The antecedents and process of innovation
A Literature Review

The IV Conference in Social Sciences
University of Iceland
February 21-22, 2003

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Introduction

The importance of innovation for firm’s to sustain their competitive advantage has never been more than in today’s hypercompetitive environment. Through the internet and effective communication networks, managers have up-to-date information’s on processes and technique that are relevant to their production or services, such as information’s on applications of new equipment, which they can utilize to increase the efficiency in their operations. These new and improved communication networks make up-to-date information’s not only open to potential customers, but also to competitors who can easily use this information to offer similar or even better products. The lifetime of new equipment and technology has therefore become substantially shorter and the focus of competitive advantage has shifted more towards innovation and technical development.

Innovation is therefore increasingly important, especially for companies that produce technology-driven products, with the risk of technological obsolescence (Brown, W.B. and Karagozoglu 1993) and in environments characterized by competitive intensity, technological and market dynamism (Kessler and Chakrabarti 1996). This trend is reflected in a number of articles on innovation and the diffusion of innovation (Brown, S.L. and Eisenhardt 1995; Hitt, Michael A 1998; Hitt, Michael A., Keats et al. 1998). Furthermore, there is an increased need for flexibility and multiple technological competencies which have led to extended use and dependence on external networks by firms of all sizes (Narula 2002).

This paper reviews and summarizes some of the key findings of the literature relating to innovation, innovation capability and technological learning. First, the concepts of innovation, such as innovation capability, individual innovation characteristics, organizational learning, technological learning, and external orientation are presented. Second, the literature reviewed is discussed. The article concludes with a summary and implications for managers.
1. Innovation

Innovation is the process of developing and implementing a new idea. Various scholars have defined innovation (Meyers and Marquis 1969; Utterback and Abernathy 1975; Rogers 1995; Kessler and Chakrabarti 1996; Ven, Polley et al. 1999). Rogers defines innovation as „an idea, practice, or object that is perceived as new by an individual or other unit of adoption … and it matters little, so far as human behavior is concerned, whether or not an idea is objectively new … the perceived newness of the idea for the individual determines his or her reaction to it. If the idea is new to the individual, it is an innovation“ (p. 11). In Ven, Polley et al.’s book (1999), the innovation journey includes the invention, development and implementation of new products, programs, services, or administrative arrangements. Kessler and Chakrabarti focus on product innovation which they define as new technologies or combination of technologies introduced commercially to meet either a user’s or market’s need (Meyers and Marquis 1969; Utterback and Abernathy 1975; Kessler and Chakrabarti 1996). Damanpour (1991) defines innovation as „a new product or service, or a new process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members.“ All innovations begin with an invention, which is the creation of new idea. Amabile, Conti et al. (1996) make a distinction between creativity and innovation. Creativity, they argue, is the production of novel and useful ideas and innovation is the successful implementation of creative ideas within organizations.

Innovativeness of organizations is dependent on internal factors such as the firm’s innovative capability, size and structure, learning orientation and strategic orientation and external factors such as network of partners, external communication and the industrial environment in which the company is located. Literature on innovation can be divided into the following four areas;

(a) antecedents to innovations
(b) consequences (outcomes) of innovations
(c) the process of innovations
(d) diffusion of innovations
This paper reviews 2 streams of literature on the antecedents to innovation; innovation capability which includes many of most researched antecedents to innovation and individual innovation characteristics, and 3 streams of literature related to the process of innovation; organizational learning, technological learning and a brief introduction of external orientation.

2. Literature review

2.1 Innovation capability

Innovation capability has been defined by various scholars (Dosi 1988; Barney 1991; Lall 1992; Guan and Ma 2002; Romijn and Albaladejo 2002). Barney (1991) defined it as the capability to quickly introduce new products and to adapt new processes to sustain a firm’s competitive advantage. The following model, from Romijn and Albaladejo’s (2002) research, gives an indication of some of the internal and external dimensions of innovation capability:

![Innovation capability model]

Their research indicated, that innovation capability includes first of all, „the knowledge and skills brought into the firm by the entrepreneur(s) and workforce, which they obtained through earlier experience“ (p. 1054). The research further indicated that an academic degree of an owner/manager is not directly associated with high innovation capability, not even a degree in science and engineering. However, but that former education has indirect impact, since it is a requirement for work experience in public R&D institutions (universities and science labs), which has significant effect on product innovation. Romijn and Albaladejo found a good correlation between total R&D experience per employee and innovation capability and
between the numbers of R&D employees as percent of total workforce and innovation capability. Dosi (1988) defines innovation capabilities as the degree of technological accumulation and efficiencies in the innovative search process. Although innovation capability has important implications for all firms, it is particularly important for export performance. In a study of 213 Chinese industrial firms, Guan and Ma (2002) found positive and significant relationship between six of seven innovation capability dimensions (learning capability, R&D capability, marketing capability, organizational capability, resources exploiting capability and strategic capability), and export performance. Furthermore, they found an interdependence relationship between the total improvement of innovation capability and export growth. One of the results of Guan and Ma’s research is that supplementary innovation assets can support and harmonize the innovation process (planning, resource, organization, culture, learning, and etc.), making it possible for core innovation assets to form and operate effectively and to improve export performance. This innovative capability is a special asset which is tacit and non-codifiable, and is closely correlated with interior experiences and experimental acquirement.

2.2 Individual characteristics

Individual innovation characteristics have been defined by various researchers. Generally the construct has been conceptualized in terms of individual characteristics, traits, behaviors, and products. Baldridge and Burnham (1975) found that individual characteristics, such as sex, age and personal attitudes did not have strong impact on innovative behavior in organizations, but structural characteristics and environmental input had strong impact. Administrative positions and roles did however seem to have an impact on the involvement of an individual on the innovation process. Two characteristics affected the capacity of the organization to innovate, size and complexity.

In a multi-dimensional measure, Kleysen and Street (2001) found a good correlation (alpha 0,95) between innovation and individual innovation behavior based on five dimensions, opportunity exploration, generativity, formative investigation, championing and application.
2.3 Organizational learning

Innovation is dependent on a variety of factors, such as innovation behavior (Baldridge and Burnham 1975; Kleysen and Street 2001), work environment (Amabile, Conti et al. 1996; Gatignon and Xuereb 1997; Hult and Ferrell 1997; Sinkula, Baker et al. 1997; Calantone, Cavusgil et al. 2002), learning orientation and organization learning procedures (Gatignon and Xuereb 1997; Sinkula, Baker et al. 1997; Tomas, Hult et al. 1997; Calantone, Cavusgil et al. 2002). Nahapiet and Ghoshal (1998) argue that „the particular capabilities of organizations for creating and sharing knowledge derive from a range of factors, including the special facility organizations have for the creation and transfer of tacit knowledge (Kogut and Zander 1993; Nonaka, Takeuchi et al. 1995; Spender 1996); the organizing principles by which individual and functional expertise are structured, coordinated, and communicated, and through which individuals cooperate (Kogut and Zander 1993); and the nature of organizations as social communities“.

2.4 Technological learning

Hitt, Ireland et.al. (2000) argue that technological learning plays a vital role in the firm’s competitive success and „is linked to the firm’s ability to develop, maintain and exploit dynamic core competencies“ (p. 231). „To generate value, firms must identify, create and continuously manage knowledge (especially technological knowledge)“ (p. 232). Hitt et.al (2000) suggest that firms gain technological knowledge through two primary avenues, internally as individuals and groups experiment across multiple projects, including those involving research and development, manufacturing or marketing activities and externally, which is knowledge gained and absorbed outside the firm’s boundaries.

In their study on the effect of international expansion on new venture firms performance, Zahra, Ireland et.al (2000) found a strong relationship between international diversity (number of countries, technological diversity, cultural diversity, geographic diversity and foreign market segments) and mode of market entry on the breadth and depth and speed of technological learning, especially when the firm undertakes formal knowledge integration. Knowledge integration is an integral component of routines to capture information and skills gained
from international expansion activities that guide the firm’s future actions (Teece, Pisano et al. 1997). According to Abrahamson & Fombrun (1994) organizations that operate in diverse national and/or product markets have access to information on new ideas and practices that sparks innovations and boosts technological capabilities. Lall (1992) argues that the transfer of technological knowledge requires learning because technologies are tacit, and their underlying principles are not always clearly understood. To acquire new technological capabilities requires skills, effort and investment by the receiving firm, and the extent of mastery achieved is dependent on these inputs.

2.5 External orientation

Although traditional thinking about the management of innovation focuses almost exclusively on internal factors – the capabilities and processes within the company for creating and commercializing technology, research on innovation is increasingly focused on the external environment (Porter and Stern 2001), external communication (Bierly and Gopalakrishnan 2001) and networks (Ancona and Caldwell 1992; Dyer and Singh 1998; Dyer and Nobeoka 2000; Bierly and Gopalakrishnan 2001; Porter and Stern 2001; Hakansson, Waluszewski et al. 2002).

According to Dayasindhu (2002) embeddedness and knowledge transfer are key determinants of industry clusters that lead to global competitiveness. Industry clusters are characterized by external economies, generalized reciprocity and flexible specialization. Flexible specialization facilitates the production of a variety of products for specific markets using general-purpose resources. Economists acknowledge that technological innovation and, more generally, technical progress result from numerous interactions between industries and technologies (Bergeron, Lallich et al. 1998).

Håkansson, Waluzewski et.al. (2002) emphasize that „interaction is closely related to the development of four types of resources: two are mainly physical – products and facilities – and two are mainly social – business units and business relationships“.
Development of resources can in turn lead to innovation and hence, interaction has impact on the innovativeness of firms. Håkansson discusses interaction in network setting according to the IMP\(^1\) approach. Interaction is affected by three different networks, network of actors, network of activities and network of resources. (figure 1). "In activities actors use certain resources to change other resources in various ways. Resources are means used by actors when they perform activities. Through these circular definitions a network of actors, a network of activities and a network of resources are related to each other" (p. 30). A series of empirical investigation conducted to gain a deeper understanding on these relationships revealed that technological development is a process dependent on both resource mobilization and resource combination.

### 3. Summary and implications for managers

The literature review revealed that innovation capability is one of the most important antecedents to innovation. Innovation capability is tacit and non-modifiable asset (Guan and Ma 2002) and includes knowledge and skills brought in by entrepreneurs, managers and the workforce (Romijn and Albaladejo 2002). Firms need therefore to emphasize the appropriate skills and knowledge in their recruitment process. Table 1 lists most of the literature reviewed in this paper,

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\(^{1}\) According to some empirical indications, interaction has a severe impact on industrial exchange which developed a new approach to industrial marketing and purchasing, and which later became the IMP industrial network approach. Håkansson, Waluszewski, et al. (2002). Managing Technological Development: Routledge. (p. 27-28)
including description of the constructs studied, the research problem and the main research findings.

The innovation process is knowledge oriented, and efficient processes to quickly introduce new products and adapt new processes are necessary for a firm to sustain it’s competitive advantage (Barney 1991). It can therefore be argued that efficient procedure, systems and structure for knowledge integration are important antecedents to innovativeness. Environmental inputs and administrative positions have strong impact on innovative behavior (Baldrige and Burnham 1975) and strong relationship with the external environment and social relations affect the speed of knowledge integration (Zahra, Ireland et al. 2000) especially when the firm undertakes formal knowledge integration and the firm’s intellectual capital is strongly rooted in it’s social relations (Nahapiet and Ghoshal 1998).
<table>
<thead>
<tr>
<th>Construct</th>
<th>Study</th>
<th>Research problem</th>
<th>Research finding</th>
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<tbody>
<tr>
<td>Innovation capability</td>
<td>Barney 1991</td>
<td>The link between firm resources and sustained competitive advantage.</td>
<td>Defines innovation capability as the capability to quickly introduce new products and to adapt new processes to sustain a firm’s competitive advantage.</td>
</tr>
<tr>
<td>Innovation capability</td>
<td>Romijn and Albaladejo 2002</td>
<td>Determinants of innovation capability in small UK electronics firms.</td>
<td>Innovation capability includes first of all the knowledge and skills brought in by the entrepreneurs and the workforce and R&amp;D. Regional proximity to suppliers is important, but regional networks around firms in similar business activities and close customer relations is not.</td>
</tr>
<tr>
<td>Innovation capability</td>
<td>Dosi 1988</td>
<td>Sources and processes to actual innovation efforts and to changes in structures and performance of industries.</td>
<td>Defines innovation capabilities as the degree of technological accumulation and efficiencies in the innovation process.</td>
</tr>
<tr>
<td>Innovation capability</td>
<td>Guan and Ma 2002</td>
<td>Relationship between innovative capability and export behavior.</td>
<td>Innovation capability is a tacit and non-modifiable asset of the firm, closely correlated with interior experiences and experimental requirement. Learning, R&amp;D, marketing, organizational capability, resources exploiting capability and strategic planning are important for innovation capability.</td>
</tr>
<tr>
<td>Organizational innovation</td>
<td>Baldrige and Burnham 1975</td>
<td>Organizational innovations and changes and what characterizes innovation behavior.</td>
<td>Environmental inputs had strong impact on innovative behavior and administrative positions to some extent, but sex, age and personal attitudes did not have strong impact.</td>
</tr>
<tr>
<td>Technological learning</td>
<td>Zahra, Ireland et al. 2000</td>
<td>Effects of international expansion on a firm’s technological learning and the effects of this learning on the firm’s financial performance.</td>
<td>Strong relationship between international diversity and mode of market entry and the breadth, depth, and speed of a new venture’s technological learning, especially when the firm undertakes formal knowledge integration.</td>
</tr>
<tr>
<td>Technological capabilities</td>
<td>Lall 1992</td>
<td>Implications of the technological capabilities at national level on development of technological capabilities on industrial success.</td>
<td>Development of technological capabilities is derived from the interplay of human resources, technological effort and institutional factors in a particular country settings and the skills, effort and investment by the receiving firm to master those inputs.</td>
</tr>
<tr>
<td>Social capital, intellectual capital</td>
<td>Naphiet and Ghoshal 1998</td>
<td>Relationships between different dimensions of social capital and the main mechanisms and processes necessary for the creation of intellectual capital.</td>
<td>The roots of intellectual capital are deeply embedded in social relations and the structure of those relations. Differences between firms, including differences in performance, may represent differences in their ability to create and exploit social capital.</td>
</tr>
<tr>
<td>Individual innovative behavior</td>
<td>Kleyesen and Street 2001</td>
<td>A multi-dimensional measure of individual innovative behavior</td>
<td>A good correlation between five dimensions: opportunity exploration, generativity, formative investigation, championing and application and individual innovation behavior.</td>
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References


