

Slack and R&D Strategy: The Effect of Slack on Internal R&D and External R&D, and Innovation

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Firms use their internal resources effectively and efficiently in order to achieve innovation, but not all types of resources trigger the same level of innovation. We provide a new insight to understand the relationship between slack resources and R&D strategy by suggesting a new typology for slack resources: tangible and intangible slack. Building on resource-based view, we propose that tangible slack leads to more external R&D activities (external knowledge acquisition) and results in radical innovation, while intangible slack facilitates more internal R&D activities and results in incremental innovation. Implications for future research are discussed.

INTRODUCTION

Innovation and resources are the core concepts of theories in the organization and strategic management field. Innovation has been explained as the result of a firm's operation because it explains a significant portion of firm performance (Roberts, 1999). It is also important to know that innovation represents how well a firm adapts to an external environment by changing organizational structure and developing new technologies and products. Under a dynamic environment, firms are required to become innovative to obtain competitive advantages (Nohria & Gulati, 1996). In this perspective, resources provide the foundation of a firm's innovation.

Where do resources come from? Firm resources can be anything that firms can use to conceive and implement their strategy (Learned, Christensen, Andrews, & Guth, 1969). It includes all types of assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. (Barney, 1991). Of these resources, there are two types – normal and slack. Normal resources are of the type that is used for regular operations of the firm such as the amount of cash holdings to pay for normal payables. Slack resources, which prior studies have recently focused on (Bourgeois, 1981; Cheng & Kesner, 1997; Cyert & March, 1963; Daniel, Lohrke, Fornaciari, & Turner Jr, 2004; George, 2005; Love & Nohria, 2005; Nohria & Gulati, 1996; Sharfman, Wolf, Chase, & Tansik, 1988; Singh, 1986; Tan & Peng, 2003) refer to the excess of what a firm needs for its regular, day-to-day operations. Unused capacity, redundant operations, employees, and unnecessary capital are examples of slack resources (Nohria & Gulati, 1996). Firms use

these slack resources to adapt to environmental changes (Bourgeois, 1981). Each firm has a different level of organizational slack depending on the degree to which the firm operates effectively and efficiently (Nohria & Gulati, 1996).

In terms of innovation, prior research focuses only on investment of slack resources in internal research and development (R&D) or search behavior of firms (exploitation vs. exploration) (see Voss, Sirdeshmukh, & Voss, 2008). Although slack resources can be used in internal or external R&D, the literature that explores the relationship between slack and innovation implicitly assumes that firms use slack resources internally to improve their capability of innovation (Nohria & Gulati, 1996, 1997; Tan & Peng, 2003). While innovation increases firm performance, not all firms invest in R&D activities, and the innovative firms do not engage solely in internal R&D. This limitation of extant research leads to the following research question: *How do firms leverage their slack resources internally and externally in order to achieve innovation?*

In this paper, we investigate the impact of slack resources on the strategic choice for innovation by suggesting a new typology which categorizes slack resources into two groups: tangible and intangible slack. Then, we propose which type of slack resources (tangible and intangible slack) facilitates which types of R&D activities (internal and external R&D) for innovation. Overall, this study contributes to the understanding of the determinants of internal R&D and external knowledge acquisition from the resource-based perspective.

The paper is organized into the following sections. The first discusses the concept of slack and innovation, and reviews related literature. In the second section, the paper discusses two types of R&D activities and proposes a specific association between two type of slack resources and R&D activities. The final section contains the discussion, limitation, and future research.

THEORETICAL FOUNDATIONS AND LITERATURE REVIEW

According to Nohria and Gulati (1996, p.1246), slack is defined as “the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output.” The role of slack in organizations has been extensively researched. Empirical studies in performance literature suggested that slack directly affects performance (Nohria & Gulati, 1996). However, this conclusion was controversial to conclusively explain the relationship between slack and firm performance because the findings varied from positive to mixed relationships. Later, Daniel et al. (2004) found the overall positive effect of slack on firm performance from meta-analysis. They also proposed firms should pursue an appropriate level of slack for high performance within their industry. Also, Love and Nohria (2005) suggest that downsizing lead to improved performance for firms with high level of slack.

In the innovation literature, there have been debates about the impact of slack on innovation. On one hand, proponents support the positive side, claiming that slack allows firms to engage in new innovative projects which might not be possible under resource-constrained environments (Cyert & March, 1963). The logic is that previous success generates slack which plays a role of seeds in innovation activities (i.e. creative and innovative experimentation), while the investment in R&D activities is hardly allowed in the situation of scarcity and under poor performance (Bourgeois, 1981; Cyert & March, 1963). Additionally, the excess resources reduce conflict in decision making, decrease the information processing needs of a system, and encourage new R&D projects (Bourgeois, 1981). On the other hand, opponents propose that slack negatively affects a firm’s innovation because slack might lead the firm not only to a lack of incentive for innovation, but also to unproductive R&D projects which do not yield benefits (M. C. Jensen, 1996; Leibenstein, 1969). In that sense, organizational slack is wasteful as it serves managerial self-interest, incompetence, and laziness rather than acts as a buffer for organizational adaptation. To the end, this theoretical debate leads to a new approach, a curvilinear relationship studied by Nohria and Gulati’s (1996, 1997). Unlike previous studies, they suggest an inverse U-shape relationship in which too little slack and too much slack are bad for innovation. Too little slack discourages investment in R&D projects of which the success is uncertain, while too much slack is likely to result in complacency, which

decreases the success rate of R&D projects due to a lack of discipline and incentives. Although there are different approaches to explaining the slack-innovation relationship, all research is likely to support the notion that slack allows organizations to engage in R&D activities to obtain higher performance from innovation activities.

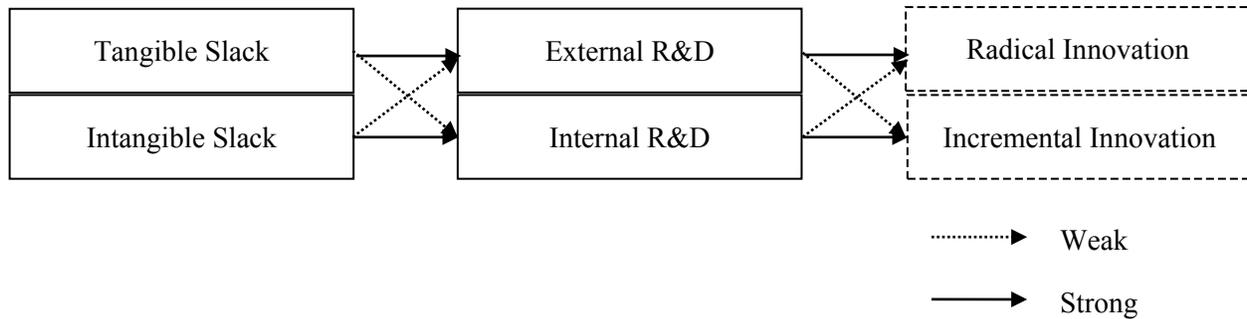
Despite of extensive research in the topic of slack, it is still not clear how slack resources influence a firm's R&D strategy. Firms pursue either external R&D or internal R&D, or both (See Table 1). External R&D broadly implies an engagement in R&D projects with other firms. First, a firm implementing external R&D strategy may form a partnership to develop a new product or technology. For example, Veugelers and Cassiman (2005) found that R&D cooperative agreements between a firm and an university are formed whenever risk is not an important obstacle to innovation and typically serve to share costs. Second, firms also obtain the external sources for innovation through outsourcing or mergers and acquisitions. Hitt, Hoskisson, and Ireland (1990) discuss the theoretical implication of the relationship between mergers and acquisition and innovation, and suggest that access to external knowledge through mergers and acquisition allow the acquired firms not only to enter a new market, but also to obtain a larger market share in an existing market (Hitt et al., 1990). In contrast, internal R&D refers to the research and development activities within a firm boundary. Firms with internal R&D strategy invest its resources in internal R&D projects in order to obtain innovation. Given that acquisition and internal R&D are considered two ends in the boundary expansion activities (Santos & Eisenhardt, 2005) and that we are interested in the binary decision of R&D strategy, external R&D in this paper implies an acquisition of external knowledge for innovation.

Literature in innovation has extensively studied the factors that influence a firm's strategic choice between internal and external R&D (Cassiman & Veugelers, 2006; Del Canto & Gonzalez, 1999; Hitt et al., 1990; Piga & Vivarelli, 2004; R. Veugelers, 1997; R. Veugelers & Cassiman, 1999; Reinhilde Veugelers & Cassiman, 2005). Using an exploratory analysis, Piga and Vivarelli (2004) explored the drivers of external R&D, and suggested that the potential drivers of external R&D include public ownership, public subsidies, and outsourcing in purchases, firm size, diversification, customer concentration, outsourcing in sales, competition from large firms, and control over other firms within a business group. Scholars also investigated organizational and environmental contingencies that impact a firm's binary decision for R&D strategies. For example, the decision depends on the firm's absorptive capacity (R. Veugelers, 1997) and resource constraint situation (Hitt et al., 1990). Specifically, Hitt and his colleagues found that when a firm is faced with a resource constraint situation, top managers tend to invest fewer resources in internal R&D (Hitt et al., 1990) and are rather inclined to find sources for innovation from external organizations or institutions.

In the high tech industry, most firms conduct both internal and external knowledge acquisition activities simultaneously. These activities are complementary in that the marginal return of one activity increases as the intensity of the others increases (Cassiman & Veugelers, 2006). Possession of internal sources (i.e., know-how, patents, absorptive capacity) contributes to the marginal return of external knowledge acquisition strategies because sufficient in-house R&D capability is essential to absorb and utilize externally acquired knowledge (Cohen & Levinthal, 1990). In addition, access to external know-how may leverage the efficiency of internal R&D activities as long as a firm is willing to accept external knowledge (Cassiman & Veugelers, 2006). Therefore, both internal and external R&D activities could lead to value creation and overall stronger competitive advantages.

Similarly, prior research on R&D strategy has examined the influence of external and environmental factors on the binary strategic choice between internal R&D and external R&D, while the literature needs more investigation from an impact of internal resources (Del Canto & Gonzalez, 1999). From the resource-based perspective, Del Canto et al.(1999) find that intangible factors are the main determinants of the probability of a firm carrying out internal R&D. Although intangible factors are examined as a determinant of internal R&D, it is still unexplored how both tangible and intangible slack resources affect the decision of internal versus external R&D activities. Therefore, this research attempts to fill this gap by suggesting the relationship between two types of slack resources and two types of R&D strategy, contributing to more understanding of firms' use of excess resources in R&D activities.

FIGURE 1
RELATIONSHIP BETWEEN TWO TYPES OF SLACK RESOURCES
AND R&D STRATEGY, AND INNOVATION



SLACK, R&D STRATEGY AND INNOVATION

We set boundary conditions and assumptions which are necessary to make an argument about how a variation of internal resources are associated with strategic choices for R&D: (1) All organizations have at least some level of slack resources; (2) Slack plays a role of a buffer for organization adaptation; (3) Organizations pursue at least one type of R&D activity (internal or external); (3) There is a heterogeneity of internal resources between organizations. Under these assumptions and boundary conditions consistent with those of resource-based view (RBV), we propose the specific relationship between slack and R&D strategy below.

Many previous studies in organizational slack selected three types of slack resources (Daniel et al., 2004; Cheng and Kesner, 1997; Bourgeois and Singh, 1983; Bromiley, 1991; Hitt et al., 1990). They divide slack into three categories – available, recoverable, and potential – according to their availability. However, the categorization interprets organizational slack from a financial perspective, which makes it relatively easy to measure organizational slack. To stay consistent with the purpose to find the effect of slack resources on the decision between internal and external R&D, this paper proposes two new terms of resource-based categories: tangible and intangible slack.

The definitions of tangible and intangible slack are defined similar with tangible assets and intangible assets. According to Wernerfelt (1989) and Barney (1991), tangible assets refer to the organizational fixed and current assets which have a fixed long run capacity. Based on this definition, tangible slack is defined as the tangible resources used more than necessary for the normal efficient operation of an organization. Examples include excess capital, plants, equipment, land, other capital goods and stocks, debtors and bank deposits. In contrast, intangible slack refers to excess intangible resources used more than necessary for normal efficient operations of an organization, for instance, unused intellectual property (old-fashioned skills and knowledge, and unused patents).

From RBV, innovation can be obtained not from searching the external environment for opportunities, but from looking inside to create core competencies of the organization (Del Canto & Gonzalez, 1999). Then, it would be an interesting question that when organizations have tangible slack, which strategic choice of R&D strategy would be preferred to support innovation?

Tangible Slack

Tangible Slack and External R&D Activity

A characteristic of tangible assets is that they are transparent and relatively weak at resisting duplication of efforts by competitors (Grant, 1991). For example, organizations with excess capital (a form of tangible slack) can invest in building additional plants as long as this activity is in line with their strategies and goals. We posit that the source of external R&D comes from tangible slack, such as low debt or high current ratio, rather than intangible slack. Low debt ratio and high current ratio, which have

been used to measure tangible slack resources (Bourgeois, 1981), indicate more discretion in making decisions, while firms experiencing resource constrained situations have limited choices. With high levels of tangible slack, external R&D through acquisition is preferred to internal R&D in that it is an effective means for gaining control of others' technology, value appropriation from their inventions and faster access to diverse markets with acquired technologies (Capron & Pistre, 2002). In the same vein, Jensen (1986) suggested that a high level of cash flow is more likely to make an acquisition and Voss et al. (2008) proposed that financial slack increases a firm's effort for exploration rather than exploitation.

Another benefit is potential high returns from radical innovation through broader searching activity beyond its core technological field. Through acquisition of external knowledge and technology, the firm enables to explore new opportunities and expand its research focus from the core business to non-core business. The diverse sources newly available from acquisition of firms in the related and unrelated business field could be integrated with the existing sources and result in more radical innovation beyond the firm's innovation trajectory. As high profitability increases liquidity of the firm, high liquidity encourages investments in external R&D activities in order to obtain high rate of returns derived from radical innovation. Therefore, the access to external knowledge and the potential high profitability of radical innovations and underline the advantages and importance of external R&D.

Tangible Slack and Internal R&D

The availability of resources in large companies is relatively higher than that in small or medium size companies. There might be efforts to reduce slack by projecting these resources into new projects. Internal R&D is one solution to consume excess slack. Reinvestment of excess internal resources results in the efficiency and effectiveness of operations so that they become more flexible to the dynamic environment. By maintaining appropriate level of resources, firms can avoid becoming oversized and bureaucratic organizations. The proper level of slack gives the firms flexibility, but too much slack hampers performance by leading to inefficiency (Nohria & Gulati, 1996). Thus, large companies tend to have high level of tangible slack which allows investing in internal R&D activities to reduce slack. However, the success of R&D activities requires an investment in highly sophisticated technical equipment which devotes to the intensity of the capital (Del Canto & Gonzalez, 1999). Pursuing external sources for innovation, such as buying a company in a different industry, mitigates the motivations of carrying out internal R&D. The cost of 'buying' is relatively higher than the cost of 'making' (Cassiman & Veugelers, 2006), but the availability of excess capital (slack) encourages the firm to pursue external R&D strategy. Further, unlike external knowledge acquisition, internal R&D is related to a significant portion of incremental innovation than to radical innovation (Nagarajan & Mitchell, 1998). The characteristics of internal R&D, such as narrow search, the limited sources of innovation, and technological trajectory are more likely to support developing and improving existing technology and products.

In short, tangible slack leads to both internal and external R&D, but the advantages of external R&D and the property of tangible resources would weigh more on carrying out external R&D through acquisitions. Therefore, we propose that tangible slack resources are positively related with external R&D activities (see Figure 1).

Proposition 1: A firm with high levels of tangible slack would engage more in external R&D than in internal R&D, which results in more radical innovations.

Intangible Slack

Intangible Slack and Internal R&D

Unlike tangible slack, intangible slack resources may have different effects on the decision of R&D activities. First, it is necessary to understand the property of intangible slack and assets in that the two are closely related and at the core of the RBV discussion. Intangible assets represent the difference between the balance sheet valuation and stock market valuation of publicly listed companies (Grant, 1991) such as patents in the pharmaceutical sector. Intangible assets have relatively unlimited capacity and firms can

exploit their value by using them in-house, renting them, or selling them (Wernerfelt, 1989). They are relatively resistant to duplication or imitation efforts by competitors, at least in the short run, because intangible assets, like intellectual property, are generally inherently complex, firm-specific, and legally protected.

Intangible slack is different from intangible assets. Intangible slack, such as overhead, old-fashioned knowledge¹ and information which is no longer useful for innovation, human resources, and routines, may impede for a firm to achieve the optimal operation of business. Simultaneously, intangible slack resources also have their own value and have the potential of value creation effect, especially when they are utilized for innovation purposes. Intangible slack indeed help firms engage in more internal R&D than in external R&D, and the firm uses its accumulated intellectual resources in its internal R&D projects to maximize its innovation productivity because of advantages of internal R&D. First, internal R&D reduces the risk of exposure of knowledge and technology, which fits the ownership property of intangible slack, even though it might negatively affect the performance (Hall, 1989). That is, firms protect their ownership of old-fashioned technology by patenting and are likely to keep renewing the duration of protection from imitation. What drives the expenditure for such old-fashioned technology would be the possibility of application for a future innovation. As such, the accumulation of old-fashioned knowledge and technology is likely to be treated as a source for the innovation rather than useless property, even though they hamper the optimal operation.

Second, as the valuable, rare, inimitable, lack of substitutable assets is necessary to achieve sustainable competitive advantage (Barney, 1991), intangible slack, such as technology and information, also involves some of those characteristics. For example, the technique of how shoes are made was developed a long time ago. A company with this technique no longer considers it the core technology to obtain sustainable competitive advantage. However, R&D activities often convert the old-fashioned knowledge to a new core knowledge which enables the firm to derive more profit. That means intangible slack resources can be transformed to support R&D activities. Thus, intangible slack is valuable. A firm with specific and superior information and technology, which are of relatively low value to other firms, is likely to keep its technology and information internal because the exposure of technology to other organizations might result in a significant loss of both profitability and competitive advantages. Also, the tacit nature of information and technology contributes to motivating internal R&D. Therefore, internal R&D is likely to control the technology and information within its firm boundary to protect intangible assets.

Third, the synergy effect would be higher if intangible slack is related to core competences. Within the organizational boundary, the core knowledge and technology can lead synergy to develop incremental innovation in terms of the existing product and technology. Banbury and Mitchell (1995)'s work emphasizes the importance of incremental innovation. They find that the more often an industry incumbent is among the first to introduce important incremental product innovations, the greater its market share in the industry and in turn reduces the likelihood of business dissolution. Like the previous example, internal R&D can change slack into a useful asset through incremental innovations rather than radical or breakthrough innovations.

Intangible Slack and External R&D

On the other hand, some intangible slack also encourages external R&D. For example, highly routinized work impedes the innovation, and motivates engaging in external R&D contracts with other organizations with less routinized works. The literature in organizational learning and evolution argues that as organizations repeat routines, they tend to exploit existing knowledge and capabilities, and remain in the current position without significant changes (Benner & Tushman, 2002; Levinthal, 1997; March, 1991). Reinforcing core capabilities creates strong routines that impede the organizational change by making it difficult for organizations to follow environmental changes (Leonard-Barton, 1992), as well as strong inertia. The decreased performance derived from a lack of adaptation to new environments and strong inertia is likely to lead to external search for innovation. Ahuja and Lampert (2001) argue that by experimenting with novel, emerging, and pioneering technologies, firms can overcome a familiarity trap,

maturity trap, and propinquity trap², and create breakthrough inventions. It is expected that the external sources for innovation will enhance the ability to respond to the environment and reduce the inertia within organizations.

Overall, we suggest that although intangible slack is related to both internal and external R&D together, intangible slack facilitates engaging in internal R&D more than external R&D because of high risk of information leakage and loss of firms' competitive advantages.

Proposition 2: A firm with high levels of intangible slack would engage more in internal R&D than in external R&D, which results in more incremental innovation.

DISCUSSION AND IMPLICATION

Improving innovation performance has become one of the main concerns to top managers in a firm. Building on resource based views, this study discusses how resource portfolio of a firm influences its strategic choice between internal R&D and external R&D strategy. It is argued that slack resources should be considered an essential factor in making a decision for R&D strategy and achieving innovation. Although firms pursue complementarily both internal investments for innovation and external R&D, tangible slack facilitates acquiring external knowledge and leads to more radical innovation, while intangible slack is positively associated with internal R&D, resulting in more incremental innovation. With the unique characteristics of two types of slack resources, the accessibility of external resources and the risk of exposure of intangible assets provide appropriate rationale to understand a firm's R&D strategy.

This paper contributes in two important ways to slack and innovation literature. First, we introduce a new typology of slack resources. Prior studies that investigated the effect of slack on innovation show inconsistent results. Recently, scholars in strategic management field developed and suggested an alternative definition or a new typology of slack resources (Mousa & Reed, 2013; Voss et al., 2008). This paper is in the line with such research effort to refine the existing concepts of slack and its effect on a firm. Second, we suggest that slack-driven R&D activity influences overall radicalness of innovation. Rather than arguing a simple positive or negative effect of slack on innovation, we propose that R&D strategy motivated by excess resources results in innovation with different level of radicalness, and emphasize that a firm accomplish breakthrough innovation when the firm has sufficient financial capital and access to newly acquired knowledge which was not available before.

For practical perspectives, it is significantly important to evaluate the level of slack using its resource portfolio. Typically, firms do not recognize their slack resources unless they face decreased performance. When a firm has high levels of slack, it should make a strategic plan to use and reduce the slack resources in a way to obtain a competitive advantage and enhance its innovation performance. The available and utilizable slack can be used to enhance innovative performance by engaging in internal R&D or external R&D. The criteria between two options would be based on the portfolio of slack, as well as their strategic objective in R&D activities. Firms with high tangible slack resources may pursue external R&D by using liquidity in order to gain access to external sources with a goal of developing radical innovation. In contrast, firms with high intangible slack resources would tend to pursue internal R&D. Carrying out internal R&D projects with intangible slack will result in incremental innovation and reduce the risk of exposure of knowledge and information. Therefore, to apply the proposed relationship from this study in a real world, managers are recommended to test intangible and tangible slack resources. If the strategy allows, investment of slack resources in innovation would be one of the best choices to adapt to dynamic environments and to obtain a competitive advantage.

There are several limitations of this research. First, the time effect on internal and external R&D is not taken into account. The external knowledge obtained from acquisitions might encourage in-house internal R&D because such external sources can not only be perceived as internal source for innovation completely after acquisitions and mergers but can also enhance firm's capability to pursue internal R&D. With a high quality of capability, organizations are likely to engage more in internal R&D. So, the time

effect on the decision between internal and external R&D would be a fruitful future research topic. Second, this paper does not address the choice of target firms when organizations engage in the external R&D. The characteristics of target firm and its relationship with acquiring firm potentially influence innovation productivity in the future. For example, it is expected that strategic fit among diversification strategy and R&D strategy enhances the acquiring firm's innovation productivity (Kim, Arthurs, Sahaym, & Cullen, 2013). Third, our propositions need to be validated with empirical supports. To overcome those limitations, future research may build panel data and test causal relationship among resource portfolio, R&D strategy, and breakthrough innovation.

At last, the future studies could integrate all the determinants of R&D activities, including internal and external factors, as well as environmental factors. For example, existing studies find that strategy and competition are related to R&D activities (Piga & Vivarelli, 2004). Of course, both the resource-based perspective and economic perspective would provide good theoretical implications in the integration. Therefore, synthesizing these determinants from the previous studies with findings from this research would shed more light in our understanding of corporate R&D activities.

ENDNOTES

1. Old-fashioned knowledge indicates knowledge or technology that is very old and no longer used in the organization.
2. Familiarity trap refers to a tendency to favor the familiar over the unfamiliar. It can be overcome by experimenting Novel technology which is new or unfamiliar to the firm, even though they possibly have existed in the industry before. Maturity trap is defined as a tendency to prefer the mature over the nascent. Experimenting emerging technology reduces maturity trap. At last, propinquity trap is a tendency to search for solutions that are near to existing solutions rather than search for completely de novo solutions. It can be solved by pioneering a new technology (see Gautam Ahuja & Morris Lampert, 2001)

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