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Examining the relationship between creativity and innovation: A meta-analysis of organizational, cultural, and environmental factors☆

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ABSTRACT

It is generally believed that creativity enhances innovative activities. However, empirical research regarding the impact of creativity on innovation, although positive, has produced a wide range of results. In this study, we conduct a meta-analysis of 52 empirical samples comprising 10,538 observations to test the nature of this relationship, and in particular how organizational, environmental, and cultural factors moderate the creativity-innovation link. We find a strong positive relationship between creativity and innovation, especially at the individual level. In addition, we find intriguing moderating effects in which the relationship between creativity and innovation is stronger for large firms, process innovations, and low-tech industries relative to small firms, product innovations, and high-tech industries. Further, we find that moderate levels of uncertainty avoidance maximize the correlation between creativity and innovation. We conclude by discussing theoretical and managerial implications and offering suggestions for future research in the entrepreneurship and innovation literature.

1. Executive summary

An innovation process consists of two main activities: creativity and innovation. Creativity involves the generation of novel and useful ideas while innovation entails the implementation of these ideas into new products and processes. This sequence seems logical and fairly evident; however, even a brief look at the innovation efforts of organizations reveals that they face many challenges and obstacles in maintaining smooth and balanced innovation processes. A careful investigation of previous empirical studies shows that the correlation between creativity and innovation varies significantly across empirical contexts and research designs. An intuitive explanation for this heterogeneity is that innovation processes are multifaceted and characterized by tensions. The process whereby creative ideas are transformed into new products and services is significantly affected by variations in institutions, cultures, organizations, and external environments.

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To elucidate some of the factors that explain this variation, we drew on previous empirical studies in the innovation and creativity literature and conducted a meta-analytical study. We used the results of 52 empirical samples comprising 10,538 observations to test the nature and strength of the relationship between creativity and innovation. In particular, we tested how organizational, environmental, and cultural factors moderate the creativity-innovation link. By quantitatively aggregating and analyzing prior research, this study systematically addresses the influence of relevant factors on the conversion of creative ideas into innovative products and services.

In line with our expectation, the results of our study indicate that overall there is a strong positive link between creativity and innovation ($r = 0.46$). The results of our bivariate analysis and meta-regression reveal that creative ideas are more efficiently converted to innovative outputs when the locus of the innovation process is at the individual level. However, we did not find any significant difference between the team and firm levels of analysis. We also found that, relative to small firms, large firms are better at turning creative ideas into innovative outputs. Surprisingly, the results showed that the relationship between creativity and innovation is stronger in low-tech industries compared to high-tech industries. Moreover, our analysis revealed that process-related ideas are converted to innovative outputs at a higher rate relative to product-related ideas. Finally, we tested the effects of the cultural setting on our focal relationship. The results indicated that the creativity-innovation link is strongest in a national setting with a moderate level of uncertainty avoidance. Our expectations that the creativity-innovation link would be strongest in countries with moderate levels of power distance and collectivism were not confirmed.

Overall, the results of our study offer several important theoretical and managerial implications. First, the association between creativity and innovation is highly contextual and multi-level in nature. Hence, researchers should carefully consider the relevant boundary conditions when studying this vital relationship. Second, another important implication of this study is that managers and entrepreneurs can exert a certain degree of control over factors that facilitate the conversion of creative ideas into new innovations. Determining firm size, locating R&D facilities, and managing cultural configuration of human resources are examples of areas that managers can strategically control to make the innovation process smoother and more balanced. Third, our findings imply that entrepreneurs should keep in mind the effect of firm size on their innovation processes. While it is traditionally believed that smaller firms are more creative than larger firms, our results do not show that they are more capable when it comes to leveraging their creativity investments. In fact, larger firms are better in this area likely due to more resource endowments, experience, and better complementary capabilities. Finally, our study highlights that the conversion of ideas into innovations differs across type of innovation projects. Process-related creative ideas are more likely to be converted into innovative outputs compared to product-related ideas, implying that managers should strike a fine balance when it comes to resource allocation.

2. Introduction

Creativity is the seed of all innovation. The successful creation of new products, new services, or new business practices starts with a person or a team thinking up a good idea—and developing that idea beyond its initial state (Amabile et al., 1996; Baer, 2012). The conversion of creative ideas into actual new products and processes has long been considered a central challenge in the management of innovation (Van de Ven, 1986) and in the creation of new ventures (Drucker, 1998). Yet, the link between creative activity and innovation is often presumed in the literature and merits a comprehensive and integrative examination. The literature defines creativity as the generation of novel and useful[1] ideas (Amabile, 1996; West, 2002). In contrast, innovation is distinguished from creativity by the implementation, rather than the mere generation, of ideas (Rosing et al., 2011). Idea implementation encompasses activities such as selling ideas, mobilizing sponsorship, gathering the necessary resources, creating the innovation, and introducing the innovation to the marketplace (Axtell et al., 2000).

What makes the conversion of creative ideas into innovative offerings so complex is the fact that creativity and innovation do not necessarily proceed in a linear fashion (Anderson et al., 2004) but rather follow a long-winding, uncertain path with unfavorable outcomes in many instances. The reason why the correlation between creativity and innovation is less than one can be explained by the fact that conversion of creative ideas into innovations encompasses two different and even opposing processes: idea generation and idea implementation (Rosing et al., 2011). Indeed, the generation of novel and useful ideas and their implementation is characterized by tensions (Lewis et al., 2002), paradoxes (Miron et al., 2004), and dilemmas (Benner and Tushman, 2003). For instance, idea generation requires experimentation, disrupts routines, challenges common assumptions (Rosing et al., 2011), and is closely associated with explorative activities (March, 1991). In contrast, idea implementation requires a process, efficiency, goal orientation, and routine execution—attributes most often associated with exploitative activities (March, 1991). Others argue that novelty and usefulness, two central attributes of creativity, hardly go together and may even be inversely related (Rietzschel et al., 2009). Useful ideas are generally valued (Sanchez-Burks, 2005), but the more novel they are, the more questions are raised about their practicality, reproducibility, and reliability (Amabile, 1996), thereby increasing uncertainty for decision makers that allocate resources and those in charge of implementing creative ideas (Baer, 2012). Uncertainty is generally an undesirable state that people seek to avoid (Whitson and Galinsky, 2008). In other words, there is an inherent bias against creative ideas which can stifle their subsequent implementation (Mueller et al., 2012).

For all of these reasons, the link between creativity and innovation might not be as straightforward and as strong as earlier conceptual work suggests (Axtell et al., 2000; Axtell et al., 2006; Clegg et al., 2002; Frese et al., 1999). Although prior research has significantly advanced our understanding of how creative ideas are transformed into innovations and studies on the creativity-

[1] Both novelty and usefulness are necessary but insufficient conditions for successful innovations. Novel ideas that lack usefulness or meaning are merely viewed as bizarre or weird by the target audience (Oldham and Cummings, 1996; Van de Ven, 1986).

innovation link have yielded positive correlations between these two constructs, it is unclear how high this correlation truly is. For instance, some authors found the relationship to be highly correlated ($r > 0.70$) (e.g., Daniels et al., 2011), while others found more moderate ($0.30 < r < 0.50$) (e.g., Kickul and Gundry, 2001) or negligible ($r < 0.10$) (e.g., Clegg et al., 2002) size effects.

In addition, there are reasons to believe that the strength of the creativity-innovation link differs across organizational levels of analysis (Bledow et al., 2009). Studies on the locus of the creativity-innovation relationship have stressed the individual (e.g., Mom et al., 2007); team (e.g., Taylor and Greve, 2006); and firm (e.g., March et al., 1991) levels. However, no real consensus has emerged at what level of analysis the conversion of ideas into innovations is more pronounced (Anderson et al., 2004). This leads us to the first research question: Does the strength of the creativity-innovation relationship vary across different organizational levels, and at what level is the relationship the strongest?

Furthermore, because the conversion of creative ideas into new products, processes, and services is a highly contextual endeavor, the factors that shape the relationship between creativity and innovation (Baer, 2012; Shalley et al., 2004) may further clarify why the effect sizes vary significantly between 0 and 1. Indeed, the tensions between processes associated with idea generation and idea implementation may be exacerbated or mitigated depending on the specific context (Bledow et al., 2009). Although prior research has shed light on a variety of factors that individually affect creativity and innovation, much less is known about factors that shape the creativity-innovation relationship (Baer, 2012), such as firm-specific and environment-specific factors. We draw on existing literature to analyze whether the strength of the creativity-innovation relationship varies with firm-specific factors such as firm size and the type of innovation, two variables of major interest to entrepreneurship researchers. We further examine contextual factors such as culture and type of industry as potential influences on the creativity-innovation link (Anderson et al., 2004). Hence, a second research question we seek to address is: In what organizational and environmental contexts is creativity more beneficial to innovation?

To investigate the different effect sizes reported in the literature on the creativity-innovation link, we provide a quantitative aggregation of empirical findings by way of a meta-analysis. Meta-analysis is a particularly appropriate technique when empirical findings yield different size effects across different empirical settings and research designs. We contribute to the innovation and entrepreneurship literature in several ways. First, we provide a quantitative evaluation of the general relationship between creativity and innovation and estimate the magnitude of this relationship, in the aggregate and at different levels of the organization. More specifically, we seek to provide a deeper understanding of what level of the organization the conversion of ideas into innovations is most impactful and where organizations should concentrate their attention, resources, and managerial capabilities (Anderson et al., 2004). Second, we shed more light on how organizational attributes such as firm size and innovation type influence the creativity-innovation link to confirm or dispel popularly held views that small firms and those with innovative products are much more proficient at converting new ideas into innovative offerings than large firms or those focusing on process innovations. And third, we elucidate the impact of industry context and different cultural dimensions that may moderate the relationship between creativity and innovation. Specifically, we distinguish between high- and low-tech industry environments because the basis of competition is distinct in these two environments. As a consequence, this may have different implications for the strength of the creativity-innovation relationship. Further, this analysis contributes to our understanding of how creativity is associated with innovation in different cultural contexts (Hofstede, 1980; House et al., 2004). Specifically, we distinguish several cultural dimensions to better understand the impact of national culture on the creativity-innovation link (House et al., 2004). Some dimensions are known to promote creativity but have a stifling effect on innovation, whereas other dimensions suppress creativity but have a positive impact on innovation, thereby shaping the creativity-innovation relationship (Erez and Nouri, 2010). This study hopes to paint a more complete and nuanced picture of the impact of culture on the creativity-innovation link by simultaneously considering several cultural dimensions.

3. Conceptual background and hypotheses

The process of generating creative ideas (creativity) and their subsequent implementation (innovation) has been characterized as riddled by tensions (Lewis et al., 2002), paradoxes (Miron et al., 2004), contradictions (King et al., 1991), and dilemmas (Benner and Tushman, 2003). Activities related to idea generation create new knowledge, require distinct organizational structures and incentive mechanisms, and are by definition exploratory in nature (March, 1991; Shalley et al., 2004), whereas idea implementation is a subset of exploitative activities (Bledow et al., 2009) as it is primarily concerned with execution, production, and efficiency (March, 1991). These activities compete for scarce resources, may even inhibit each other, and are influenced by different underlying antecedents such as leadership behaviors, cultural values, and mindsets (Bledow et al., 2009). In sum, factors that facilitate the generation of new ideas are likely to cause conditions that may inhibit the implementation of new ideas.

To explicate the creativity-innovation process from a conceptual standpoint, we adopt an ambidexterity perspective (O'Reilly and Tushman, 2004). An ambidexterity perspective argues that the conversion of creative ideas into innovations involves potentially conflicting activities and imposes potentially conflicting demands on individuals, teams, and organizations (Lewis et al., 2002; March et al., 1991). The dichotomy between idea generation and idea implementation and the distinction between exploration and exploitation are directly related (Bledow et al., 2009). The tensions that arise between idea generation (an exploratory activity) and idea implementation (an exploitative activity) need to be managed and reduced as much as possible to achieve ambidexterity. Several strategies have been suggested in the literature to create a more ambidextrous process for developing new products, processes, and services (for an overview, see Turner et al., 2012). Three major approaches to achieve ambidexterity have been discussed in the literature: 1) temporal ambidexterity where the same unit performs exploratory and exploitative activities but at different times (Tushman and O'Reilly, 1996); 2) structural ambidexterity where separate units perform exploratory and exploitative activities (Bower and Christensen, 1995; O'Reilly and Tushman, 2004); and 3) contextual ambidexterity defined as the behavioral capacity to simultaneously demonstrate alignment of organizational activities as well as adaptability through reconfiguration of activities to meet changing demands (Gibson and Birkinshaw, 2004).

Further, managing the tensions between creativity and innovation is a challenge that spans all levels of an organization and is likely affected by contingent organizational, environmental, and cultural factors. While a variety of moderating factors may affect the creativity-innovation relationship, in this study we argue that organizational level, firm size, the type of innovation (product/process), and type of industry (high-tech/low-tech), as well as cultural attributes are especially salient to the process that transforms creative ideas into new products and processes. For instance, the debate over whether small or large firms are more successful in turning ideas into new innovations has been a central topic in the entrepreneurship and strategy literature (e.g., Hitt et al., 1990; Pérez-Luño et al., 2011). Distinguishing between different types of innovation such as product and process innovation has been advocated by many innovation scholars[2] (Damanpour and Gopalakrishnan, 2001; Gopalakrishnan et al., 1999) since prior research suggests that not all innovations have similar attributes (Tornatzky and Klein, 1982) and that their implementation differs significantly (Daft, 1978). The industry environment plays a major role as well. Innovation is a critical element of competition in high-tech industries in which firms are forced to introduce new products and processes based on creative ideas grounded in science and technology (Rubera and Kirca, 2012), and inability to innovate may result in firm failure (Thornhill, 2006). In contrast, firms in low-tech industries do not experience the same pressure to create new innovations because consumers are less sensitive to innovativeness (Mizik and Jacobson, 2003). Finally, based on many previous studies, national culture has been considered a powerful force accounting for cross-national variations in innovation (Shane, 1992, 1993; Taylor and Wilson, 2012). Culture may influence the creativity-innovation relationship because differences in cultural traits affect the generation of creative ideas and the conversion of these ideas into innovations (Rosenbusch et al., 2011). We examine three cultural dimensions that have been found by prior studies to profoundly affect creative and innovative activity (Jones and Davis, 2000; Mueller and Thomas, 2001): collectivism, uncertainty avoidance, and power distance. The conceptual model is depicted in Fig. 1 below.

3.1. Direct effect at different organizational levels

There are both theoretical and practical arguments as to why the conversion of creative ideas into innovations is easier to be accomplished at lower levels of the organization. For example, the mechanisms to achieve ambidexterity become more complex and resource-intensive and also entail more consequential trade-offs at higher levels of the organization (Lubatkin et al., 2006; Mom et al., 2007). This increased complexity makes it managerially more challenging and more demanding in terms of resources to proficiently execute two conflicting activities. In addition, to make ambidexterity work at higher organizational levels, additional necessary and sufficient conditions must be met (Bledow et al., 2009; Turner et al., 2012). We use arguments and variables that, although not empirically tested here, serve to highlight the increasing complexity of the conversion of new ideas into innovations when moving from the individual to the organizational level of analysis. Therefore, we expect that the correlation would be relatively lower at higher levels of the organization.

Let us first consider the creativity-innovation link at the individual and team levels, and then make some comparisons. Idea generation and idea implementation are not only conflicting but also intertwined activities that pose significant problems of self-regulation for individuals engaged in innovation processes (Bledow et al., 2009). The tension that arises between these two activities needs to be actively managed. Ambidexterity at the individual level refers to an individual's capacity to perform and integrate both idea generation and idea implementation through self-regulation (Bledow et al., 2009). Five sets of variables have been found to affect the creativity-innovation link at the individual level: expertise, creative processing activities, dispositional characteristics, motivation, and task environment (Amabile et al., 1996; Mumford and Hunter, 2005). First, relevant domain expertise is a major factor that facilitates the conversion of creative ideas into new products and processes. Taylor and Greve (2006) found that the role of expertise can enhance both idea generation and implementation to such an extent that it overwhelms the tension between the two activities, and that individuals are better than teams at integrating the depth and breadth of their expertise. Second, cognitive processing activities affect the execution of idea generation and the subsequent implementation of those ideas (Mumford and Hunter, 2005). Third, dispositional characteristics such as openness, flexibility, conscientiousness, and criticality have a significant impact on the creativity-innovation link (Mumford and Gustafson, 1988). Fourth, motivation – especially intrinsic motivation – is critical to creativity and innovation (Amabile, 1996; Amabile et al., 1996). Finally, the task environment has a significant impact on the conversion of creative ideas into innovations (Amabile, 1996).

Numerous studies in the innovation literature show that innovation frequently emerges from collectives of individuals, e.g. teams (Im et al., 2013; Sethi et al., 2001). In addition to the factors listed at the individual level, a much more complex interplay of these factors and other interactive and collaborative processes affect the creativity-innovation link at the team level (Miron-Spektor et al., 2011). Prior research notes that teams bring a variety of perspectives, a richer set of skills and expertise, and more cognitive capacity to the conversion of ideas into innovations (Im et al., 2013). This would potentially enhance the team's ability to generate more creative ideas of a larger scope and of higher complexity and better handle the magnitude of the tasks required for idea implementation (Lovelace et al., 2001). Five key attributes affecting the creativity-innovation link at the team level have been identified: climate and environment, leadership, team processes, team task characteristics, and team structure/composition (Mumford and Hunter, 2005; West, 2002). We focus on the last variable for the sake of illustration and brevity, although arguments on why ambidexterity at the team level will be harder to achieve than at the individual level can be made for the other sets of variables as well.

[2] Another useful distinction between different types of innovations is incremental and radical innovation. However, the studies incorporated in this meta-analysis did not allow us to reliably code the available data this way.

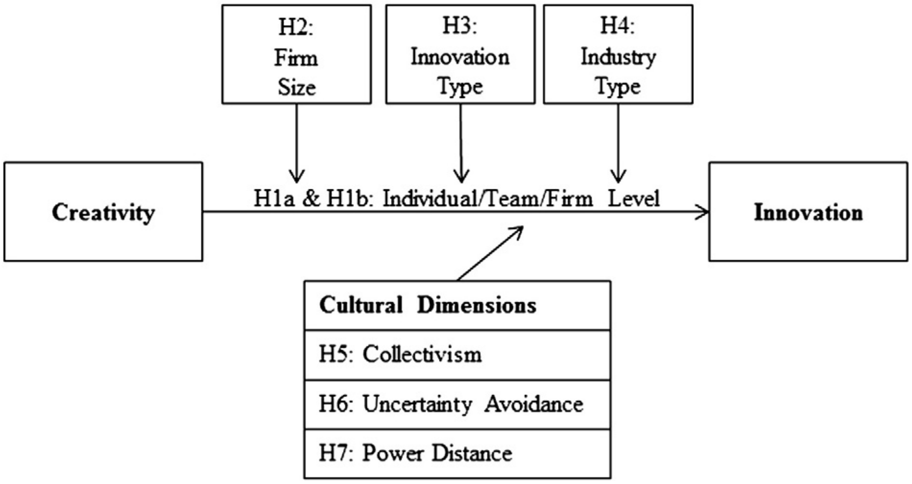

Fig. 1. Model of studied relationships.

Team structure/composition can be further disaggregated into structural factors such as team heterogeneity, team size, and team tenure (West and Anderson, 1996). Team heterogeneity in terms of function, profession, education, tenure, knowledge, skills, or expertise has been shown to be helpful for idea generation, because these attributes bring to bear diverse perspectives and knowledge sets and also trigger communication with members outside of the team (Perry-Smith, 2006; Perry-Smith and Shalley, 2003). However, other research shows that team heterogeneity increases conflict and damages team cohesiveness, leading to higher turnover, less social integration, and more communication problems, which are all important for effective idea implementation (Knight et al., 1999; O'Reilly et al., 1989).

Similarly, team size affects the creativity-innovation link in the sense that small teams lack the diversity required to generate many new ideas, yet having too many team members impedes interaction, coordination, exchange, and participation needed for effective idea implementation (Jackson, 1996). Long team tenure suggests that team members have been together for a long time, and this is helpful for idea implementation because team members have been socialized and share similar experiences. However, long team tenure tends to lead to groupthink, and team members become less critical and less likely to challenge the status quo, which hurts creativity (Katz, 1982). This brief exposition serves to illustrate the myriad factors that amplify or attenuate the tensions between idea generation and idea implementation at the team level.

An ambidextrous leadership style at the team level has been proposed as a potential integration mechanism to manage tensions between creativity and innovation. However, effective ambidextrous leadership requires cognitive, emotional, and behavioral complexity and flexibility (Denison et al., 1995; Hülsheger et al., 2009; Mumford et al., 2002). In short, while teams can deal with larger scope ideas and more complex tasks utilizing a broader and more diversified resource base, the discussion above suggests that achieving ambidexterity to reduce the numerous tensions is likely harder at the team-level than at the individual level. Hence:

Hypothesis 1a. *The relationship between creativity and innovation is relatively stronger at the individual level than the team level.*

In this study, we argue that achieving ambidexterity at the organizational level is even more complicated and resource-intensive than at the team level, and as a consequence would lower the probability of converting a novel idea into a new product or service even further. The complexity of devising an ambidextrous organization can be attributed to the fact that idea generation and idea implementation require substantially different organizational structures, processes, strategies, capabilities, and cultures (Gibson and Birkinshaw, 2004; Tushman and O'Reilly, 1996). For instance, idea generation is facilitated by organic structures, loosely coupled systems, improvisation, and autonomy, whereas idea implementation requires mechanistic structures, tightly coupled systems, routinization, and controls (He and Wong, 2004).

Structural separation of idea generation and idea implementation has long been advocated as a potential integration mechanism to achieve ambidexterity at the organizational level (Benner and Tushman, 2003; Tushman and O'Reilly, 1996); however, this separation frequently leads to isolation because the dual structures are not effectively coupled or really novel ideas are not accepted by the implementing unit (Gibson and Birkinshaw, 2004). A complementary integration mechanism is offered by the contextual ambidexterity approach, whereby managers create a context that encourages individuals and teams to make judgments as how to best divide their time between conflicting activities (Gibson and Birkinshaw, 2004). The integration of both conflicting activities starts at the top management level (Jansen et al., 2006; Raisch and Birkinshaw, 2008), and a cultural change must take place to infuse the organization with organizational values and practices that enable the effective management of conflicting activities (Miron et al., 2004), which is more challenging at the organizational than the team level (Cameron and Quinn, 2011). The coordination and integration of idea generation and idea implementation requires new organizing logics and collective patterns of interaction (Helfat and Peteraf, 2003), which are more difficult to implement at the organizational than team level. Contextual and structural ambidexterity are dynamic meta-capabilities that are complex, causally ambiguous, widely dispersed, and time- and resource-consuming to develop and implement (He and Wong, 2004; Jansen et al., 2009), especially at higher levels of the organization (Turner et al., 2012). Therefore, we posit that:

Hypothesis 1b. *The relationship between creativity and innovation is relatively stronger at the team level than the organizational level.*

3.2. Moderating hypotheses

3.2.1. Firm size

Firm size is considered a principal attribute of organizational design and among the most important factors affecting the creativity-innovation relationship in an organization (Damanpour, 1996), often due to the availability of resources. From an ambidexterity perspective, large firms typically have the resources to effectively perform activities related to idea generation and idea implementation, whereas small firms that are less endowed with resources have to make choices and may not be able to pursue a strategy to make the firm ambidextrous (Raisch and Birkinshaw, 2008). Additional arguments have been advanced on this moderating impact of firm size on the creativity-innovation relationship. Some scholars have argued that larger firms have more financial slack, more sophisticated marketing skills, stronger research capabilities, and deeper product/process development experience which would facilitate the conversion of creative ideas into new products and processes (Branzei and Vertinsky, 2006). For instance, the presence of higher levels of slack in larger firms might help to buffer the idea-to-innovation conversion from disruptions that might have a negative or mortal impact on firm viability (Azadegan et al., 2013). Other scholars have argued that smaller firms are at a disadvantage relative to their larger peers because they do not have the kind of hierarchical administrative systems to help manage conflicting knowledge processes, which constrains the level of ambidexterity that they can achieve (Lubatkin et al., 2006).

However, smaller firms may be compared to teams in terms of size. In Hypothesis 1b, we argue that the creativity-innovation link is stronger at the team level than at the organizational level because there are more complexities involved with achieving ambidexterity at the organizational level. However, the same argument does not hold here. Teams within larger firms have access to necessary resources to convert creativity into innovation, whereas smaller firms may not be able to achieve this ambidexterity because they are resource-constrained.

Hence, we posit that:

Hypothesis 2. *The relationship between creativity and innovation is stronger for larger firms than for smaller firms.*

3.2.2. Innovation type

Product innovations refer to novel products or services being introduced into the market to meet customer needs (Cooper, 2008), and they are market-focused and primarily customer-driven. In contrast, process innovations refer to deliberate and new organizational attempts to change intra-company production and service processes to make them more efficient (Damanpour and Gopalakrishnan, 2001; Ettlie and Reza, 1992), and they are internally-oriented and efficiency-driven (Tornatzky and Klein, 1982). We expect that the creativity-innovation link is stronger for process innovations than for product innovations.

An ambidexterity perspective suggests that process-related ideas tend to be implemented at a higher rate than product-related ideas for three reasons. First, prior research indicates that process innovations are relatively more systemic in nature, whereas the knowledge associated with product innovations is more autonomous (Gopalakrishnan et al., 1999). Systemic innovations typically are the outcome of a process where idea generation and idea implementation are very strongly intertwined and where generation and integration of knowledge from different areas within the organization are coordinated through mutual adjustment (Ettlie and Reza, 1992; Hutchins, 1991). Second, process innovations tend to be internally sourced and require a complete open exchange of information to facilitate the generation and integration of knowledge during idea generation and implementation (Gopalakrishnan and Bierly, 2001), which is an important feature of ambidextrous organizations. Product innovations, in contrast, require integration of external parties such as suppliers, distributors, and customers, which from an ambidexterity perspective is much more challenging given costs of coordination, communication, and complete trust that parties will not behave in opportunistic ways (Das and Teng, 1998; Gopalakrishnan and Bierly, 2001). In addition, product innovations require organizations to clearly assimilate customer needs and supplier requirements into the conceptualization of the product design (Ettlie et al., 1984), further complicating the integration of the two conflicting activities. And third, evidence suggests that product innovations fail at a higher rate (Dillon and Lafley, 2011) than process innovations (Aiman-Smith and Green, 2002).

Hence:

Hypothesis 3. *The relationship between creativity and innovation is stronger for process-related innovations than for product-related innovations.*

3.2.3. Industry type

Industry type may also affect the strength of the creativity-innovation relationship. We expect that the creativity-innovation link is stronger in high-tech than in low-tech industries. More specifically, high-tech industries have on average higher levels of technological dynamism, which in turn increases the importance of innovation-related activities (Uotila et al., 2009). Indeed, firms operate within a specific industrial context applying specific technologies. When the basic set of industry technologies is stable as is frequently the case in low-tech industries, creative activity will be less important to a firm, and less energy and time will be expended generating new ideas and implementing them (Aldrich and Cliff, 2003). In contrast, rapid technological change spurs creative and entrepreneurial activity, and the resulting innovations are a response to uncertainty brought about by technological change (Heidenreich, 2009).

High-tech industries, relative to low-tech industries, are characterized by high levels of R&D expenditures (Kirner et al., 2009; Zahra, 1996) and much better-developed R&D capabilities and integration mechanisms for ambidexterity, which facilitates the conversion of ideas into novel innovations. The basis of competition in high-tech industries is focused on the rapid conversion of creative ideas into new innovations, and firms are required to be more ambidextrous than those in low-tech industries where competition is based on economies of scale or access to distribution channels (Bierly and Daly, 2007), attributes that do not necessitate a strong link between idea generation and idea implementation. Further, low-tech industries are populated by supplier-dominated firms that typically have weak R&D capabilities and primarily rely on external technology suppliers to develop and produce a new product or service (Pavitt, 1984). Hence, we posit that:

Hypothesis 4. *The relationship between creativity and innovation is stronger for high-tech industries than for low-tech industries.*

3.3. Cultural dimensions

Cultural values are conceptual representations of societal needs and demands (Erez and Earley, 1993; Rokeach, 1973). Different cultures may place different priorities on similar societal needs, as guided by the cultural values created through socialization processes (Erez and Nouri, 2010). Idea generation requires novelty, and therefore, people should be willing to break existing frames of thought and use divergent thinking (Guildford, 1967). In contrast, idea implementation stresses conformance to rules and norms, attentiveness to detail, and requires convergent thinking (Erez and Nouri, 2010). Prior research indicates that the conversion of creative ideas into innovations is shaped by three cultural dimensions: collectivism, uncertainty avoidance, and power distance (Jones and Davis, 2000; Mueller and Thomas, 2001).

3.3.1. Collectivism

The collectivism dimension has been extensively examined in international business studies (Hofstede, 1983; Teissen, 1997; Triandis and Suh, 2002). We expect that the collectivism dimension has a non-linear (inverse U) moderating impact on the creativity-innovation link. Countries that score low on the collectivism (high on the individualism) dimension favor open-mindedness, independence, personal initiative, and self-confidence, and all of these characteristics spur the generation of creative ideas (Feist, 1998; Taylor and Wilson, 2012). However, idea implementation is a collective endeavor that requires convergent thinking, rule compliance, and alignment of people's tasks, all activities that favor collectivism over individualism (Nakata and Sivakumar, 1996). This suggests that the two opposite poles of the individualism-collectivism dimension have a conflicting impact on the conversion of ideas into innovations. In other words, highly individualistic societies or strongly collectivist societies will exacerbate the pre-existing tension between creativity and innovation.

Collectivistic cultures prioritize collective goals and alignment with social system norms (Triandis, 1995). Organizations can make use of the convergent forces in a collectivistic society to align the activities of different employees (Nakata and Sivakumar, 1996). In addition, these forces may enhance the usefulness and appropriateness of ideas, so as to assure their acceptance by others and their adherence to social norms (Erez and Nouri, 2010). A weakness of collectivism, however, is that it can suppress the novelty of ideas being generated (Herbig and Dunphy, 1998). Therefore, as an integrative strategy to facilitate the conversion of creative ideas into innovations, organizations should expose employees to new external knowledge, challenge entrenched viewpoints in a non-threatening way, or use reward systems, all actions that are beneficial for creativity (Bledow et al., 2011; Eisenberg, 1999).

In contrast, individualism has dysfunctional consequences for convergence and alignment of people's activities and may lead to conflict among individuals during idea implementation (Nakata and Sivakumar, 1996) because individuals like to pursue their own ideas. Here, to facilitate the conversion of ideas into innovations, organizations need to attempt to strike a fine balance between promoting individualistic behaviors that create variety and convergent behaviors that are required for collective action. The least resistance to an effective integration mechanism for idea generation and idea implementation, however, can be found in cultures with a moderate level of collectivism. In such a culture, the tension between these two conflicting activities would be minimized to the greatest extent. Therefore, we expect that:

Hypothesis 5. *A moderate level of collectivism will maximize the correlation between creativity and innovation.*

3.3.2. Uncertainty avoidance

Uncertainty avoidance refers to insecurity regarding the future, resistance to change, and risk aversion (Hofstede, 1980). We expect that uncertainty avoidance has a non-linear (inverse U) moderating impact on the creativity-innovation relationship. High uncertainty avoidance reflects cultures where norms are clearly expressed and unambiguous and where severe sanctions are imposed on those who deviate from those norms (Erez and Nouri, 2010). In such societies, rules and procedures restrict improvisation and experimentation (Jansen et al., 2006). As a result, the novelty of ideas being generated is rather modest. That said, high uncertainty avoidance may be beneficial for idea implementation because it imposes order, conformity, routine, and stability (Erez and Nouri, 2010). Therefore, high uncertainty avoidance tends to enhance idea implementation and suppress idea generation, thereby impeding the conversion of creative ideas into innovations.

Conversely, low uncertainty avoidance cultures encourage deviation from rules, routine breaking, and tolerance for mistakes, characteristics that have a very dysfunctional impact on idea implementation (Bledow et al., 2011). In low uncertainty avoidance cultures, organizations often neglect to specify clear goals, deadlines, and plans of action (Bledow et al., 2011), and a systematic approach (e.g., project management) to implementation is very difficult and time-consuming to accomplish especially when the ideas generated are very novel (O'Connor and DeMartino, 2006). We may conclude that low uncertainty avoidance would be harmful for idea implementation but helpful for generating novel ideas (Miron et al., 2004; O'Reilly et al., 1991). In sum, very high and very low levels of uncertainty avoidance exacerbate the pre-existing tension between idea generation and idea implementation, and integration mechanisms to reduce the tension between idea generation and idea implementation will be most effective in cultures with a moderate level of uncertainty avoidance. Hence:

Hypothesis 6. *A moderate level of uncertainty avoidance will maximize the correlation between creativity and innovation.*

3.3.3. Power distance

Power distance refers to "the extent to which less powerful members of organizations and institutions accept and expect that power is distributed unequally" (Hofstede and Bond, 1988, p. 10). We expect that power distance has a non-linear (inverse U) moderating impact on the creativity-innovation relationship. Cultures high in power distance are more autocratic and readily accept differences in power and wealth as opposed to cultures that have low power distance and believe more in egalitarianism and wealth distribution (Hofstede, 1980). In cultures with high power distance, people tend to conform to prevailing rules and do not engage in experimentation without permission of their supervisors (Bledow et al., 2011). Although high power distance cultures have dysfunctional consequences for idea generation, some aspects of power distance are helpful for idea implementation or exploitative activity (Nakata and Sivakumar, 1996). For instance, high power distance cultures may facilitate fast and efficient top-down implementation of novel ideas. Because power distance is strongly associated with leadership style, an effective integration mechanism would be a leadership style that institutes elaborate communication channels and feedback systems – necessary to stimulate creativity – to compensate for the lack of communication in high power distance cultures.

Conversely, low power distance tends to facilitate idea generation because individuals are willing to challenge the status quo and autonomously pursue ideas even if supervisors show resistance (Shane et al., 1995). Organizations in low power distance societies face their own challenges. In such a culture, organizations require streamlined collective action to turn novel ideas into new innovations, and leaders may find less acceptance of their decisions if they rely solely on the position of power (Bledow et al., 2011). Here, a strong vision as an integration and coordination mechanism can help to align followers with leaders. Thus, becoming more ambidextrous through some form of integration mechanism is most effective in cultures with a moderate level of power distance because the pre-existing tension between idea generation and implementation is likely to be reduced to the largest extent under this condition. Hence:

Hypothesis 7. *A moderate level of power distance will maximize the correlation between creativity and innovation.*

4. Method

4.1. Literature search and selection strategy

To identify relevant studies for our meta-analysis, we followed a four-step process. As a first step, we embarked on a comprehensive search of the academic literature by conducting keyword searches in databases such as ABI-Inform, ISI Web of Science, SCOPUS, the SSRN repository, and the working paper series of major universities with strong capabilities in innovation management. Keywords used in our searches included combinations of creativity, innovation, idea generation, idea implementation, new products, and improvisation. To ensure that all highly relevant studies were included, and due to the generic nature of creativity and innovation as constructs, as a second step, we manually searched the most important journals in management (e.g., *Academy of Management Journal*; *Administrative Science Quarterly*), strategy (e.g., *Strategic Management Journal*; *Strategic Entrepreneurship Journal*), innovation management (e.g., *Research Policy*; *Journal of Product Innovation Management*), creativity (e.g., *Creativity Research Journal*; *Creativity and Innovation Management*), applied psychology (e.g., *Journal of Applied Psychology*; *Journal of Organizational Behavior*), and entrepreneurship (e.g., *Journal of Business Venturing*; *Entrepreneurship Theory and Practice*), as well as conference proceedings. As a third step, we searched the reference sections of relevant articles for further studies. Finally, we sent emails to Listservs of the relevant divisions of the Academy of Management and asked for applicable published and unpublished studies.

To be included in our sample, studies had to meet certain criteria (Hunter and Schmidt, 2004). First, we searched for studies that addressed the creativity–innovation relationship as a major research question, followed by additional articles that included creativity and innovation as variables of interest. Second, and due to the nature of a meta-analysis, we only included studies that reported the Pearson's correlation r or the necessary statistics for calculating the correlation coefficient. Third, we carefully checked each study to eliminate those that were based on the same sample in order to avoid potential biases or overrepresentation of specific samples. This sample check resulted in the exclusion of three studies. Table 1 provides an overview of the final sample of 52 studies.

4.2. Measures

In a meta-analytical study, the definition of the relevant variables guides the coding of studies in the sample. Because the aim of a sound meta-analysis is the objective and accurate evaluation of prior studies, it is extremely important to formulate protocols to serve as a set of guidelines for the coders of the studies. Even though Aguinis et al. (2011) argue in their comprehensive evaluation of meta-

Table 1
List of studies included in the meta-analysis.

Year	Authors	Sample Size	Effect Size (r)	Corrected Effect Size	Level of Analysis	Innovation Type	Industry Type	Country
1994	Scott, Bruce	172	0.18	0.20	Individual	Process	High-tech	United States
1996	Oldham, Cummings	171	0.23	0.27	Individual	Product	Low-tech	United States
1997	Moorman, Miner	92	0.13	0.15	Firm	Product	Low-tech	United States
1998	Heunks	200	0.14	0.16	Firm	Product	Low-tech	Multiple
2000	Bharadwaj, Menon	634	0.38	0.50	Firm	Process	Low-tech	United States
2000	Unsworth et al.	331	0.41	0.47	Individual	Process		UK
2001	Kickul, Gundry	120	0.28	0.32	Firm	Process	High-tech	United States
2001	Kleysen, Street	225	0.75	0.87	Individual	Process	Low-tech	Canada
2002	Clegg et al.	128	0.62	0.75	Individual	Process	High-tech	UK
2002	Soo et al.	317	0.36	0.41	Firm	Product	Low-tech	France
2003	Atuahene-Gima	104	0.29	0.42	Team	Product	High-tech	Hong Kong
2003	Caldwell, O'Reilly	244	0.38	0.44	Team	Process	High-tech	United States
2004	Im, Workman	312	0.32	0.38	Firm	Product	High-tech	United States
2004	Krause	399	0.34	0.43	Individual	Process	Low-tech	Germany
2004	Miron et al.	349	0.22	0.26	Individual	Process	High-tech	Israel
2005	Cheng	58	0.44	0.65	Individual	Process	Low-tech	Multiple
2005	Vera, Crossan	38	0.16	0.19	Team	Product	Low-tech	Canada
2006	Griffiths-Hemans, Grover	144	0.26	0.31	Individual	Process	High-tech	United States
2006	Hanke	89	0.07	0.08	Team	Product	Low-tech	United States
2007	Birdi	191	0.64	0.73	Individual	Process	Low-tech	UK
2007	Cantner, Joel	182	0.22	0.22	Firm	Process	Low-tech	Germany
2007	Chen	112	0.14	0.15	Team	Product	High-tech	Taiwan
2007	Li et al.	109	0.05	0.06	Firm	Product	High-tech	United States
2009	Gumusluoglu, Ilsev	43	-0.08	-0.09	Firm	Product	High-tech	Turkey
2009	Noefer et al.	81	0.72	0.81	Individual	Process	Low-tech	Germany
2009	Verworn	144	0.00	0.00	Firm	Product	High-tech	Germany
2010	Chen, Huang	305	0.44	0.44	Firm	Product	High-tech	Taiwan
2010	Lehmann-Willenbrock, Kauffeld	427	0.83	0.83	Individual	Process	Low-tech	Germany
2010	Tu	96	0.32	0.35	Team	Product	High-tech	Taiwan
2010	Urbach et al.	135	0.50	0.57	Individual	Process	High-tech	Poland
2011	Atuahene-Gima, Wei	396	0.21	0.29	Team	Product	High-tech	China
2011	Baron, Tang	99	0.22	0.26	Firm	Product	Low-tech	United States
2011	Bishop et al.	475	0.23	0.23	Firm		Low-tech	UK
2011	Choo	181	0.52	0.52	Team	Process	High-tech	Multiple
2011	Daniels et al.	89	0.75	0.88	Individual	Process	High-tech	UK
2011	Knudsen, Cokpekin	147	0.28	0.36	Firm	Product	Low-tech	Denmark
2011	Lee et al.	172	0.72	0.83	Individual	Process	High-tech	Singapore
2011	Li, Wu	970	0.78	0.92	Individual	Process	Low-tech	Taiwan
2011	Miron-Spektor et al.	41	0.16	0.18	Team	Process	High-tech	Israel
2011	Rietzschel	33	0.77	0.92	Team	Process		Netherlands
2011	Weiss et al.	94	0.11	0.12	Team	Product	High-tech	Germany
2012	Baer	216	0.13	0.15	Individual		Low-tech	United States
2012	Binnewies, Gromer	89	0.40	0.47	Individual	Process	Low-tech	Germany
2012	Carlo et al.	121	0.34	0.41	Firm	Process	High-tech	United States
2012	Da Silva, Oldham	93	0.60	0.60	Individual	Process	Low-tech	United States
2012	Engelen, Brettel	243	0.01	0.01	Firm	Process	High-tech	Germany
2012	Holman et al.	327	0.56	0.61	Individual	Process	Low-tech	UK
2012	Kim et al.	100	0.42	0.48	Team	Process	High-tech	United States
2012	Pratoom, Savatsomboon	138	0.62	0.72	Team	Product	Low-tech	Thailand
2012	Tang et al.	109	0.27	0.33	Individual			United States
2012	Yao et al.	247	0.34	0.43	Individual	Process		China
2013	Im et al.	206	0.36	0.45	Team	Product	High-tech	United States

Note: r = raw form of effect size (correlation), Corrected effect size = reliability-corrected correlation.

analytical studies that judgment does not really bias the results of meta-analysis, we took precautions to avoid judgmental bias. More specifically, in this study two independent raters coded the relevant variables based on predefined guidelines. Because most of the variables were objective, it was relatively straightforward to reach agreement. In the rare event that a disagreement arose, we resolved the conflict by including a third rater in the coding process in order to come to an agreement. The interclass correlations are reported in Table 4.

4.2.1. Dependent variable

Innovation in a broad sense is the dependent variable of this study. This construct was reported in the sample studies using different types of operationalization based on context and data availability. The main criterion for considering a measure of innovation in this study was that it should be related to the implementation of ideas that were generated in a prior period (Baer, 2012). Some

Table 2
Examples of measures at different levels of analysis.

Level of Analysis	Creativity Measure	Innovation Measure
Individual	creativity-related personal characteristics, generativity, idea generation	application of ideas, implementation of ideas, innovative behavior, patent disclosures written
Team	general creativity measure, generation of many ideas, improvisation, new product creativity, team creativity	general innovation, group members' innovation, idea realization, rated group innovation
Organization	creativity efforts, general creativity measure, managerial creativity, new product creativity, new product novelty, supervisor rating of creativity	innovation performance, managerial innovations, new product performance, organizational innovation

common operationalizations of the construct included number of ideas implemented, number of new products, development of a prototype, or perception of innovation.

4.2.2. Independent variable

Creativity is the independent variable of this study. Like innovation, this construct is operationalized differently across prior studies. Some common operationalizations of the creativity construct included the number of novel and useful ideas generated, team creativity, new product creativity, or a perception scale gauging the construct. Our guiding principle for considering a variable as an appropriate

Table 3
Bivariate analysis of studies.

Hypotheses	K	N	r	95% Confidence Interval	I^2	Q	r to Z-Transform	Safe-fail K
Overall relationship	52	10538	0.463	0.393: 0.532	95.46	1123.96**		67
H1: Level of analysis								
Individual	22	5123	0.603	0.496: 0.711	97.48	832.41**	17.69**	144
Team	14	1872	0.381	0.288: 0.473	83.58	79.17**	11.01**	44
Firm	16	3543	0.302	0.221: 0.383	87.06	115.95**	3.12**	35
H2: Firm Size								
Large	3	1137	0.509	0.382: 0.636	92.31	26.02**	8.71**	15
Small	10	1543	0.217	0.111: 0.323	81.91	49.76**		12
H3: Innovation Type								
Process	29	6526	0.569	0.478: 0.660	96.87	895.81**	15.28**	160
Product	20	3212	0.306	0.235: 0.378	81.50	102.72**		38
H4:Industry Type								
Low-Tech	22	5183	0.571	0.460: 0.682	97.38	801.62**	14.45**	131
High-Tech	26	4635	0.342	0.263: 0.421	89.94	248.54**		69
H5:Collectivism [a]								
Low	35	6674	0.424	0.345: 0.503	93.89	556.88**	4.22**	129
Medium	5	1011	0.300	0.211: 0.389	68.07	12.53*	10.9**	11
High	12	2853	0.610	0.456: 0.765	97.95	536.12**	11.48**	80
H6:Uncertainty Avoidance [a]								
Low	5	706	0.381	0.181: 0.582	92.04	50.24**	3.21**	16
Medium	34	7153	0.484	0.401: 0.568	95.63	755.72**	3.27**	59
High	13	2679	0.426	0.275: 0.576	96.04	303.40**	1.25	48
H7: Power Distance [a]								
Low	4	570	0.317	0.161: 0.473	83.04	17.68**	4.47**	9
Medium	44	9270	0.479	0.401: 0.555	95.92	1052.89**	3.35**	196
High	4	698	0.371	0.152: 0.589	93.54	46.43**	1.08	12
Measure of Creativity								
Qualitative	46	9159	0.448	0.374:0.522	95.19	934.95**	5.12**	185
Quantitative	6	1379	0.558	0.362: 0.755	97.14	174.82**		34
Measure of Innovation								
Qualitative	37	7459	0.473	0.391: 0.556	95.52	803.95**	2.15*	162
Quantitative	15	3079	0.437	0.305: 0.568	95.57	316.61**		58
Publication Status								
Published	48	9892	0.471	0.397: 0.545	95.73	1102.93**	3.99**	199
Unpublished	4	646	0.335	0.184: 0.487	84.56	19.44**		13

* $p < 0.05$, ** $p < 0.01$.
Note: To show the difference in correlations for moderating variables with three categories, we calculated the Z-statistics for the upper and middle categories in the first row of the corresponding section. The second row corresponds to the middle and lower categories differences, and the third row shows the difference of lower and upper categories. The absolute values of Z-statistics are shown. K = number of studies, N = number of observations, r = reliability-corrected correlation Q = Q-statistic, $I^2 = I^2$-Statistic, r to Z-Transform = Z-statistics for difference in r between groups.
[a] The high, medium, and low categories correspond to the GLOBE study Bands A, B, and C, respectively.

Table 4
Means, standard deviations, and correlations.

Variables	Mean	S.D	1	2	3	4	5	6	7	8	9	10	11	12
1. Effect Size (Correlation)	.41	.26	n/a											
2. Measure of Creativity (Qualitative = 1)	.88	.32	-.148	.914										
3. Measure of Innovation (Qualitative = 1)	.71	.46	.098	.434**	.864									
4. Publication Status (Published = 1)	.92	.27	.081	-.104	.135	n/a								
5. Innovation Type (Process = 1)	.59	.50	.528**	-.006	.302*	.056	.923							
6. Industry Type (High-tech = 1)	.54	.50	-.248	.284	.372**	.328*	-.011	.924						
7. Firm level	.31	.47	-.451**	-.020	-.403**	-.120	-.349*	.030	n/a					
8. Firm Size	.23	.44	0.656*	-.272	0.141	0.158	0.318	-.225	-.527	n/a				
9. Individual level	.42	.50	.494**	-.178	.116	.101	.605**	-.281	-.571**	.527	n/a			
10. Collectivism	.00	.63	.055	.144	.082	-.048	-.164	.256	-.178	-.170	-.040	n/a		
11. Uncertainty Avoidance	.00	.50	.158	-.092	-.016	-.139	.213	-.234	.018	-.176	.155	-.312*	n/a	
12. Power Distance	.00	.30	-.021	.144	-.063	-.182	.020	-.114	.070	-.092	.091	.107	.349*	n/a

Note: N = 13 for those cells that correspond to the firm size variable, N = 48 for those cells that correspond to the industry type variable, N = 49 for those cells that correspond to the innovation type variable, and N = 52 for all other cells.
Numbers on diagonals represent the interclass correlations (ICCs) resulting from judgments of two independent coders. Dummy variables are coded as 0 and 1.
* Correlation is significant at the $p < 0.01$ level (2-tailed).
** Correlation is significant at the $p < 0.05$ level (2-tailed).

measure of creativity was that it pertained to the generation of some new and useful idea or solution (Amabile et al., 1996; Stein, 1974). Table 2 provides some examples of the creativity and innovation measures at different levels of analysis.

4.2.3. Theoretical moderating variables

We employ a number of moderating variables in this study. The first set of moderating variables is related to organizational and industry characteristics such as firm size, innovation type, and type of industry. To that end, we defined a binary variable, *firm size*, based on a cut-off value of 500 employees. This approach for distinguishing small and medium-sized enterprises from larger firms is consistent with prior empirical research (Rosenbusch et al., 2011). For the *innovation type* variable, we distinguished between process innovation and product innovation. The process innovation construct was coded for studies in which the primary focus was measuring innovative activities related to improvements or novelties in ongoing manufacturing or business practices. In contrast, product innovation was coded for studies that assessed innovation in terms of some novel or improved output (embodied in a product or service) that had been introduced in the market. Most studies included an appendix detailing the measurement of the variables, and this provided a firm basis for judgment about the operationalization of the innovation measures. Finally, for those studies that reported the industry setting we created a binary variable, *industry type*, by dividing the studies into two subgroups of high-tech and low-tech industries based on the specific industrial context. Examples of low-tech industries included advertising, agricultural processing, education, municipal management, and road cargo transport. Examples of high-tech industries included aerospace, biotechnology, computer component manufacturing, microelectronics, and software development.

The second set of moderating variables represents a number of cultural dimensions that are widely used in international business studies. We used the Global Leadership and Organizational Behavior Effectiveness (GLOBE) cultural dimension data (House et al., 2004) for our study. We mean-centered the societal cultural practice scores ("as is") for *in-group collectivism*, *uncertainty avoidance*, and *power distance*, and matched these country scores to the studies in our sample. Three samples in our study had observations from more than one country. Because we had accurate frequencies of each country in these samples, we calculated a weighted score of each cultural dimension for these studies. For analytical purposes, we then used GLOBE study categories to put studies into different groups for the bivariate analysis. For the meta-regression, we used the continuous values of these three cultural dimensions.

4.2.4. Methodological moderators

We included three methodological moderators in our study. First, in line with previously published meta-analyses (e.g., Stam et al., 2014), we created a binary variable, *publication status*, to differentiate between studies that have been published in peer reviewed journals or presented at conferences from those that are working papers or dissertations. This variable also serves as a proxy for study quality. Second, we developed two binary variables (one for creativity and one for innovation) representing the types of operationalization in each study to differentiate between qualitative and quantitative measurements (e.g., *qualitative creativity* includes new product novelty and improvisation, whereas *quantitative creativity* includes number of ideas generated and creative workforce density; *qualitative innovation* includes new product quality and new product innovation, whereas *quantitative innovation* includes patent disclosures and number of ideas implemented).

4.3. Meta-analysis

We performed the meta-analysis in two stages: a bivariate analysis followed by meta-regression. In the first stage, we conducted a bivariate analysis following Hunter and Schmidt's (2004) approach to independently address each moderating effect. According to this approach, researchers should correct for reliability and sampling bias. First, we corrected for reliability error by dividing each effect size by the product of square root of reliabilities of their respective constructs. Because innovation and creativity were measured as multi-item or continuous constructs in most studies, we used the reported Cronbach Alpha as the measure of reliability. For a few studies that did not provide reliability measures, we used the average of reported reliabilities in other studies, which is a commonly accepted procedure (Geyskens et al., 1998). Second, we corrected the sampling error by weighting the effect size of each study by its sample size.

After carrying out these corrections, we aggregated the individual effect sizes to obtain an overall effect size between creativity and innovation, which establishes the basis for the moderating analysis. We performed a test of heterogeneity on all studies. As a standard procedure recommended in the literature (Higgins and Thompson, 2002; Higgins et al., 2003), we calculated Q and I^2 statistics which can be used to demonstrate heterogeneity. The I^2 statistic describes the percentage of variation across studies due to heterogeneity rather than chance. High values of I^2 (greater than 75 percent) and Q (based on degrees of freedom) suggest heterogeneity is present (Higgins and Thompson, 2002; Higgins et al., 2003).

To perform a moderating analysis, we created several sub-groups of the studies and calculated the mean effect size for each of them. To test for the significance of the moderated relationship, we used several criteria. We initially calculated the inverse Fisher Z-transform of the mean effect sizes and tested for differences among sub-groups. We further constructed the confidence interval of the mean effect size for each group. Finally, we calculated the previously mentioned statistics (I^2 and Q) to test the heterogeneity of each subgroup. To test for potential publication bias or the file drawer problem, we calculated the fail-safe number suggested by Orwin (1983). It indicates the number of studies needed to make the mean effect size insignificant. If this number is larger than the number of studies used to calculate the mean effect size, then the file drawer problem is not present. As shown in the last column of Table 3, all values are larger than their corresponding number of studies, indicating that the file drawer problem is not present.

In the second stage of the meta-analysis, we ran meta-regression models to simultaneously take into account the effect of several moderator variables. We followed the procedure suggested by Wilson and Lipsey (2000). In a meta-regression model, the effect size serves as the dependent variable and the moderators are used as independent variables. Within the three meta-regression models, we included three continuous moderating variables (collectivism, uncertainty avoidance, and power distance), five binary moderating variables (innovation type, firm size, firm-level, individual-level, and industry type), and the methodological moderators to assess the robustness of the bivariate analysis (see Table 3 for the logic behind our model selection).

5. Results

The bivariate meta-analysis results, correlations between coded variables, and meta-regression analysis results are presented in Tables 3 through 5. Table 3 includes the effect sizes for our relationships of interest. Using the overall relationship between creativity and innovation as a reference point and to investigate heterogeneity, we averaged all individual corrected effect sizes. The results indicate that there is a strong positive relationship between creativity and innovation ($r = 0.46$). The magnitude of this effect is considered large according to Cohen's (1988) rules of thumb regarding correlation effect sizes. To test the necessity of a moderating analysis, we calculated the Q-statistic (1123.96) and I^2 Statistic (95.46). The results suggest that a large part of the variance is caused by factors other than sampling error or chance, so we may reject the null hypothesis of homogeneity of effect size across the studies. This conclusion led us to continue our analysis of the effect sizes for subgroups.

Table 5
Meta Regression (standardized coefficients are presented).

Variables	Model 1[a]	Model 2[b]	Model 3[b]
Measure of Creativity	-.3525**	-.3394***	-.0756
Measure of Innovation	-.0716	.1626*	.0609
Publication Status	-.3958**	.1737**	.1636**
Firm Size	.8071***		
Innovation Type		.4656***	
Industry Type		-.4483***	-.3597***
Firm level			-.0258
Individual level			.3971***
Collectivism		.4205***	.3471**
Collectivism Squared		-.0007	-.0027
Uncertainty Avoidance		.0217	.0643
Uncertainty Avoidance Squared		-.3169***	-.2145***
Power Distance		.1139	.0794
Power Distance Squared		.0980	.0626
R-Squared	.7693	.6473	.5238

Coding for binary variables: **Measure of Creativity**: Qualitative = 1, Quantitative = 0; **Measure of Innovation**: Qualitative = 1, Quantitativ = 0; **Publication Status**: Published = 1, Unpublished = 0; **Firm Size:** Large = 1, Small = 0; **Innovation Type:** Process = 1, Product = 0; **Industry Type:** High-tech = 1, Low-tech = 0; team level is the reference category for the firm and individual level variables.

Note: Based on the results of the correlation tables, we did not include the level of analysis variables and innovation type on the same model to reduce the effect of multi-collinearity.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

[a] We ran this model with studies at the firm level. However, we also ran separate two-way ANOVA analyses to test the joint effect of firm size and other moderators on the effect size, of which none were significant.

[b] We ran this model with all studies (firm size is not included in this model to keep the number of included studies large enough). Due to multi-collinearity issues, the innovation type and level of analysis variables were not included in the same models (based on the cut-off point 0.5 on the correlation table).

First, to test Hypotheses 1a and 1b, we calculated the aggregate effect size for each level of analysis. The results show that the strongest correlation between creativity and innovation occurs at the individual level ($r = 0.60$), followed by the team level ($r = 0.38$) and the firm level ($r = 0.30$). The results from the r-to-Z transform difference test are significant for individual and team effect sizes ($z = 11.01$) as well as team and firm effect sizes ($z = 3.12$). The result of the meta-regression Model 3 (see Table 5) confirms the individual-team difference in effect size, but there is no significant difference between the team and firm level in Model 3. Thus, we find strong support for Hypothesis 1a, but not for Hypothesis 1b.

After testing whether firm size positively moderates the relationship between creativity and innovation, the results suggest that the relationship between creativity and innovation is stronger in large firms ($r = 0.51$) compared to small firms ($r = 0.22$). In addition, the meta-regression Model 1 results indicate a significant positive moderating effect for firm size. Thus, our results indicate strong support for Hypothesis 2. Considering the moderating effect of innovation type, the bivariate meta-analysis results suggest that the relationship between creativity and innovation is significantly stronger for process innovations ($r = 0.57$) than for product innovations ($r = 0.31$). The results of the meta-regression Model 2 suggest that innovation type has a strong positive moderating effect, offering support for Hypothesis 3.

Next, we tested the moderating effect of industry type (high-tech versus low-tech). To our surprise, the results indicate that the link between creativity and innovation is stronger in low-tech industries ($r = 0.57$) than in high-tech industries ($r = 0.34$). This result is consistent across both the bivariate meta-analysis and the meta-regression, thereby rejecting Hypothesis 4.

We tested Hypotheses 5 through 7 concerning the moderating effects of three cultural dimensions. Regarding the moderating impact of the collectivism dimension, the result of the bivariate meta-analysis did not indicate an inverse U-shaped relationship. Even after controlling for other influencing factors in the meta-regression models, we did not find support for this inverse U-shaped relationship. Therefore, we did not find support for Hypothesis 5. However, a closer look at the results reveals that the linear effect of collectivism on creativity-innovation link is significant. The correlation at higher levels of collectivism ($r = 0.61$) is significantly larger than the correlation at lower levels of collectivism ($r = 0.42$). Moreover, the collectivism linear term is significantly positive in the meta-regression models. So, we can conclude that collectivism positively moderates the link between creativity and innovation. With regard to the uncertainty avoidance dimension, we find an inverse U-shaped relationship in the bivariate analysis. The link between creativity and innovation is stronger for moderate levels of uncertainty avoidance ($r = 0.48$) than for lower levels ($r = 0.38$) and upper levels ($r = 0.43$). This result is also confirmed in the meta-regression. The squared term coefficient is significantly negative and the inflection points (0.03 for Model 2; 0.15 for Model 3) are within the range of values for the uncertainty avoidance variable (Lind and Mehlum, 2010). Therefore, our results offer support for Hypothesis 6. Finally, regarding Hypothesis 7, the link between creativity and innovation is stronger for moderate levels of power distance ($r = 0.48$) than for lower levels ($r = 0.32$) and upper levels ($r = 0.37$). However, this result could not be replicated in the meta-regression. Hence, Hypothesis 7 is not supported.

Finally, our analysis also reveals some insights into the effects of our methodological variables on the strength of the creativity-innovation link. The results of the bivariate analysis show that the size of our correlation of interest is significantly different between published ($r = 0.47$) and unpublished ($r = 0.34$) studies. This result is not surprising given the fact that review processes are usually biased toward significant results. Further, we find interesting results related to the operationalization of the creativity and innovation variables. At a high level, the results of the bivariate analysis show that operationalization matters for both creativity ($r_{qual} = 0.45$ and $r_{quant} = 0.56$) and for innovation ($r_{qual} = 0.47$ and $r_{quant} = 0.44$). We find that the effect size is significantly different depending on the choice of qualitative or quantitative measurement. However, the creativity variable appears to be more sensitive to operationalization based on the results of the r to Z-transform test as shown in Table 3.

6. Discussion

This study investigates the important association between creativity and innovation, taking into account several salient contextual attributes. Indeed, insight into the factors that support the conversion of creative ideas into innovations is still limited. Overall, we found a strong correlation between creativity and innovation. However, significant differences in the strength of the association could be observed across different levels of analysis. The strongest correlation was observed at the individual level, a finding that is consistent with Taylor and Greve (2006) who found that experienced individuals outperform teams in terms of performing exploratory and exploitative activities because they do not suffer from process losses (losses due to coordination, conflict management, communication, etc.). This result suggests that despite having relatively fewer cognitive, intellectual, and skill-based resources compared to those present at the team and firm levels, individuals appear relatively more successful at converting creative ideas into innovations because ambidexterity can be achieved through relatively simple cognitive mechanisms like switching mind and action sets (Gollwitzer et al., 1990). This finding demonstrates that firms could improve their record of turning useful and new ideas into process innovations and innovative products/services by identifying ambidextrous individuals and leveraging their efforts (Atuahene-Gima, 2003; Baer, 2012; Patanakul et al., 2012). The lower correlation and greater challenge to achieve ambidexterity at the team level is consistent with prior findings in the literature highlighting the complexity of ensuring clarity and commitment to shared objectives among team members, effective participation in decision making, management of task and interpersonal conflict, creation of support systems, intragroup safety, and an appropriate climate to convert creative ideas into innovations (e.g., West, 2002). It is generally assumed that the conversion of ideas into new innovations is non-linear, and this is certainly the case at the team level where innovative outcomes require the balancing and management of numerous complexities, tensions, and trade-offs (Van De Ven, 1986). In this study, we could not find any significant difference in the size of the creativity-innovation correlation between the team and firm level. Perhaps this can be explained by the fact that most organizations organize their product/process development activities in teams, and thus, an organization can be viewed as a collection of teams where alignment of creativity and innovation at the organizational level can be reduced to alignment of these activities at the team level. An alternative explanation is the fact that most (77 percent) of the firms in our sample are small and that in many cases the organizational level might closely approximate the team level.

In addition, our moderator analysis yields some intriguing organizational- and environmental-specific findings. Our findings suggest that the relationship between creativity and innovation is stronger in large firms than in small firms, consistent with our theoretical argument that larger firms have more resources and more established routines to handle the two conflicting knowledge-related processes in an ambidextrous fashion. This finding also is consistent with much of the empirical literature on the impact of firm size on the innovation process (Damanpour, 1996; Nord and Tucker, 1987). Furthermore, we found that the link between creativity and innovation is relatively stronger for process innovations than for product innovations. In this context, the integration of knowledge from several departments should occur more easily for process than for product innovations. Consistent with recent findings in the literature, the conversion of creative ideas into improved processes occurs through knowledge sharing practices, the introduction of knowledge management systems, and the application of alternative mechanisms (Trigo, 2013). While product innovations are of paramount importance to the long-term success of the firm, the results suggest that creative ideas may be easier to translate into new process innovations to keep internal processes as efficient as possible.

A surprising finding of our study is that the association between creativity and innovation is stronger in low-tech industries than in high-tech industries. Several scholars (Covin et al., 1990; Hirsch-Kreinsen et al., 2006) point to very low levels of R&D intensity and very weak R&D capabilities along with structural conditions in low-tech industries as primary reasons why the conversion of creative ideas into innovations is rather modest at best. However, more recent research that highlights the heterogeneity of R&D capabilities of firms in low-tech industries (Mendonca, 2009) may suggest that exceptional firms in low-tech industries may be able to translate high levels of creativity into new innovations. Another plausible explanation is that most innovations in low-tech industries (dominated by suppliers) are incremental in nature in order for firms to maintain their competitiveness in the market (Heidenreich, 2009), and the conversion of creative ideas into innovations may be stronger for such a type of innovations than for more radical innovations. A final explanation is that firms in high-tech industries might be more creative in terms of business model design, new ways of delivering value, or in their marketing approach and the implementation thereof (Chesbrough, 2010) – correlations that are not captured by our data.

The final three moderating factors in our study involve the cultural dimensions of collectivism, uncertainty avoidance, and power distance. We find no support for an inverse U-shaped effect of collectivism on the creativity-innovation relationship. However, results suggest that collectivist cultures have a greater success rate in converting creative ideas into innovations and that ambidexterity is relatively easier to achieve, which is consistent with prior research (Nakata and Sivakumar, 1996). It may be easier to stimulate creativity in a collectivist society, an activity that takes place early on in the conversion process, than to facilitate idea implementation in a highly individualistic culture, the stage that is longer in duration and where trust, participation, and esprit de corps are required (Nakata and Sivakumar, 1996). Next, we find strong support for moderate levels of uncertainty avoidance maximizing the relationship between creativity and innovation. This finding suggests that moderate levels of risk-taking and an ability to overcome resistance to change are critical to generate novel and useful ideas and to implement them effectively into innovations. Finally, our results do not provide full support for moderate levels of power distance maximizing the creativity-innovation relationship. Perhaps the leadership style within an organization will have a more powerful impact on the ability of organizations to be ambidextrous and turn creative ideas into innovations (Bledow et al., 2011).

This study has several limitations. First, we study the creativity-innovation relationship at discrete levels of analysis and do not consider interactions between the individual, team, and firm levels because our sample data did not allow us to address this issue. Second, the primary studies may have a survival bias limitation, which may restrict our results to only those innovations that performed well or at least survived in the market. Third, the Pearson correlation coefficients used as primary inputs for the meta-analysis are intended to gauge the strength of linear relationships between two variables. Therefore, correlation coefficients are unable to capture potential non-linear effects that may exist between variables. Fourth, there has been a relative lack of studies conducted at the team level, a level at which most innovative projects are carried out (Im et al., 2013). Finally, the data did not allow us to make a distinction between radical and incremental innovations. Depending on the conditions, both radical and incremental ideas can be important for innovation (Sorenson, 2002) and likely have different emphases on idea generation and idea implementation

6.1. Implications and future research

In terms of theoretical implications, this study indicates that the association between creativity and innovation is highly contextual and multi-level in nature. Therefore, new theories on how creativity affects innovative outcomes should clearly explicate the causal relationships of direct and contingent factors at multiple organizational levels while accounting for interactions of salient attributes across different levels of analysis. Empirical studies should subsequently test these new theories.

In terms of practical implications, the moderating effects revealed in this study imply that managers and entrepreneurs should not pursue innovative activities without taking context or contingency into account; rather, they should be aware of boundary conditions that can constrain the positive impact of creativity on innovation. First, managers and entrepreneurs have a certain degree of control over some of the moderating variables discussed in our study, such as managing firm size, locating their R&D units in countries with specific cultural profiles, hiring individuals from countries or ethnic groups with distinct cultural traits for their innovation teams, and balancing the mix between process and product innovation performed in their organizations. This implies that the link between creativity and innovation could be strategically managed to a certain degree. Second, the association between creativity and innovation is strongest at the individual level. It thus makes sense to involve and incentivize every individual in the organization to come up with many creative ideas and transform them into innovative outputs, a long-established business practice in certain highly-innovative firms such as P&G, 3 M, and Google. Further, firms should make an effort to identify, nurture, and effectively deploy ambidextrous individual researchers and also consider them for participating in innovation teams. Figuring out how to best accomplish this presents another area for future research. Third, another finding of our study suggests a strong correlation between creativity and innovation at the team level, which is not surprising given the fact that many new products and services are developed in a team context (Im et al., 2013). This finding presents another avenue for future research since little is known about project management practices and leadership styles in new venture teams and the interaction of activities related to idea generation and idea implementation in such a context. Fourth, our results demonstrate that larger firms, despite the popular image of being bureaucratic and inertial, are more capable of managing the creativity-innovation relationship than smaller firms. The implication here is that entrepreneurs should consider adopting a growth strategy to acquire necessary resources and to enable successful integration mechanisms to simultaneously generate novel and useful ideas and subsequently implement these ideas. Fifth, our findings appear to suggest that the creativity-innovation link is stronger for process innovations relative to product innovations. Hence, managers should not neglect the importance of process innovation especially in competitive industries where manufacturing or business process efficiency is critical for survival. We exhort scholars to more closely investigate the differential impact of process innovation, especially in a small (new) business setting.

Finally, the empirical results suggest that different cultural dimensions substantially affect the association between creativity and innovation. These findings could have implications for where firms should geographically locate their R&D activities (e.g., in countries with moderate uncertainty avoidance levels) as well as how they should structure and lead product/service development teams across different cultural diversities and nationalities.

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