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Social capital, exploitative and exploratory innovations: The mediating roles of ego-network dynamics

Yan Yan^a, JianCheng Guan^{a,b,*}^a School of Economics & Management, University of Chinese Academy of Sciences, 100190 Beijing, China^b School of Business Administration, South China University of Technology, 510640 Guangzhou, China

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ABSTRACT

Previous research has considered researchers' social capital as a determinant of innovation. However, how individual social capital affects exploitative and exploratory innovations has not yet been sufficiently addressed. The purpose of this study is to demonstrate what and how social capital affects two types of innovations at the researcher level, by positing and testing ego-network dynamics as important mediators of the social capital–innovation process.

We collect a panel patent dataset from a large US biotechnology company between 1976 and 2013, and conduct data analysis using Negative Binomial (NB) model and robust tests (e.g., Sobel test and 2SLS model). Results indicate that individual relational capital has a negative effect on exploratory innovation, but a positive effect on exploitative innovation. Structural capital positively affects both types of innovation. Cognitive capital has a positive impact on exploratory innovation but not exploitative innovation. The findings further show how ego-network stability and ego-network expansion mediate the relationships between social capital and two types of innovations. This paper contributes to exploitative and exploratory innovations theory by introducing social capital and network dynamics as important factors and mediators, and social network theory by exploring the antecedent and subsequence of ego-network dynamics.

1. Introduction

The term social capital initially indicates the aggregate of the actual or potential resources that are acquired from network relationships of social units (Nahapiet and Ghoshal, 1998). Recent work has sought to apply this concept to innovation research and claimed that social capital is essential to innovation (Subramaniam and Youndt, 2005). Social capital theory provides important perspectives for explaining innovation activities (Landry et al., 2002; Laursen et al., 2012; Nahapiet and Ghoshal, 1998). Social capital, as an important intangible asset, can influence activities that cover individuals' knowledge creation (McFadyen and Cannella, 2004), interorganizational knowledge transfer (Inkpen and Tsang, 2005; Tsai, 2001), and firms' incremental and radical innovation (Subramaniam and Youndt, 2005). Despite the importance of social capital in innovation, the relationship between social capital and innovation didn't reach consensus among scholars (Adler and Kwon, 2002). In some cases, social capital had a positive effect on innovation (Subramaniam and Youndt, 2005; Tsai and Ghoshal, 1998). In others, the risk or the negative effect dominated (Edelman et al., 2004).

One primary reason for these mixed findings is that different types of innovation require different dimensions of social capital to develop. Previous literature proposed three dimensions of social capital—namely, relational, structural and cognitive capital (Nahapiet and Ghoshal, 1998). Relational capital describes relationships people have with others; structural capital refers to the overall pattern of personal network; cognitive capital means the resources an individual develops in sharing expertise and experience. Scholars have also claimed the big differences between exploratory and exploitative innovation (March, 1991; Benner and Tushman, 2003; Guan and Liu, 2016). Exploratory innovation involves discovering, creating and pursuing new knowledge and products. Exploitative innovation refers to improving, implementing and extending existing knowledge and products (Benner and Tushman, 2002; Corey, 2010; Bierly et al., 2009; March, 1991). These two well-known types of innovation need distinct resource and knowledge, display different knowledge formation processes, and require different search scope and depth (Jansen et al., 2006; Corey, 2010; Jansen et al., 2009; Wang et al., 2014). Different dimensions of social capital involve different key concepts, and represent different ways how units' resource gets accessed and possessed. Yet distinct

* Corresponding author at: School of Economics & Management, University of Chinese Academy of Sciences, 100190 Beijing, China.
E-mail address: guanjianch@ucas.ac.cn (J. Guan).

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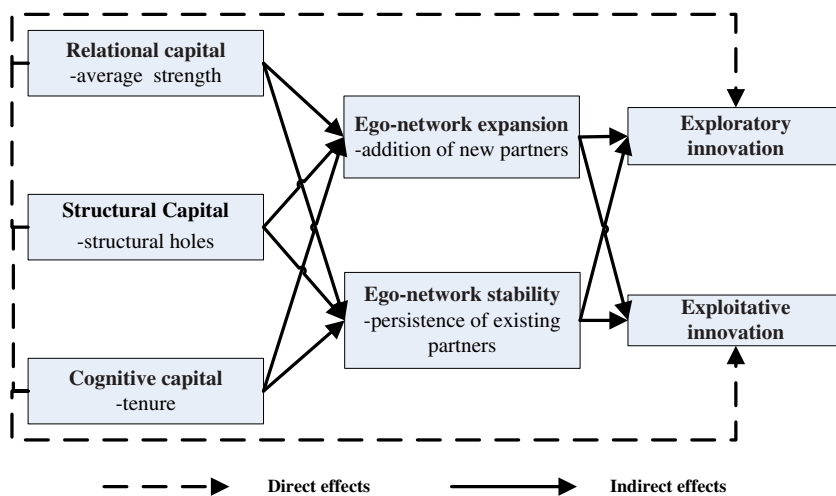


Fig. 1. Research model.

dimensions of social capital remained unlinked with the certain types of innovation units possess, with majority of research only connecting social capital with some innovation outcomes that are broadly defined. Some scholars appeal for taking an integrated perspective to capture the effects of sub-construct of social capital on different types of innovation, rather than taking a single and limited view (Zheng, 2010). The crucial gap existing in extant research originates from that existing research generally adopted a single viewpoint. This gap is of importance given that the investment in social capital is difficult to reverse or recoverable (Adler and Kwon, 2002), and social units usually need to adopt different strategies for achieving these two distinct innovation (Li et al., 2008).

Our first contribution is to address the prior omission by presenting an analysis framework that explains and empirically tests how two types of innovation (exploratory and exploitative) vary in the dimensions of social capital (relational, structural and cognitive) they draw upon. We aim to shed light on the social capital–innovation relationship by complementing the neglected detailed links between them. To be specific, from research on social capital, we explore how relational, structural and cognitive capital enables units to acquire or possess their resource. On the other hand, from research on innovation, we investigate the distinction of needed resource between exploratory and exploitative innovation delineated above (Jansen et al., 2006; Gupta et al., 2006).

The second contribution of this study is assessing the researchers' ego-network expansion and stability as mediators between their social capital and innovation. A researcher's ego network means the set of researchers with direct collaborative ties to a focal researcher, named "ego", and the set of ties among them (Borgatti et al., 2009). We define ego-network expansion and stability as new direct partners addition and old direct partners persistence. We propose researchers' ego-network dynamics as mediators for two reasons. On the one hand, network is a critical strategic option for individuals to strengthen their innovation capabilities (Ibarra, 1993; Li et al., 2013). According to the network dynamics theory, knowledge creation and innovation are dynamic processes, and people who desire and pursue new knowledge have to occupy and expand information channels through network dynamics (Arikan and Knoblen, 2014; Cannella and McFadyen, 2013; Sosa, 2011). However, to our knowledge, the impact of network dynamics (ego-network stability and expansion) on innovation (exploratory versus exploitative) has not been studied before. On the other hand, we address that the social capital a researcher has, which explains the goodwill and resources (especially knowledge) necessary for achieving goals (Zahra, 2010), will influence his/her partner and network dynamics. Because actors are purposeful and intentional agents, their social capital causes the self-seeking actions (e.g., mitigating

opportunism or enhancing reciprocity) to generate the network structures (Heidl et al., 2014). According to previous network dynamics research, social capital can be one of the drives of ego-network dynamics (Ahuja et al., 2012), while empirical work to address these issues is scant.

Besides the above contributions, our study makes important implications by focusing on the researcher level. First, the individuals reflect very basic, but important research unites that can be readily observed. Innovation at a higher level to a large extent originates in the activities of their researchers (Tasselli et al., 2015; Mom et al., 2007). Furthermore, to our knowledge, little is known about exploratory and exploitative innovation at the individual level, especially what factors affect these activities, which can enrich our understanding of two types of innovations activities. Secondly, social capital has its basis in individual actions, behaviors and predispositions (Brehm and Rahn, 1997). Individuals face incentives to behave selfishly and search the benefits of social capital with paying less cost. It is not clear about the influence mechanism of different social capital on different innovation activities, and we try to fill this gap at the individual level. Thirdly, we advance the network dynamic research at the individual level by firstly exploring the mediating role of individual ego-network dynamics. We recognize that macro changes at the intra-firm network level are driven by the aggregation of numerous micro changes (changes at the scientist ego-network level). In other words, we provide a further understanding of antecedents and consequences of individual ego-network dynamics.

In the next part, we present the conceptual background and hypotheses underlying the framework as showed in Fig. 1. Following this, we present our methodology and the empirical finding using panel data in a long period (1976–2013). This study concludes with a discussion and suggestions for future research.

2. Theory and hypotheses development

2.1. Conceptual background

2.1.1. Exploratory and Exploitative innovation

Exploitative innovation involves a search process which improves and deepens the current knowledge base without changing the essence of technological trajectory. However, exploratory innovation makes an advance to the new and different technological trajectories requiring recombination of diverse and fresh information (Benner and Tushman, 2002; Corey, 2010; Bierly et al., 2009). We provide a systematic comparison between explorative and exploitative innovation including definition, information needs and knowledge requirements in Table 1. According to exploration-exploitation framework, exploitation uses and expands existing knowledge, searching improvements and refinement,

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