Our research illustrates how opposing logics underlying the innovative process can be solved at individual and team levels, which has rarely been done in previous work (Andersen et al., 2014). (3) Our moderating analysis clarifies factors that shape the creativity-innovation link (Baer, 2012; Sarooghi et al., 2015; Perry-Smith and Mannucci, 2017). Our study theorizes the paradox of ambidexterity and provides empirical evidence of how size, R&D investment and industry (manufacturing versus service) impact the association between creativity and innovation. Our results indicate that the association between creativity and innovation is highly contextual which is consistent with some recent studies (Sarooghi et al., 2015).

Implications for Practices

Managers should be aware of the opposing forces that underlie the innovation process. Idea generation emphasizes exploration and divergent thinking but idea implementation does the opposite, emphasizing exploitation and convergent thinking. We suggest that these contradictions can be resolved with an ambidextrous combination of creative methods. Managers need to do more than merely promote creativity within organization; they should monitor idea implementation to identify whether there might be any sign of counterproductive outcomes. Our results show that a combination of different creativity mechanisms applied with ambidexterity is more effective to encourage innovation than a single creativity method. For example, providing creative-relevant skills for individuals and/or extrinsic rewards for experienced individuals may be not sufficient in terms of innovation if not accompanied by technical skills to solve operational problems. Similarly, at the team level, brainstorming may be insufficient to promote innovation if it does not come with multidisciplinary team work that integrates a diversity of experiences and builds consensus about the implied real situation. Because the conversion of new ideas to innovation spans all levels of an organization, our results indicate that managers could improve their level of innovation success by addressing ambidexterity of creativity mechanisms at different levels of analysis. This finding is especially relevant at the team level given that creativity and innovation are social processes bolstered by team-based structures.

Another important managerial implication pertains to how situational contingencies may interfere with the creativity-innovation link. For instance, our results show that sufficient size is required to successfully implement ambidexterity. Despite the problems large firms face in trying to innovate, they are more able to deal with the challenges of ambidexterity than small firms. Similarly, our results suggest that managers should invest enough in R&D to build the absorptive capacity that facilitates the acceptance of ideas and oversees correct implementation. Our results also advise service firms about their additional risk in terms of innovation. Managers who pursue innovation in the services sector should be cautioned that they might encounter resistence to innovation due to its

intangible nature, the higher personal involvement of workers, and the required presence of clients.

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