

## **Organizing for exploration and exploitation**

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### **Abstract**

Exploitation of current technologies and competences generates revenues in the present, while exploration of new technological options creates the basis for future revenues. Exploitation is needed for short-term survival, while exploration is needed for long-term survival. Between exploration and exploitation, a tension exists, which is one of the essential tensions in the management of innovation. To develop and maintain innovation strategies and organizational forms that facilitate both exploration and exploitation and that can cope with the tensions, is a major challenge for the management of innovation. The purpose of this paper is to give a succinct overview of relevant literature, and to draw the outline of a research project on the organization of exploration and exploitation in the field of biotechnology. The main research questions of this project are: Under which circumstances is the strategic choice to engage in multiple technological trajectories sensible? and: To what extent are ambidextrous organizational forms effective structures for firms pursuing a multiple technology strategy?

### **Introduction**

Managing innovation concerns the construction of organizations that can realize innovation projects and that are flexible enough to adapt to new situations in the market and the technological domain. To create and maintain such an organization is a major challenge for innovation management. It is particularly difficult because managers of established firms cannot put all their resources on the development of potential breakthroughs, nor can they strive for maximum strategic flexibility (de Weerd-Nederhof, 1998; Johnson et al., 2003). They also have a current business to run. Without earnings from their present business, they cannot survive in the short run, let alone in the long run. They should perform well both in terms of operational effectiveness and in terms of strategic flexibility (de Weerd-Nederhof, 1998). According to March (1991), they therefore have to create a balance between dedicating their resources to, on the one hand, 'sustaining' innovative activities that exploit existing knowledge and networks, and on the other hand, 'radical' innovative activities that explore entirely new opportunities. "The basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and,

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at the same time, to devote enough energy to exploration to ensure its future viability. Survival requires a balance [...]” (Levinthal & March, 1993, p.105).

It is especially in turbulent periods that a well-maintained balance between exploitation and exploration pays off, and that an ill-maintained balance is dangerous, sometimes fatal. In stable periods, innovations build on existing competences and structures, and strengthen the position of established firms, while in turbulent periods, the winds of creative destruction blow (Schumpeter, 1912; Abernathy & Clark, 1985), making established competences and structures obsolete (Leonard-Barton, 1992) and giving newcomers potentially an opportunity to invade, and sometimes conquer the industry. It is mainly through exploratory activities that radically new technologies are created and that organizations build up the strategic flexibility to be able to switch technologies, and it is through exploitation that these innovations are made into a business. With a lack of exploration, organizations remain stuck in their current technologies, and with a lack of exploitation they cannot reap the fruits of their innovative accomplishments.

The need for, on the one hand, operational effectiveness and exploitation for short-term survival, and, on the other hand, strategic flexibility and exploration for long-term survival, creates one of the essential tensions in the management of innovation. Both sides do apply for the same scarce resources, and furthermore, exploratory activities, when successful, may result in creative destruction, not only of the competences and products of competitors, but also of the organization as-is (Henderson, 2006), which may give rise to an organizational equivalent of the Oedipus legend<sup>2</sup>. Besides, exploration and exploitation require an entirely different way of working, organizing and managing, difficult to combine and to balance within one organization (Tushman & O’Reilly, 1997). In addition, several forces are at play that may disturb the balance in favor of either exploration or exploitation. Levinthal & March (1993) identified a success trap and a failure trap, mechanisms that lead to a worsening unbalance. The success trap is a vicious cycle in which successful exploitation leads to more exploitation and less exploration, finally resulting in a lock-in, while the failure trap is a cycle in which failure in exploration leads to more exploration, just until the resources will have dried up. Balancing exploration and exploitation is a difficult and paradoxical undertaking.

## Managing the tension between exploitation and exploration

The management of the balance between exploration and exploitation has a strategic and a structural dimension. According to theory, a firm should engage in multiple technological trajectories, some of them mature, for current exploitation, some of them emergent, for future exploitation. A well-known example is Shell, which invests in renewable energy in order to safeguard its continuity for the time oil resources will have run out. Other examples are pharmaceutical companies participating in biotechnology and semi-conductor companies investing in nano-electronics. The strategic choice to engage in multiple technological trajectories seems sensible, in particular from a viewpoint of continuity and risk reduction. There also is much support in management literature for such a strategy, but the empirical support is mostly weak

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<sup>2</sup> An organization creates an ‘exploratory’ child, which is brought up far away from the parents, returns when it is strong enough, kills the dominant parent, marries the other, and takes over control.

(typical evidence is derived from case-studies of companies that had lost their position because of their inability to carry on when their technological trajectory declined). Van Looy et al. (2005), on the basis of a mathematical model, have shed doubt on the profitability of a multiple technology strategy over focused firms. They hypothesize that such a strategy is only profitable under certain circumstances.

If an organization engages in multiple technological trajectories, how can it design organizational forms that can manage both mature and emerging technologies. Some authors favor a strict separation through spin-offs. (Christensen & Raynor, 2003). Iansiti et al. (2003), however, argue that spin-offs give a quick start, but have difficulties with upscaling their activities in a later stadium, as they cannot use the mother company's marketing and production resources. Besides, future integration with the mother company is problematic. Therefore, they favor a strategy of internal balancing and integration of the old and the new. To create such a balance, Tushman and O'Reilly (1997) have proposed an ambidextrous organizational form, in which exploration and exploitation are separated in different units, and integration is supposedly achieved in the top of the organization, by a clear mission and strategy. Under which circumstances ambidextrous organizing is effective is a debated issue (Markides and Charitou, 2004; Van Looy et al., 2005), just as the question whether ambidexterity can be achieved in other ways than through organizational structuring (Gibson & Birkinshaw, 2004).

## Exploration and exploitation in biotechnology

The University of Twente in the Netherland and the Catholic University of Leuven in Belgium have initiated a research project to generate empirical evidence around the described questions of multiple technology strategies and ambidextrous organizations. The purpose of this project is come to empirically based strategic and structural design heuristics for managers. The project tries to tackle two related questions:

- Under which circumstances is the strategic choice to engage in multiple technological trajectories sensible?
- To what extent are ambidextrous organizational forms effective structures for firms pursuing a multiple technology strategy?

With regard to these questions, the following hypotheses can be formulated, based on literature (Anderson & Tushman, 2001; Van Looy et al., 2005):

H1a: All other things being equal, firms with a multiple technology strategy outperform focused firms in case of complementary technologies.

H1b: All other things being equal, focused firms outperform firms with a multiple technology strategy in case of conflicting or unrelated technologies.

H2a: All other things being equal, firms with a multiple technology strategy outperform focused firms in periods of technological turmoil.

H2b: All other things being equal, focused firms outperform firms with a multiple technology strategy in periods of technological stability.

H3a: All other things being equal, organizing radical innovation through ambidextrous organizing is effective in case of complementary technologies.

H3b: All other things being equal, organizing radical innovation through ambidextrous organizing is not effective in case of conflicting or unrelated technologies.

To be able to test these hypotheses, and to develop additional hypotheses about the relation between strategic choices, technological trajectories and organizational forms, information will be needed – over a longer period of time – on performance indicators of firms, on technological strategies and portfolios of firms, on organizational structures, on characteristics of technologies, and on the dynamics of technological fields. We will collect this information in the field of biotechnology. Biotechnology is a turbulent, emerging field, worthy of explorative activities. To chart the technological trajectory and to identify active firms in biotechnology, patent databases will be used. To reconstruct the strategies and structures of these firms, annual reports will be used, next to a questionnaire. Interviews with experts inside and outside these firms will be used to judge the relatedness between technologies. The first conclusions from the analysis, focusing on biotechnology firms in the Netherlands and Belgium will be available in the summer of 2006. These results will be presented at the conference.

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