NEW VENTURE INNOVATION IN DYNAMIC MARKETS

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ABSTRACT

The important relationship between knowledge and innovation is well established in the literature. However, little is known about how new ventures’ acquisition, assimilation, transformation, and exploitation of knowledge (i.e., their absorptive capacity) affects innovation. We examine the role of the individual components of absorptive capacity on innovation on a sample of new firms in the Swedish telecom, IT, media, and entertainment sectors. Our results suggest that the direct effects of the components of absorptive capacity on innovation are more complex than previously anticipated or articulated in the literature. We also find that while the four components of absorptive capacity are important for explaining innovation in new ventures, acquiring new technological knowledge and employing mechanisms for exploiting new knowledge are of greatest importance.

INTRODUCTION

Liabilities of newness in terms of limited routines, resources, and legitimacy may prevent new firms from competing with established ones on the basis of price or product differentiation (Lee, Lee & Pennings, 2001). But the associated absence of core rigidities (Leonard-Barton, 1991) and sunk costs facilitate new firms’ competitiveness based on innovation strategies (Li & Atuahene-Gima, 2001). Innovation can help new ventures overcome liabilities of newness (Schoonhoven, Eisenhardt & Lyman, 1990), thus increasing chances of survival and growth (Brüderl & Preisendorfer, 2000). In economics, new venture innovation is often seen as a one-time event, coinciding with the establishment of the new firm (e.g., Baumol, 1968). However, empirical studies of new firm innovation suggest that they go through extended innovative processes where they experiment with new products and processes (Nicholls-Nixon, Cooper & Woo, 2000), potentially developing portfolios of new products on the way (Schoonhoven, Eisenhardt & Lyman, 1990).

That knowledge acquisition and exploitation form important antecedents of innovation is well established in the literature (Smith, Collins & Clark, 2005). Market knowledge and technological knowledge play key roles for the types of innovations that entrepreneurs and new firms can develop (Daneels, 2002). While some of that knowledge resides in the previous experience of the business founders (Shane, 2000), the absorption of new knowledge is needed for continued innovation and competitiveness (Grant, 1996). This process is especially important in dynamic markets, where perceived opportunities may morph and appear only briefly as technologies and customer demands fluctuate frequently (Rindova & Kotha, 2001).

At present little is known about how new ventures go about acquiring, assimilating, transforming and exploiting knowledge, i.e., little is known about their absorptive capacity (Zahra & George, 2002). This represents an important gap in the literature because: (a) new ventures constitute a major source of innovation in our society (Audretsch, 1995); and (b) innovation is an important strategy for new firm survival and performance (Schoonhoven, Eisenhardt & Lyman, 2000).

In order to address this gap in the literature we investigated 318 new firms examining the effect of their absorptive capacity (AbCap) on their level of product/service innovation. In doing so we make the following contributions to the literature: (a) we empirically unpack the AbCap construct, estimating how each of the knowledge acquisition, knowledge assimilation, knowledge conversion and knowledge exploitation activities contribute to new firm innovation; (b) we examine two dimensions of knowledge
that are germane to innovation, namely market knowledge and technological knowledge; and (c) we evaluate the relative importance of different aspects of the firms’ AbCap, showing that not all dimensions have the same importance to new firms.

The paper proceeds as follows. First we present our theoretical frame of reference and develop testable hypotheses. We then present information on our sample and the variables that we employed. Following that, we test and analyze our hypotheses on a sample of new firms in Sweden, and finally discuss the implications of our findings for theory and future research.

THEORY AND HYPOTHESES

Absorptive Capacity and Innovation

Innovation, defined as a new product or service that a firm creates for a market (see e.g., Li & Atahne-Gima, 2001), has long been connected to knowledge-based approaches to the firm (Smith, Collins & Clark, 2005). While studies into the antecedents of innovation have focused on a great number of variables, we choose to focus on how the firm’s internal stock and flow of knowledge, in terms of its AbCap, contribute to innovation outputs. We adopt a knowledge lens for two reasons. Firstly, because of idiosyncratic knowledge, some individuals discover opportunities for innovation that others cannot see (Kirzner, 1997) and knowledge assists in the exploitation of opportunities via innovation (Shane, 2000). Secondly, knowledge is particularly important in dynamic markets because, as opposed to many other resources, knowledge is relatively generally applicable despite environmental changes (e.g. McEvily & Chakravathy, 2002). Empirical research suggests that in dynamic markets, superior performance is associated with the acquisition and use of knowledge (Wiklund & Sheikh, 2003).

Absorptive capacity, a concept first proposed by Cohen and Levinthal (1990), refers to the ability of the firm to recognize and acquire external knowledge, assimilate it, and apply it in a commercial way. As such, the concept of AbCap can explain why firms are able to learn certain new things but not others and how they are able to apply this knowledge for commercial purposes. However, in their review of the AbCap literature, Zahra and George (2002) note that the interpretation and usage of the concept varied greatly across studies. Much of the work has relied on proxies rather than direct measures of AbCap, including proxies such as the number of scientists employed or levels of R&D spending. In order to clarify the construct, Zahra and George (2002) suggested a re-conceptualization of AbCap into four sub-concepts: knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation. In this study we adhere to the definition provided by Zahra and George (2002) and observe how these four sub-processes of AbCap are related to innovation. Such empirical testing has not been previously done. More precisely, we examine their role in innovation in the context of new ventures in dynamic markets.

Market Knowledge and Technological Knowledge

Knowledge comes in many different shapes and forms. Two strands of knowledge are particularly important to recognizing and exploiting new opportunities and have a key role in the AbCap of firms: market knowledge and technological knowledge (Cohen & Levinthal, 1990). Therefore, in this study, we explicitly focus on the ability of firms to absorb and exploit market knowledge and technological knowledge.

Market knowledge can potentially be useful in discovering and evaluating opportunities for innovation due to: a) true awareness of customer problems as sources of potential opportunities; b) the ease of determining the market value of new technological discoveries or other market changes; and c) increased communicability of tacit knowledge of new technology between user and end-customer. Oftentimes it is difficult to express needs for solutions to problems that are not yet explicitly formulated (Cohen & Levinthal, 1990; Shane, 2000).
Technological knowledge is also an alleviator in the discovery and exploitation of an opportunity. Possessing technological knowledge can amplify the firm’s ability to evaluate an opportunity due to expertise in designing an optimal structure, manufacturing process or reliability of a new technology (McEvily & Chakravarthy, 2002). This same knowledge can also be harnessed as an economic or cost-related advantage (Dixon & Duffey, 1990). Sometimes technological knowledge can allow for understanding of competitors’ moves (Cohen & Levinthal, 1990). Finally, technological knowledge can lead to a radical or break-through technology that represents a new opportunity, despite the fact that market suitability is not yet established (Abernathy & Utterback, 1978). From the above discussion, one can posit that both market and technological knowledge are of great significance in the innovation process. We now turn to the role of market knowledge and technological knowledge in the four sub-concepts of AbCap and their effect on innovation output.

**Knowledge Acquisition**

Discovering opportunities in the market depends on possessing and generating new knowledge about the market and technology. This is vital in dynamic markets, where customer demands change frequently, and new knowledge of these shifting demands is imperative. While all firms possess static knowledge stocks based on their human capital (Nerkar & Roberts, 2004), new flows of knowledge must also be acquired to permit learning about new market characteristics and technological opportunities (Cohen & Levinthal, 1990; Grant 1996).

In order to acquire market knowledge, especially in fast-changing markets, firms can scan their environments in search of potential new market openings (Gaglio & Katz, 2001) or discuss with potential stakeholders, such as customers and suppliers (Freel, 2005). Empirical work supports the idea that familiarity with and in-depth understanding of the market and its needs enhances the ability to innovate (Shane, 2000; Von Hippel, 1986).

New technological knowledge must also be continuously acquired. This is traditionally done via R&D and engineering (Bierly & Chakrabarti, 1996), and scientific and related activities (Tsai, 2004). However, new technological knowledge may also be acquired by less formal activities such as partnerships, attending conferences, or scanning trends (Lee, Lee & Pennings, 2001). Both Henderson (1994) and Katila and Ajuha (2002) find a relationship between indicators of technological knowledge and innovative output.

Firms who are able to acquire substantial levels of new knowledge about the market and their technology are able to reduce the uncertainty about future customer demands and the firm’s ability to satisfy these (Daft & Lengel, 1986). Knowledge flows to the firm can thus be seen as being important for innovation. In particular, the more knowledge that the firm is able to acquire, the greater the possibility for the firm to spot opportunities in the market and for its technology.

*H1a: Higher levels of market knowledge acquisition will be positively related to innovative output.*

*H1b: Higher levels of technological knowledge acquisition will be positively related to innovative output.*

**Knowledge assimilation**

After knowledge is acquired, it must be assimilated before it can be transformed and exploited. This requires spreading acquired knowledge throughout the firm so that it can be integrated with existing knowledge. Here communication is important as the knowledge must be clearly communicated and effectively understood (Brown & Eisenhardt, 1995). Market knowledge assimilation allows for others within the firm to become aware of and understand the main issues at play in the market, to help make
sense of what this acquired knowledge truly means, and to process it into more formal understanding. Technological knowledge assimilation provides firms with the ability to make sense of potential solutions to customer problems and increased understanding of technological capabilities. Galbraith (1973) argues that knowledge assimilation will lessen the gap between knowledge that is necessary for decisions and knowledge that is available. Assimilation also provides higher levels of agreement between decision makers as more people understand the main issues and implication of newly acquired knowledge (Beinhocker, 1999).

Recent work addresses the role of knowledge assimilation in driving innovation (Verona & Ravasi, 2003). These authors argue that knowledge articulation, integration and codification between organizational members lie at the heart of producing new resource usages and subsequently innovation. Thus, the more assimilation that takes place within the firm, the increased ability of the firm to innovate.

H2a: Higher levels of market knowledge assimilation will be positively related to innovative output.

H2b: Higher levels of technological knowledge assimilation will be positively related to innovative output.

Knowledge transformation

While the knowledge brought into and understood by the firm provides one aspect of AbCap, the actual usage and application of knowledge provides another. Knowledge transformation involves bringing together sets of knowledge that previously were unconnected (Zahra & George, 2002) or combining elements of these in new ways (Nahapiet & Ghoshal, 1998). Intersecting different areas of knowledge, including accumulated and acquired knowledge, can “trigger” new knowledge (Garud & Nayyar, 1994), which, in turn, can provide new ideas for further application of knowledge, novel solutions to market problems (Ahuja & Lampert, 2001), or multiple uses for technological knowledge (Moorman & Miner, 1998). Thus, innovation can be accomplished by bringing separate entities together, such as allowing those individuals possessing market knowledge to discuss opportunities with those possessing technological knowledge, to brainstorm about the implications of the assimilated knowledge, or to recognize opportunities that stem from assimilated knowledge. As this generally involves combining market and technological knowledge, we will not keep these separate.

H3: Higher levels of knowledge transformation are positively related to innovative output.

Knowledge exploitation

Finally, knowledge exploitation involves the actual application of knowledge to commercial ends (Cohen & Levinthal, 1990). This encompasses harvesting transformed knowledge into tangible activities such as launching prototypes, service ideas, or patent applications. This also involves developing systems for further exploitation of knowledge to allow for the persistent creation of new value to the firm (Spender, 1996). March (1991: 85) writes, “The essence of exploitation is the refinement and extension of existing competencies, technologies and paradigms.” Thus, the ability of the firm to leverage its knowledge and put it to use in its operations is positively linked to innovation, we argue.

H4: Higher levels of knowledge exploitation are positively related to innovative output.

METHOD

Sample

Data were collected via a mail survey in 2005. The sample consisted of all incorporated new firms in Sweden started in the TIME sector (Telecom, Information Technology, Media, and Entertainment) during
the period 1995-2003. These industries were selected because they are knowledge-intensive and innovation is frequent and of paramount importance for competitive advantage (Zahra & Bogner, 1999). The sector is also known for dynamic changes and a large number of start-ups.

The survey was sent to 2038 firms. Of these, 458 responded for a response rate of 22.5%. Out of these, we excluded a number of firms that had gone bankrupt, engaged in some sort of corporation action (e.g. merger), did not fit into the sampling frame (e.g. based on age) or did not fully answer the survey. Thus, this paper is based on the response of 318 firms, corresponding to 16% of the original sample. The potential of non-response bias was assessed by tests of differences between responding and non-responding firms for firm size, age, and sales levels. No statistically significant differences were found, suggesting that the sample was not biased.

Variables and Measures

Development of the Scales. All constructs made use of multi-item five-point Likert scales. In total, there were close to 100 items. Prior to sending out the questionnaire, we carried out a pre-test on a convenience sample of 10 practitioners and academics.

In order to determine discriminant and convergent validity, we entered all items pertaining to dependent and independent variables in an orthogonal principle component analysis, extracting factors with Eigen values above 1.0. This analysis resulted in seven factors largely corresponding to our constructs. However, some items cross-loaded across the factors. After deleting these items, the analysis was re-run, resulting in seven clean factors. When summed to indices, all scales had Cronbach’s alpha values above 0.7 suggesting that the measures were reliable (Nunnally, 1978). Taken together, these analyses suggest that our measures have discriminant and convergent validity.

In order to assess common method variance, we used Harman’s one factor test (Podsakoff & Organ, 1986). A factor analysis of the independent and dependent variables produced numerous variables explaining 65 percent of the variance. Factor 1 accounted for 26 percent of this variance. As one single factor did not emerge and one factor did not account for the majority of the variance, common method variance should not pose a grave problem for this data.

Dependent variable. Innovative output can be measured in a number of different ways (see e.g., Li & Atuahene-Gima, 2001). This present study relied upon self-evaluation of radical and incremental innovation, based on established measures (Cooper, 2000). Following Cooper (2000), we focused on the number of new products and services and constructed a scale consisting of four items. One item related to the modifications/extensions of existing products/services launched in the market during the past 12 months and one item tapped radical new products/services launched during the same time span. We also posed two questions pertaining to plans for developing new products or services to be released over the next 12 months. A similar approach has been used in other studies concerning knowledge and innovation (e.g., Smith, Collins & Clark, 2005). All items were measured on five-point scale ranging from “no new products or services” to “very many new products or services”. When summed to an index, the Cronbach’s alpha of the scale was 0.862.

Independent variables. The independent variables employed reflect the four sub-dimensions of AbCap proposed by Zahra and George (2002). However, one difference between our study and previous work within AbCap was that we distinguished between market and technological knowledge. As our study spanned more than one industry, orientations (i.e. manufacturing, service and R&D) and sizes of firms, we attempted to craft generalizable measures based on extant literature.

Market knowledge acquisition, which examined the methods used to acquire information about the market, consists of nine items and was based on the market orientation literature (cf. Kohli, Jaworski & Kumar 1993). The Cronbach’s alpha for this construct was 0.763.
Technological knowledge acquisition measured methods that the firm employed in order to acquire new knowledge about technology and builds upon Zahra, Ireland and Hitt’s (2000) study of new venture learning. Our items mirrored those used in that study and consisted of 13 items with a Cronbach’s alpha of 0.894.

The items used for Market knowledge assimilation were based on the market orientation literature (e.g. Kohli, Jaworski & Kumar, 1993) and consisted of ten items (Cronbach’s alpha = 0.753). We adapted the wording of the items to reflect the fact that we were dealing with new, and oftentimes small, firms.

The Technological knowledge assimilation measures were taken from the market orientation literature but were modified to reflect the assimilation of technological knowledge. The scale consisted of eight items and had a Cronbach’s alpha of 0.857.

We scoured the literature for appropriate items to be used for Knowledge transformation. Building upon the theoretical foundations laid out by Zahra and George (2002) and Garud and Nayyar (1994), in addition to being influenced by the empirical work of Szulanski (1996), we developed original measures for knowledge transformation. Fifteen items were used, with a Cronbach’s alpha of 0.898.

The measures of Knowledge exploitation, gauging the ability of the firm to incorporate knowledge into its operations, were developed following the guidelines set out in previous literature focusing on the usage of knowledge, such as Cohen and Levinthal (1990) and Zahra and George (2002). We used eleven items, with a Cronbach’s alpha of 0.897.

Control variables. We used three control variables for this study. We asked respondents which year the business was started and converted this into Firm Age. Firm Size was measured by asking the respondents for the number of employees converted into full-time equivalents. We also included measures of perceived technological dynamism in the industry (seven items; Cronbach’s alpha = 0.828).

ANALYSES AND RESULTS

The correlations and descriptive statistics for the non-categorical variables are presented in Table 1. There are relatively strong positive correlations between the dependent product/service innovation variable and all variables pertaining to market and technological knowledge. This suggests that (to the extent that the results are not caused by common method bias) firms that innovate more are also involved in all dimensions of AbCap, as the theory would suggest. There are also strong positive relationships between the control variable of technological dynamism and all of the components of AbCap. This intimates that knowledge and related activities are more prevalent in dynamic markets.

Tabachnick and Fidell (2000) recommend that bivariate correlations between independent variables be under 0.7 in order to avoid problems with multicollinearity. In this study, some of the bivariate correlations are close to 0.7 and one correlation (technological knowledge assimilation and knowledge conversion) is over this level. We also examined the variance inflation factors (VIFs). Individual figures ranged from 1.008 to 3.098 (due to space limitations, individual figures are not reported), which is well below the critical value of 10 (cf. Hair, Anderson, Tatham, & Black, 1998) suggesting that multicollinearity is not a serious problem. However, in order to ascertain that multicollinearity does not lead to erroneous results, we have chosen to combine two analysis strategies. First, we separately entered each of the AbCap variables corresponding to the hypotheses (in addition to a base model containing the control variables), examining the effect of each separate variable. These results are presented in Table 2. Second, we entered all AbCap variables jointly in order to test the relative importance of the variables. These results are presented in Table 3.
Starting with the analyses of each variable separately, the control variables of business size, business age and technological dynamism were first entered in a base model reported in column 2 of Table 2. This model presented a significant share of the variance of the innovative output dependent variable, due to the important role of technological dynamism. In the next step, the independent variables were entered into different blocks of subsequent regressions, one at a time per regression. Explained variance increases substantially in all of the regressions, ranging from 15% in the case of the “technological knowledge assimilation variable” to a full 38.5% for the “knowledge exploitation” variable. The results also show that the each of the AbCap variables have a statistically significant positive regression coefficient. This suggests that each of the categories involved in AbCap has an important role to play, providing preliminary support for H1a, H1b, H2a, H2b, H3 and H4 respectively. This is valuable knowledge as it demonstrates that each dimension of AbCap contributes to the overall innovative output.

In order to validate these findings, all AbCap variables were entered jointly, although in a hierarchical manner, as presented in Table 3. The variables are entered in the order of the knowledge process of the firm, starting with knowledge acquisition and ending with knowledge exploitation. The market knowledge dimension is entered before the technological knowledge dimension. Moving from left to right in the table, the effect of the “market knowledge acquisition” variable disappears in the face of the “technological knowledge acquisition”. As variables are subsequently included in the equation, the effect of “technological knowledge acquisition” prevails, but the only additional variable to have a positive and statistically significant effect is “knowledge exploitation”. Re-examining Table 2, the “technological knowledge acquisition” and “knowledge exploitation” variables were also the variables that had the largest effect size and contributed most to explained variance when each of the AbCap variables were entered separately, suggesting that the effect of these variables is not spurious. Thus, we conclude that H1b and H4 are supported, while partial support is obtained for H1a, H2a, H2b and H3.

DISCUSSION

In this paper we set out to examine the relationship between knowledge and innovation by studying how the different components of absorptive capacity influence innovative output on a sample of new firms in dynamic markets. We find that there is a positive effect of acquisition of market knowledge on innovative output. This supports the mass of literature that stresses that it is essential for firms to stay tuned to the preferences of its customers in order to develop new products to the market. However, this positive effect vanished when we also considered the acquisition of new technological knowledge. Therefore, it appears that the acquisition of market knowledge is subordinate to the acquisition of technological knowledge for the development of new products or services. While our results are based on a single cross-sectional study of selected industries and therefore are far from definite, they indeed challenge that merely acquiring new market knowledge among new firms should lead to greater innovative output. It appears that innovation among new firms in these dynamic industries is more closely related to being tuned into and updated on technological advances. Perhaps, this signifies that the industries studied are technology driven, as the large effect of industry technological dynamism indicates. Indeed, further research is needed in order to tease out the relative importance of the acquisition of technological vs. market knowledge in new firms. At the very least, our results suggest that not taking the acquisition of technological knowledge into account in studies of acquisition of market knowledge could lead to biased results.

The acquisition of technological knowledge has enjoyed a central role in innovation (e.g. Tsai, 2004). This is at least partially due to the fact that technological knowledge is less plausible to be copied or found in competing firms (Nerkar & Roberts, 2004). In part, such a statement is supported by our findings. One explanation for the emphasis on technological knowledge acquisition is due to sunk costs. As developing a resource base in new ventures requires time and money (Brush, Greene, & Hart, 2001), strategic flexibility and responsiveness may be based on exploiting current technological bases. That is, while new firms engage in the process of finding their niche in the market, success might stem from being better able to exploit opportunities or drive new unproven innovations to market. For example, Raff
(2000) finds that firms who show increased levels of flexibility in using their resource base are better able to take advantage of emerging opportunities.

However, we did not find a unique contribution of the assimilation and transformation of knowledge as predicted by the AbCap literature. A likely explanation for this is the size and age of the firms in our sample. Freel (2005), in his study of the innovation processes of small firms (regardless of age) found that this involved integrating knowledge from different departments. Garud and Nayyar (1994) find that such appropriate knowledge is stored and accumulated in robust systems and structures. It is likely that small and new firms can assimilate new knowledge without having elaborate processes for doing so. The lack of history of the firms may mean little previous knowledge or organizational memory from which to combine acquired knowledge as well (cf. Moorman & Miner, 1998). A valuable next step would be to examine interaction effects on knowledge assimilation and transformation of firm size and age. It would appear likely that the larger and older the firm, the more likely that explicit mechanisms for knowledge assimilation and transformation would produce positive innovation outcomes.

Additionally, the lack of effects of knowledge assimilation and transformation may be due to knowledge concentration in individuals within the firm. Individuals within the firm are frequently viewed as knowledge repositories (Argote, 1999). In the case of new and small firms, imperative knowledge about technology and the market may be concentrated within the founder who may pursue multiple tasks. While this potentially diverges from previous findings that the internal activities, such as cross-functional teamwork, is important for innovation, new firms oftentimes do not have organizational structures that would facilitate such knowledge transformation.

Knowledge exploitation has been described as the application, harvesting, and incorporation of knowledge, the outcomes of which can be seen as the persistent creation of goods or services (Spender, 1996). Therefore its role can be seen as the final and definitive step in providing innovations to market. Indeed, we did find that the strongest effect on innovative output was found for the knowledge exploitation variable, as this theory would predict.

Finally, we find significant positive relationships between the different sub-components of AbCap. This provides a valuable first empirical illustration of how these components work together. Our findings indicate that this relationship is more complex than has previously been discussed in the literature. Further unpacking of AbCap and examining the specific structure of its sub-components is clearly needed. More advanced analysis of the role of market and technological dynamism also appears to be useful, given the important role of the control factor of technological dynamism that we employed.

Limitations

As with all studies, there are certain limitations. Most importantly, although tests for common method bias were conducted showing satisfactory results, we cannot rule out that the use of single respondents and collecting all data from one questionnaire could inflate the results. This paper should be seen as a first step in empirically assessing some of the more important relationships between knowledge and innovation, using the theoretical lens of AbCap. Our results apply at least to new ventures in dynamic markets, but whether these findings are applicable in other types of markets is an open question.

Moreover, we have focused on innovation as the dependent variable, without examining the financial performance outcomes of this. Indeed, innovation may be a perilous path for many new firms, as it involves taking on further costs and risks. This is particularly relevant for new ventures that frequently are subject to limited managerial time and resources (Eisenhardt & Schoonhoven, 1990). Although innovation has been connected to new venture growth (Brüderl & Preissendorfer, 2000), further examination of the relationship between innovation and performance is needed (see Li & Atuhene-Gima, 2001).
CONCLUSIONS

Innovation is central to new firms and knowledge is essential for the capacity of a firm to innovate. In this paper we build on recent conceptual developments in AbCap research to hypothesize and test how knowledge activities contribute to innovation among new firms in dynamic markets. Our results suggest that in particular activities for acquiring new technological knowledge and mechanisms for exploiting new knowledge are of central importance for the innovative capability of these young firms. These findings provide a first empirical test of the recent re-conceptualization of the AbCap concept (Zahra & George, 2002) refines the theory and points to areas where future research is particularly valuable.

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REFERENCES


TABLE 1. Descriptive statistics and Spearman correlations for relevant variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>5.56</td>
<td>2.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Nr employees</td>
<td>12.72</td>
<td>4.24</td>
<td>-0.023</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Technological dynamism</td>
<td>25.56</td>
<td>4.83</td>
<td>-0.022</td>
<td>-0.018</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4. Market Acquisition</td>
<td>28.81</td>
<td>5.42</td>
<td>0.007</td>
<td>0.078</td>
<td>0.243**</td>
<td></td>
<td></td>
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<tr>
<td>5. Technology Acquisition</td>
<td>39.81</td>
<td>9.92</td>
<td>-0.054</td>
<td>0.086</td>
<td>0.286**</td>
<td>0.608**</td>
<td></td>
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<tr>
<td>6. Market Assimilation</td>
<td>35.02</td>
<td>6.59</td>
<td>-0.179**</td>
<td>-0.021</td>
<td>0.121*</td>
<td>0.544**</td>
<td>0.418**</td>
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<td>7. Technology Assimilation</td>
<td>30.34</td>
<td>5.79</td>
<td>-0.142*</td>
<td>-0.028</td>
<td>0.287**</td>
<td>0.473**</td>
<td>0.598**</td>
<td>0.536**</td>
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<tr>
<td>8. Transformation</td>
<td>54.22</td>
<td>9.91</td>
<td>-0.121*</td>
<td>0.019</td>
<td>0.246**</td>
<td>0.622**</td>
<td>0.668**</td>
<td>0.645**</td>
<td>0.715**</td>
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<td>9. Exploitation</td>
<td>36.12</td>
<td>8.29</td>
<td>-0.091</td>
<td>-0.028</td>
<td>0.280**</td>
<td>0.432**</td>
<td>0.672**</td>
<td>0.360**</td>
<td>0.445**</td>
<td>0.570**</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.01, *** p < 0.001; n = 318.
TABLE 2. Hierarchical regression analysis with separated independent variables

<table>
<thead>
<tr>
<th></th>
<th>Base model</th>
<th>Market Acquisition</th>
<th>Technology Acquisition</th>
<th>Market Assimilation</th>
<th>Technology Assimilation</th>
<th>Transformation</th>
<th>Exploitation</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.078</td>
<td>-0.077</td>
<td>-0.041</td>
<td>-0.025</td>
<td>-0.040</td>
<td>-0.034</td>
<td>-0.015</td>
</tr>
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<td>Nr employees</td>
<td>-0.037</td>
<td>-0.064</td>
<td>-0.077</td>
<td>-0.036</td>
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<td>-0.012</td>
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<td>0.197**</td>
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<td>0.123*</td>
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<tr>
<td>Technology Acquisition</td>
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<tr>
<td>Transformation</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Exploitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>0.087***</td>
<td>0.225***</td>
<td>0.354***</td>
<td>0.157***</td>
<td>0.151***</td>
<td>0.210***</td>
<td>0.385***</td>
</tr>
<tr>
<td>Adj. R2</td>
<td>0.078***</td>
<td>0.215***</td>
<td>0.345***</td>
<td>0.145***</td>
<td>0.139***</td>
<td>0.199***</td>
<td>0.377***</td>
</tr>
<tr>
<td>Change R2</td>
<td>0.087***</td>
<td>0.136***</td>
<td>0.268***</td>
<td>0.072***</td>
<td>0.066***</td>
<td>0.126***</td>
<td>0.297***</td>
</tr>
</tbody>
</table>

Notes: Standardized regression coefficients are displayed in the table.
* p < 0.005, ** p < 0.01, *** p < 0.001; n = 318.
TABLE 3. Hierarchical regression analysis with all independent variables included

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Nr employees</th>
<th>Technological dynamism</th>
<th>Market Acquisition</th>
<th>Technology Acquisition</th>
<th>Market Assimilation</th>
<th>Technology Assimilation</th>
<th>Transformation</th>
<th>Exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base model</td>
<td>-0.084</td>
<td>-0.038</td>
<td>0.273***</td>
<td>0.376***</td>
<td>0.470***</td>
<td>0.054</td>
<td>-0.067</td>
<td>0.020</td>
<td>-0.084</td>
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<td>-0.065</td>
<td>0.181***</td>
<td>0.114*</td>
<td>0.464***</td>
<td>0.076</td>
<td>-0.073</td>
<td>-0.084</td>
<td>-0.046</td>
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<tr>
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<td>-0.079</td>
<td>0.114*</td>
<td>0.087</td>
<td>0.491***</td>
<td>0.071</td>
<td>-0.073</td>
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<td>-0.084</td>
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<td>-0.076</td>
<td>0.115*</td>
<td>0.090</td>
<td>0.485***</td>
<td>0.071</td>
<td>-0.073</td>
<td>0.020</td>
<td>-0.084</td>
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<tr>
<td>Technology Assimilation</td>
<td>-0.035</td>
<td>-0.080</td>
<td>0.124*</td>
<td>0.087</td>
<td>0.287***</td>
<td>0.071</td>
<td>-0.073</td>
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<td>Transformation</td>
<td>-0.035</td>
<td>-0.080</td>
<td>0.124*</td>
<td>0.087</td>
<td>0.287***</td>
<td>0.071</td>
<td>-0.073</td>
<td>0.020</td>
<td>-0.084</td>
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<tr>
<td>Exploitation</td>
<td>-0.014</td>
<td>-0.046</td>
<td>0.087</td>
<td>0.105</td>
<td>0.287***</td>
<td>0.068</td>
<td>-0.044</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R2                    | 0.086***| 0.218***     | 0.354***               | 0.356              | 0.358                  | 0.358               | 0.435***               |              |              |
Adj. R2               | 0.076***| 0.207***     | 0.342***               | 0.342              | 0.339                  | 0.339               | 0.416***               |              |              |
Change R2             | 0.086***| 0.132***     | 0.136***               | 0.002              | 0.002                  | 0.000               | 0.076***               |              |              |

Notes: Standardized regression coefficients are displayed in the table.
* p < 0.005, ** p < 0.01, *** p < 0.001; n = 318.