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# In the eyes of the beholder: The effect of participant diversity on perceived merits of collaborative innovations

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## ABSTRACT

Technological innovations often involve collaboration among firms from diverse industries. Existing literature has largely viewed participant diversity as a conduit for non-redundant information or complementary resources, thereby affecting the *ex-post* outcomes of innovation projects. However, it is seldom examined how projects are initially evaluated during the resource competition stage. In this study, we develop a theory of diversity as a cognitive primer, asking how collaborators from diverse backgrounds may affect external reviewers' *ex-ante* evaluation of potential merits of an innovation project. We argue that there are two logics at work in the process of evaluating innovations: the logic of technological advancement and the logic of market value. When an innovation project involves firms from diverse industries, it may be perceived as having a fuzziy market identity, hence making it less appealing to reviewers who hold with the strong market value logic. However, the penalty associated with participant diversity should be less pronounced among reviewers who hold the technological advancement logic. We also expect the relationship between participant diversity and reviewers' ratings to be moderated by project novelty and fuzziness of technology category. We find support for our hypotheses with a sample of collaborative innovation projects funded by the Advanced Technology Program of the U.S. National Institute of Standards and Technology.

## 1. Introduction

Innovation and management scholars have increasingly emphasized the importance of collaborative innovation among firms from different domains (Ahuja, 2000; Davis and Eisenhardt, 2011; Powell et al., 1996). In particular, prior research has highlighted that heterogeneity of participants' functional, technological, or industry backgrounds may affect innovation outcomes. The central theme in this line of research is that collaborative innovations among participants with heterogeneous knowledge sources could help generate non-redundant information flows, stimulate meaningful debates (Eisenhardt, 1989), and pull together complementary resources and capabilities (Fleming et al., 2007; Mowery et al., 1998), thus leading to better innovation performance.

In this study, we contribute to this line of research by examining the role of participant diversity in innovation from a different perspective. Instead of focusing on how participant diversity may affect the *ex-post* outcomes of innovation projects through the process of collaboration, we ask how participant diversity is associated with the *ex-ante* perceptions of key audiences in the stage of evaluation—especially evaluations from external resource providers or expert reviewers.

Organizations continuously make critical resource allocations among potential projects, and resource providers consistently face the difficult task of determining which projects are worth investing in. Yet, research has shown that evaluators' decisions are not always a function of objective merits of the focal project, but rather an outcome of complex social-cognitive processes (e.g., Hsu, 2006; Lamont, 2009; Rivera, 2015; Simcoe and Waguespack, 2011; Tan and Roberts, 2010; Zuckerman, 1999). Evaluators' perceptions may shape project selection and resource allocation, thereby influencing the amount of innovation exploration by organizations. Given that evaluation is an important step for essentially any innovative endeavor, it is surprising how little we know regarding the effect of participant diversity on *ex-ante* evaluations.

We believe that it is critical to ask what happens when multiple projects compete for resources and evaluators' attention for two reasons. First, an innovation project might be underfunded or dismissed if it does not receive favorable assessments from key audiences, and evaluators' *ex-ante* biases may thus shape organizations' innovation outcomes by underinvesting in promising innovation projects. Second, initial evaluation outcomes may also affect motivation and resource

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allocation during the actual developmental phase of a project and thereby shape *ex-post* realized collaborative innovation performance. By highlighting the role of participant diversity as a signal or cognitive primer in the evaluation of collaborative innovations, this study complements existing views of diversity as conduits of information or resources, and addresses an important gap in the literature.

In environments where external audiences lack adequate information to judge the intrinsic quality of an offer or candidate, they rely on external attributes of the focal offer or the organization's observable qualities as a signal to make a judgment (Spence, 1974). Such attributes may include a product's brand name and price (Dawar and Parker, 1994), a firm's status (Podolny, 1994), or an organization's partnership and alliance portfolio (Chang, 2004; Stuart et al., 1999). In the context of collaborative innovations in which the process is technically complex and the outcome is often highly uncertain, we expect that external reviewers will pay particular attention to externally observable traits or affiliations of innovation projects. The composition of the collaboration team should thus be associated with the project's perceived value or potential. Determining the type of composition that will be valued more favorably, however, depends upon the primary logic held by the evaluators.

As Utterback (1971: 77) points out, to qualify as an innovation, an idea has to be "carried far enough to begin to have an economic impact." In other words, an innovation concerns not just the creation of new things, but also the creation of new value from a market perspective. The evaluation of an innovation, therefore, inherently involves two different logics: the logic of technological advancement<sup>1</sup> and the logic of market value. The tension between technological advancement and market value is reflected in the divergence of different theoretical traditions, particularly when juxtaposing the mostly optimistic view of diversity in the innovation literature with cautions against diversity from the emerging literature of categorization in organization studies. While some innovation scholars have cautioned against potentially higher risk associated with highly innovative ideas that involve novel recombination (e.g., Wang et al., 2017), the innovation literature has largely suggested that technological advancement comes from recombining or reconfiguring preexisting diverse knowledge elements (Galunic and Rodan, 1998; Katila and Ahuja, 2002). Following this perspective, collaborative innovation projects that involve more diverse participants should be associated with higher evaluations for their technical potential. However, based on the ecological principle of allocation (Bogaert et al., 2010; McKendrick et al., 2003), the literature on categorization in organization studies stresses the importance of category coherence, and cautions that category fuzziness may reduce the perceived value of an offer (Hsu, 2006; Zuckerman, 1999). Although the focus of past categorization research has been on the focal offer's categorical purity or fuzziness, in this study we extend this insight to the composition of a collaboration team's diversity, and propose that participant diversity may cause confusion among the audience, thereby lowering the perceived value of the innovation project.

The evaluation of innovation projects with diverse participants thus poses an uneasy tension for management scholars. That is, the innovation literature mostly touts the importance of diversity in fostering new ideas, while the literature on categorization implies that pulling together a diverse team might be a risky move. Therefore, how participant diversity is associated with the *ex-ante* evaluation of a collaborative innovation is not only a question of empirical significance, but also a theoretical puzzle that has not yet been well understood. In fact, authors from a variety of disciplines have written about both the potential merits of interdisciplinary research and the difficulty in evaluating such work (Aboelela et al., 2007; Campbell, 2005; Naiman, 1999;

<sup>1</sup> By "technological advancement," we refer to not only physical technologies, but also to social technologies.

Wang et al., 2017; Lamont et al., 2006). The implication from this line of research is that, while innovation involving diverse participants may potentially create greater technological or scientific breakthroughs, such efforts may also encounter hurdles in obtaining funding or being published in the first place.

In this paper, we attempt to contribute to our understanding of the diversity-innovation relationship by developing and testing a theoretical framework that explains why, and under what conditions, participant diversity is associated with the perceived merits of collaborative innovations in the eyes of external reviewers. Bringing together the literature of innovation, categorical imperative, and institutional logics, we argue that, while reviewers may discount diverse projects based on the categorical imperative thesis (Zuckerman, 1999), the strength of this "imperative" also depends on other contextual factors. Specifically, different evaluation logics—logics that stresses technological advancement versus those that emphasize market value—will invoke different reactions to participant diversity in innovation projects, and diverse projects will be associated with a greater "illegitimacy discount" when reviewers hold a stronger market-value logic. We also propose that the effect of project participant diversity on the evaluation of external reviewers should be contingent upon the novelty of the focal project, as well as the fuzziness of the technology category to which the project belongs.

We test our arguments with data on collaborative innovation projects funded by the Advanced Technology Program (ATP) at the U.S. National Institute of Standards and Technology (NIST). ATP was a federally funded, cost-sharing program designed to partner with the private sector to further the R&D of technologies that have the potential to provide significant benefits for the nation. ATP is an excellent context for addressing our questions for two reasons. First, ATP collected information on every funded proposal, including participating firms' industry affiliations and evaluation scores from both technical and business reviewers upon submission of proposals, which allows us to inspect the effects of participant diversity on *ex-ante* evaluations of collaborative innovations before these projects were carried out. Second, ATP's mission was to fund projects that were collaborative and innovative in nature, as well as the potential for commercialization and broad economic impacts. This setting constitutes an ideal context for examining the tension between a logic favoring technological advancement and one that emphasizes commercialization and market potential, as well as the theoretical debate about the perceived merits of collaborative innovations and problems of knowledge and expertise diversity among participating firms.

## 2. Participant diversity, evaluation logics, and perceived value of collaborative innovation

Management scholars have long been interested in the notion of diversity and its effects in various organizational contexts. Diversity, especially expertise- or knowledge-based diversity, has been argued as an important source of creativity and innovation (Hoffman and Maier, 1961). Scholars have examined how diversity of participating firms affects innovation outcomes and firm performance (e.g., Ahuja, 2000; Fitjar and Rodríguez-Pose, 2013; Fleming et al., 2007; Lee et al., 2015; Walsh et al., 2016). Although insightful, existing literature has primarily focused on the effect of participant diversity on *ex-post* performance (as opposed on *ex-ante* perceptions) of an innovation, and on the informational aspect (as opposed on the cognitive aspect) of potential mechanisms. However, recent research on category studies and institutional logics offers some important insights that may significantly advance our understanding of the role of participant diversity in innovation.

According to the categorical imperative thesis, categories are often durable elements of institutional environments. People use categories to make sense of the world (Zerubavel, 1997). If human perceptual capabilities are the hardware for sensemaking, categories constitute the

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