

# Exploration and exploitation innovation processes: The role of organizational slack in R & D intensive firms

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## Abstract

This study considers how organizational slack (available and recoverable) affects the process of innovation by facilitating or hindering the process of exploration and exploitation in the case of technology intensive firms. It is argued that the R & D intensity of the firm moderates the effect of organizational slack on innovation quantity, innovation quality as well as the process of exploration and exploitation. These hypotheses are tested using a sample of 208 technology intensive firms in a variety of manufacturing industries during 1989–1995. The hypotheses are supported for the measure of available slack but not recoverable slack. These findings suggest that different types of slack may impact firm behavior in different ways.

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Slack can be thought of as resources available to an organization that are in excess of the minimum necessary to produce a given level of organizational output. The concepts of organizational slack and innovation are central elements in the strategic management literature. Innovation has received a great deal of attention (Hitt, Hoskisson, Johnson, & Moesel, 1996; Hitt, Hoskisson, & Kim, 1997; Stuart, 2000) due to its importance in creating a competitive advantage through organizational adaptation and product development (Hiitt et al., 1996; Sorensen & Stuart, 2000). The concept of organizational slack has also received attention (Cheng & Kessner, 1997; Greenley & Oktengil, 1998; Palmer & Wiseman, 1999) because of its ability to buffer firms from shortages of funds and because of its potential to foster innovation (Bourgeois, 1981; Cyert & March, 1963). It has also been argued however that organizational slack is wasteful, inefficient, and accumulates due to the self-serving interests of managers (Jensen & Meckling, 1976; Nohria & Gulati, 1996; Simon, 1957). The opposing notions on the role of slack have led researchers to conclude that when it comes to innovation, slack can be both a blessing and a curse. More specifically, Nohria and Gulati (1996) showed that an inverted U-shaped relationship exists between slack and innovation. Moderate levels of slack were found to positively impact firm innovation, but at some point too much slack had a negative effect.

The high-technology sector plays a pivotal role in today's "knowledge economy" and according to The Office of Science and Technology, more than half of economic growth during 1945–2002 is attributed to innovations within the

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high-technology sector (Leary, 2002). While most management scholars would agree that certain levels of organizational slack facilitate the innovation process, little is known about how much or what type of slack is most beneficial for technology intensive<sup>2</sup> firms or how other variables interact with slack in the innovation process.

In this paper, we extend the literature on slack and innovation in four ways. First, we extend Nohria and Gulati's (1996) work by looking at the effect of organizational slack on *innovation quantity* and *innovation resonance*. In technology intensive firms where innovation is critical, considering characteristics of their patent portfolio would reveal a more refined picture of their innovation capability than looking at improvements in policy or structure. As such, while Nohria and Gulati (1996) defined innovation very broadly to include accomplishments in policy, organizational structure, method, process, product or market, we define innovation as inventions that have been patented (Ahuja & Lampert, 2001) and consider patent quantity as well as patent impact. Secondly, we examine how organizational slack affects the process of innovation by facilitating or hindering the process of exploration (Cyert & March, 1963). While many have examined the effects of slack on firm performance (e.g. Bromiley, 1991) no study that we know of has looked at the effect of organizational slack on the exploration and exploitation process of innovation. Thirdly, we examine how different types of slack (available and recoverable) have differential effects on innovation depending on the technological intensity of the firm. Finally, while Nohria and Gulati's (1996) study design was a cross-sectional one, we investigate the relationship between organizational slack and innovation using a longitudinal approach.

Central to our argument is the idea that the innovation process can involve both exploration and exploitation (March, 1991). Exploration is "experimentation with new alternatives whose returns are uncertain, distant, and often negative while exploitation is the refinement and extension of existing competencies, technologies, and paradigms exhibiting returns that are positive, proximate, and predictable" (March, 1991). Scientific and technological knowledge play different roles in support of these two innovation processes. Scientific knowledge can provide a type of road map for exploration and may increase the effectiveness of innovation search by helping researchers avoid wasted effort (Fleming & Sorenson, 2004). Technological knowledge on the other hand supports an incremental search process, a process of exploitation, where research activities are tightly linked to prior research activities (Fleming & Sorenson, 2004). Simply put, while technological knowledge facilitates incremental movement on the innovation landscape, scientific knowledge provides guidance which enriches innovation (Fleming & Sorenson, 2004).

While prior research examined the effect of organizational slack on innovation output, no studies to date have examined the impact of organizational slack on the process of innovation. Building on the differences between scientific and technological knowledge we argue that organizational slack affects the use of scientific and technological knowledge in innovation<sup>3</sup> and consequently the extent to which firms invest in exploration and exploitation processes. Further, we suggest that by influencing these two innovation processes organizational slack can also influence the extent to which firms develop innovations that are novel and influential (Fleming & Sorenson, 2004). Finally, we suggest that the R & D intensity of the firm moderates the effect of slack on innovation. We expect that the greater the R & D intensity of the firm, the greater the influence of slack on innovation quantity and quality. In the following section we first define the concept of organizational slack and we then provide a review of the literature involving slack, science and innovation. The development of the hypotheses of interest will follow.

## 1. Organizational slack, science search and firm innovation

### 1.1. What is organizational slack?

Slack has been defined in the literature in different ways. For example, Cyert and March defined slack as "the disparity between the resources available to the organization and the payments required to maintain the coalition" (1963: 36). Similarly, Dimick and Murray defined slack as "those resources which an organization has acquired which are not committed to a necessary expenditure. In essence, these are resources which can be used in a discretionary manner" (1978: 616). Also, Bourgeois (1981) defined slack as resources in excess of what is required for the efficient operation of a firm. Most recently, Nohria and Gulati defined slack as "the pool of resources in an organization that is in excess of the minimum

<sup>2</sup> We use the terms "high-technology," "technology intensive," and "R & D intensive" interchangeably. Operationally, a firm's technological intensity is measured as R & D expenditures as a percentage of sales.

<sup>3</sup> It is important to draw a distinction between an invention and an innovation. Consistent with Ahuja and Lampert (2001), for reasons of simplicity and focus, the use of the term 'innovation' does not refer to commercialized inventions, but rather inventions that have been patented.

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