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ABSTRACT

Prior research calls for more attention to organizational contexts’ moderating effects on a relationship between diversity in antecedent knowledge and resultant new knowledge generation. The authors examined 11,939 firms granted 103,952 U.S. patents between 1975 and 1999, and found a stronger positive association between the diversity and resultant new knowledge’s degree of usefulness under the context more strongly characterized with extensive search efforts (i.e., U.S. applicants). Under the context more strongly characterized with selective appropriation (i.e., non-U.S. applicants), the study found a weaker inverted U-shape association between the diversity and resultant new knowledge’s variability in usefulness. Author’s findings show that it is important to properly control for the effect of such organizational contexts for a more conclusive explanation on the role of antecedent knowledge diversity in new knowledge generation.

Keywords: Appropriation, Exploration, Knowledge Diversity, Knowledge Generation, Knowledge Recombination, Search, Technological Innovation

INTRODUCTION

In studies of organizational learning, it is widely understood that more useful knowledge is generated by recombining diverse antecedent knowledge. We use “diversity” to describe the distribution of differences among knowledge components recombined to generate new knowledge, with respect to a common attribute, such as technological class. For example, firms embedded in a more diverse alliance network are more innovative in that they are granted patents more frequently (Ahuja, 2000), or they generate patents with more exploratory nature (Phelps, 2010). When applicants recombine technologically, as well as organizationally boundary-spanning knowledge, their patents are more frequently cited by subsequent patents (Rosenkopf & Nerkar, 2001).

In spite of such an array of studies, empirical results on a relationship between diversity in antecedent knowledge and innovation outcomes...
are inconclusive at best (Harrison & Klein, 2007; Jackson, Joshi, & Erhardt, 2003; Pitcher & Smith, 2001; Webber & Donahue, 2001). It is because moderating effects of organizational contexts on the relationship between diversity and generation of useful knowledge is not properly accounted for (Jackson, Joshi, & Erhardt, 2003; Pitcher & Smith, 2001; Webber & Donahue, 2001). Accordingly, our research question is how the relationship between diversity in antecedent knowledge and its innovation outcomes differ across two organizational contexts characterized with distinct knowledge recombination practices.

The current paper tries to address the deficiency in extant research by analyzing recombination of diverse antecedent knowledge represented in U.S. patents granted to U.S., as well as to non-U.S. applicant private organizations. These two groups of applicants are characterized with quite distinct knowledge recombination practices. On the one hand, U.S. applicants search for antecedent knowledge more extensively. On the other hand, non-U.S. applicants are more selective in appropriating their inventive outcomes by U.S. patents. We particularly focus on how technological diversity characteristics in backward citations influence recombined knowledge’s degree, as well as variability of usefulness measured by the focal patent’s forward citation frequency.

Our results show a positive moderation by search efforts on the relationship between technological diversity characteristics in antecedent knowledge and new knowledge’s degree of usefulness. We also found a negative moderation by selective appropriation on the relationship between technological diversity characteristics in antecedent knowledge and resulting new knowledge’s variability in usefulness. With these findings, our contribution to the research on knowledge management is twofold. Firstly, we uncovered conditions under which diverse antecedent knowledge can be more effectively recombined to generate useful new knowledge. Secondly, we explained more precisely how alternative knowledge recombination practices contribute to the generation of useful new knowledge. Together, these findings enable us to more deeply understand the nature of the relationship between antecedent knowledge diversity and innovation performance.

**THEORY AND HYPOTHESIS**

The new combination is a hallmark of novelty creation (Schumpeter, 1934). Favorable innovation performance can be expected to the extent that new ways to effectively combine hitherto uncombined components are identified. One effective strategy to achieve such a new combination is increasing the degree of diversity in combined components, including raw material, products, and knowledge. New knowledge is often generated by recombining extant knowledge. Accordingly, it is expected that diversity in such antecedent knowledge positively influences resultant new knowledge. As such, prior research focuses on characteristics of recombined knowledge components *per se* as possible determinants of resultant new knowledge’s usefulness. The key question asked has been what type of knowledge components selection can be best recombined to generate useful new knowledge. Such knowledge recombination characteristics like diversity in technological classes or diversity in external knowledge sources have been extensively analyzed (Benner & Tushman, 2002; Rosenkopf & Nerkar, 2001; Sørensen & Stuart, 2000).

Conversely, there is a growing call for research to rethink the relationship between diversity and innovation outcomes (Ancona & Caldwell, 1992; Lovelace, Shapiro, & Weingart, 2001; Tortoriello & Krackhardt, 2010). In contrast to those who argue for beneficial effects of diversity, these authors contend that the difficulty to integrate diverse antecedents hinders innovation performance. Careful reviews of empirical proofs on the relationship reveal an accumulation of nonsignificant, inconclusive, and mutually contradicting results (Harrison & Klein, 2007; Harrison, Price, & Bell, 1998; Jackson, Joshi, & Erhardt, 2003; Webber & Donahue, 2001). Consequently, "the previous
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