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Understanding the Advantages of Open Innovation Practices in Corporate Venturing in Terms of Real Options

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Part of the advantages of using open innovation (compared to closed innovation) in corporate venturing can be explained by applying the real options approach. Open innovation in risk-laden activities such as corporate venturing has the following advantages: (i) benefits from early involvement in new technologies or business opportunities; (ii) delayed financial commitment; (iii) early exits reducing the downward losses; and (iv) delayed exit in case it spins off a venture. We furthermore argue that these benefits do not automatically materialize. Innovative firms have to learn new skills and routines to develop the full 'real option' potential of open innovation practices.

Introduction

As each business matures over time, firms have to look for new growth opportunities. Extending products' lifetime may be a short-term solution, but in the longer run companies have to invest in new business opportunities or explore new technological areas. Firms investing in new technologies or new applications face uncertain futures. We give two examples to illustrate this. First, when a new technology is in search of potential applications, the innovating firm usually has in the first stage(s) no well-defined idea of potential target customers and how the technology can create value. How the firm can create and capture value only becomes clear after extensive market research, lead user interaction and investments in application technology. Second, a company perceives a potential market opportunity but has to develop a technology to create the business. In both cases, committing prematurely to a new venture may impose considerable risks and the innovating firm should delay irreversible investments until it has gained sufficient information that reduces uncertainty to a manageable level.

Historically, market leaders have tackled these types of uncertainties related to the introduction of radical innovations through the establishment of large, centralized R&D labs. The success of these labs is based on the exploitation of economies of scale and scope in R&D (Chandler, 1977, 1990). However, Chesbrough (2003, 2006) and other scholars claim that the internally oriented, centralized approach to R&D is becoming obsolete in many industries. Useful knowledge is widely disseminated and ideas must be used, or else should be sold to other organizations. R&D is becoming more costly and returns on it are diminishing because of increasing competition in product markets and shorter product life cycles. These are a few of the factors that are responsible for the emergence of the open innovation paradigm. In this approach innovating firms are searching for interesting ideas far beyond their organizational boundaries. Moreover, they are leveraging their internal ideas outside their own business by using external channels to market.

In this study, we argue that the alleged benefits of open innovation can be partly explained by the real option approach. We focus on *external corporate venturing* as a

management practice to stimulate corporate growth (Keil, 2002; Block & MacMillan, 2003). We have two reasons for doing so. First, it has been one of the major organizational vehicles to apply open innovation in innovating firms (Chesbrough, 2000, 2003). Second, it is a risk-laden activity that can be used as a first but reversible step in a sequence of investments with increasing financial commitment on the part of the investing company. In this way, corporate venturing is an interesting area to apply real options theory. Corporate venturing can thus be analysed both in terms of open innovation and real options and it is rather surprising that nobody so far has connected open innovation to real options reasoning. Chesbrough (2003, 2006) developed the concept of open innovation independent of the real options approach, although the benefits of open innovation are implicitly using real option arguments. In this study, we make explicit linkages between the open innovation and real options literature. In particular, we assess the advantages of corporate venturing – as a particular open innovation mechanism – from a real options perspective. This is a first, explorative investigation on open innovation and real options and offers scholars some initial ideas on how real options theory can strengthen the theoretical foundation of the open innovation literature.

We also argue that the benefits of the extended flexibility, so characteristic of open innovation, do not materialize automatically. Firms have to learn new skills and routines. We focus among other issues on the changing requirements to develop absorptive capacity to learn effectively from other companies.

Uncertainty and Real Options

The creation of new businesses inherently involves a high level of uncertainty, especially in the early stages of new business development. One way for firms to cope with the technological and market uncertainty associated with new business development is by making small investments in multiple options on technology. These small, initial investments can be regarded as a real option. A real option is 'the right, but not the obligation, to take an action in the future' (Amram & Kulatilaka, 1999, p. 5), and typically consists of two distinct actions: option creation and option exercise. Option creation is the initial investment, which creates an option for the future. At some point in time, this option can be exercised through a follow-on investment. In the management literature, real options reasoning is often referred to as a tool for uncertainty reduction –

making a small, initial investment under high levels of uncertainty allows one to create an option while waiting until the uncertainty about the opportunity has decreased. When the uncertainty has decreased, the investing firm can decide whether to make a follow-on investment or whether to abort the project (Adner & Levinthal, 2004; McGrath & Nerkar, 2004).

The real options approach has been discussed frequently in the literature as a tool to reduce the uncertainty of innovation projects, corporate venturing and new business development (e.g., Bowman & Hurry, 1993; Teisberg, 1994; Huchzermeier & Loch, 2001; Miller & Arikan, 2004). Owing to its explicit nature to cope with uncertainty, real options reasoning may also provide us with a better understanding of how innovating firms evaluate sequential investment decisions concerning the *external* sourcing of technologies. In particular, this is applicable at the fuzzy front end of the innovation funnel where R&D co-operation with upstream technology providers and corporate venturing plays a crucial role in reducing the uncertainty inherently present in early phases of technology ventures. In these early phases with unacceptable levels of technological and market uncertainty, firms are better off creating options through learning investments: grants to universities to further explore new inventions or emerging technologies, joining a research consortium or establishing research agreements with partners, or investing in seed capital ventures or corporate ventures (Roberts & Berry, 1985; Dushnitsky & Lenox, 2005) are different possibilities to explore technologies or business opportunities in the first phase. They represent the 'option creation' phase. By investing in collaborative research or taking a minority position in high-risk (external) ventures, investing firms learn about this opportunity and in this way decrease the huge uncertainty related to the initial investment. Once the learning investments result in an improved understanding of the technology and uncertainty has dropped to an acceptable level, innovating firms may invest in more substantial ways using other external governance modes such as equity alliances, joint ventures, spin-ins or outright acquisitions (Van de Vrande et al., 2006).

In sum, real options are investments that can be characterized as sequential, irreversible investments made under conditions of uncertainty. The options create value by generating future decision rights and, in this way, providing strategic flexibility. This flexibility is more valuable the higher the level of uncertainty. Real options reasoning can also be applied to

the context of new business development and corporate venturing. Small initial investments made at an early stage of technology development allow a company to learn about the technology. In this way, it can defer additional investments and reduce the strategic risk of making irreversible commitments to a particular application of that technology. Corporate ventures could thus be considered as compound options where firms at each stage have the option to commit additional resources or to pull the plug.

Consequently, the real options approach offers a framework to explain the sequential investment rounds in new technologies within a company. In the next section, we analyse in detail how the real option approach can explain the benefits of external corporate venturing as one of the most important open innovation practices in large companies in order to accelerate their internal innovation or to expand the markets for external use of their innovations (Chesbrough et al., 2006).

Real Options and Open Innovation

So far, open innovation has not been linked explicitly to real options reasoning in its application to external corporate venturing. In our opinion, real options may provide us with a better understanding of how innovating firms evaluate sequential investment decisions in corporate venturing. Open innovation can be defined as 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively' (Chesbrough et al., 2006, p. 1). Depending on its business model, a firm decides whether or not external and internal knowledge is valuable to be further developed and commercialized into a new business. When the venture project is expected not to be profitable enough or when it does not fit a firm's business model, the firm will not simply abort the project (as in the closed innovation framework), but it will try to license or to sell it to other firms who can use the innovation productively because they have different business models.

Comparing closed innovation versus open innovation practices in terms of real options reasoning, there might be several advantages working in an open innovation style in external corporate venturing. (We follow the typology of real options provided by Janney and Dess, 2004.)

First, innovating firms benefit from early involvement in new technologies or business opportunities. Open innovation allows innovating companies to sense developments in a

wide range of externally developed inventions by buying minority stakes in (high-tech) start-ups, participating in venture capital funds, or by providing educational investments in promising projects at universities or research labs. This is an option-creation process in order to get more information and learn about projects or technologies with uncertain payoffs. The advantage of this strategy is that companies learn early on about new technologies: at that stage investments are small and reversible when investing companies exit. Moreover, tapping into externally developed technologies also enhances the upward potential of the real option because the company can scan a broad range of interesting ideas and projects. In real option terms, open innovation allows companies to scan a much wider range of the available technologies or new market developments, instead of just writing options on internal projects alone. The ability to access a broader range of technologies and market opportunities has financial value because there may be more varied opportunities, and some of these may be uncorrelated with internally perceived opportunities. The result is more alpha, in terms of higher return, and lower beta, in terms of robust diversification, enabling the open innovation firm to build a portfolio of projects that will be more resistant to problems in any one part of the business.

Nokia, for instance, is continuously identifying opportunities in its own ventures organization; it systematically scans emerging trends and changes from the perspectives of technology, business and users. The knowledge gained from these multiple perspectives helps identifying potential indicators of change or disruption. By early identification of these indicators, Nokia can take steps to address change or disruption sooner. By identifying the disruptors, and understanding their business models, Nokia can develop its own response to otherwise unforeseen changes.

Second, innovating firms also benefit from delayed entry or delayed financial commitment. The staged process in which new technologies are developed and commercialized into new business opportunities can be analysed as a compound option. In closed innovation, firms can only start with an internally developed idea/invention and pull it through the funnel. Open innovation practices offer firms more flexibility about when to start the internal portion of the innovation process: a company can start exploring the commercial possibilities of a technology outside initially, via relationships with universities, SMEs and other innovation sources. The ability to delay the investment in internal innovation activity

enables the firm to consider a broader portfolio of entry options at the beginning, and also supports more ways to develop growth opportunities from a technology. This flexibility also creates the possibility to differentiate innovation strategies: some firms have developed the ability to scan widely for technologies and ideas early on, other firms prefer to invest in technologies at a later stage when the level of uncertainty has decreased to a level where the future market potential of the new venture becomes more predictable.

Third, open innovation offers firms the advantage of an early exit, and the ability to realize some value from projects that do not go forward internally. Open innovation is characterized by the possibility that innovating firms can always license or sell technologies or spin-off ventures that are not promising enough and/or that do not fit with their business model or core competencies. Thus, a project that is determined to be unpromising as a business (but might be valuable as a complement to another part of the business) could be spun off to a supplier, a complementor, or other third party. Strategic initiatives can thus be pursued through multiple firms, with multiple sources of investment, rather than exclusively through the firm's own capital. This implies one of two favourable outcomes: either the firm gets more 'at bats' with the same amount of capital, or the firm is able to pursue the same degree of innovative exploration with a lesser budget. There are two caveats to note here. First, firms may have to trade part of their intellectual property rights in order to enlist the investment and support of other firms. Second, the financial benefits of this are more interesting in the early stages of the innovation funnel, because application-specific investments in the later commercialization phase may be sunk costs, and harder to recover or redeploy (depending on the contestability of the market).

Fourth, open innovation allows firms to benefit from delaying an exit. The creation of corporate ventures that reside outside the organization allows firms to monitor its developments while delaying the exit decision. While the venture grows further and matures, the corporation can decide whether to spin in the venture or whether to sell it to external capital providers such as venture capitalists. This decision depends, of course, on the strategic fit and the commercial success of the venture. If the firm chooses to syndicate its investment in the venture and invite other investors in, the firm also benefits from 'other people's money' supporting the development of the venture. This is capital efficient for the firm, though it does relinquish a substantial

degree of strategic control to the outside investors. In this way, the open innovation paradigm allows firms to maintain flexibility while keeping their different venture options open.

These four arguments show that the alleged benefits of open innovation – i.e., improved access to other organizations' technological capabilities or higher R&D productivity through the combination of internal and external channels to market – can only be fully explained using a real options perspective that focuses on the process of how firms cope with high levels of uncertainty through subsequent investments in new ventures. First, open innovation enables firms to get easy access to others' technology because of their small and reversible educational investments in universities, research labs and high-tech start-ups. These small investments represent an *option creation* process which effectively copes with the substantial technological and market uncertainty in radical innovation projects. At the same time, these initial investments allow innovating companies to delay further financial commitment. Second, open innovation boosts the performance of companies because of the external channels to market such as licensing deals and spin-offs. These external channels to market represent alternatives for innovating firms to capture value from their innovation ventures. Open innovation allows innovators to choose in the *option exercising* phase to capture value from ventures in different ways, even when the firm is not active on the product market. Licensing and spin-offs are also effective means to delay an exit. Although the firm decides not to develop the venture as part of its own businesses, it can still benefit from extended control and delayed exit until it finally decides to break all ties with the venture. This delayed 'exit' is strategically interesting as long as spin-offs or licensees represent a potential competitive threat or when technological and market uncertainty prevent the making of a final decision because of the (lack of) strategic value of a particular technology or application for the innovating firm.

Real Options and Implications for Organizational Learning

In the previous section we have shown that real options reasoning is an important rationale to understand the potential benefits from open innovation. But real options are not only interesting to increase the financial value of a firm's innovative activities. It also requires a process of learning and competence building. The value of learning about new technologies

prior to the full-scale business development is enormous. As open innovation practices potentially enhance the upward potential of new venturing projects and limit downward risks, they increase the learning space for innovating companies. In this way, firms have the possibility to speed up their learning and development of new competencies in order to migrate towards more attractive technologies and applications.

However, these advantages do not come automatically. Organizations have to develop new skills, routines and strategies. For example, firms cannot and should not explore externally developed technologies randomly. As Nobel Laureate Herb Simon once observed, 'where there is a wealth of information, there is a poverty of attention'. They have to learn over time which technologies offer interesting, new growth opportunities. They have to develop the ability to scan efficiently trends in research and new technologies. They must become skilled at recognizing useful ideas, and separating those from the vastly more numerous ideas that are distractions. Hence, firms that try to open up their innovation process have to learn new skills to recognize and absorb externally developed technologies and innovations. Moreover, in open innovation, companies tap into external sources of knowledge. This is certainly not an easy process. It takes most firms years of learning before they effectively learn from external partners (Day et al., 2000; Schoemaker, 2002). How to build a learning relationship with partners? (Kale et al., 2002; Hoffmann, 2005, 2007; Heimeriks et al., 2007; Heimeriks & Duysters, 2007; Kale & Singh, 2007). How to build responsible partnership and trust? (Nooteboom, 2004).

Hence, to work effectively, firms that adapt to the open innovation approach have to develop new competences and routines to become highly effective and to exploit the most benefits that can be obtained by the real options underlying the open innovation approach. We will explore this further by focusing on the development of interorganizational absorptive capacity (Lane & Lubatkin, 1998). Real options reasoning has major implications for the absorptive capacity of innovating firms. Absorptive capacity consists of three dimensions: identification, assimilation and exploitation of external knowledge (Cohen & Levinthal, 1990; Zahra & George, 2002; Todorova & Durisin, 2007). Real options reasoning has important implications for each of these three dimensions.

First, making small learning investments allows firms to tap into different technologies at the same time. These small, initial investments allow them to learn about the different

technological opportunities ahead. In this way, the investing firm builds up absorptive capacity in a number of technologies simultaneously. Real options reasoning also indicates that absorptive capacity is not simply a by-product of a firm's own R&D investments. It is not a passive process in which innovating firms automatically can profit from knowledge spillovers of other firms as has been described in the literature in the wake of the seminal publication of Cohen and Levinthal (1990). Firms identify and assimilate new technologies through purposively investing in interesting external technology sources, and then purposively develop processes in order to learn from them. Specific job functions such as technology scouts are developed for that purpose. R&D expenditure levels alone cannot explain the large variability in absorptive capacity among innovating firms. It is the organization of the internal R&D unit, its connection with external partners and its interaction with the other parts of the company that determine the innovative capability of a firm.

Moreover, the stage-gate process of real options reasoning leads to a gradual improvement of a firm's absorptive capacity. Firms learn about new technologies and opportunities by making small learning steps. This accumulation of absorptive capacity over time is an important precondition for an effective and efficient selection of options. By gradually improving its absorptive capacity, firms gain knowledge about the future potential of the projects. When a follow-on investment decision has to be made, this knowledge is necessary to select the best options ahead.

As a consequence, real options reasoning is a dynamic approach that helps firms to improve their ability to identify, assimilate and exploit the external knowledge (Teece et al., 1997). As such, real options reasoning has important implications for the way in which firms build up absorptive capacity. Real options allow firms to build and strengthen their absorptive capacity in a broad range of technologies, by making small steps at a time and bringing down uncertainty in that way. The larger the portfolio of options, the stronger the absorptive capacity skills a firm will be able to build. In an open innovation paradigm, this is particularly important. Firms are constantly being confronted with the decisions whether to (further) develop a particular technology in-house, or whether to source it externally. The lack of absorptive capacity that may exist in the early stages of technology development can be gradually enhanced through the use of real options, in addition to the internal R&D activities. When uncertainty related to a venture decreases over time and the value

of the opportunity becomes apparent, the increased absorptive capacity of the firm will help to make the right decision.

Conclusion

Open innovation has to our knowledge not been linked explicitly to real options reasoning. Real options may provide us with a better understanding of how innovating firms that are engaged in corporate venturing evaluate sequential investment decisions in sourcing external technologies. In particular, this is applicable at the fuzzy front end of the innovation funnel where R&D co-operation with upstream technology providers and corporate venturing play a crucial role. Open innovation in risk-laden processes such as corporate venturing has several advantages. First, firms can benefit from early involvement in new technologies or business opportunities. Because of investments in universities, or high-tech start-ups, investing firms have an early look at new or emerging technologies or trends. Second, firms can profit from delayed financial commitment as they can invest step by step, avoiding investing large up-front costs. Next, they can benefit from early exits as corporate venturing is a fairly flexible investment instrument. This reduces the risk of financial losses. Finally, investing firms can also delay exit in the case of spins-offs. Although the firm decides not to continue the venture as part of its own businesses, it still can benefit from extended control and delayed exit until it finally decides to break all existing ties with the venture.

In a similar way, the creation of real options in the context of insourcing external technologies also increases the learning and absorptive capacity of investing firms. Linking absorptive capacity to real options reasoning has according to us a major potential to refine our understanding of the former. Absorptive capacity of firms in relation to radically new ideas in an early research phase is quite different from absorptive capacity related to proven technology that can readily be translated into new products or markets (Leifer et al., 2000). Hence, we have to differentiate the concept of absorptive capacity along the 'innovation funnel'. It is different for technological exploration compared to exploitation and it has quite different strategic and organizational consequences. Combining both requires that companies become ambidextrous (Tushman & O'Reilly, 1996; O'Reilly & Tushman, 2004). Open innovation would add to this, by advising firms to become more open, as well as ambidextrous.

This paper is a first, explorative study investigating the link between open innovation and real options theory. We are in particular interested in assessing how the advantages of external corporate venturing – as a specific open innovation practice – can be understood only by applying real option concepts. However, the current study is only an eye-opener; we invite other scholars to further apply real options theory to strengthen the theoretical foundation of the open innovation literature. We narrowed the scope to external corporate venturing to keep the analysis short and tractable; future research should analyse whether real options theory can be applied to other open innovation practices. Can it be applied to the use of intermediaries, crowd sourcing, open IP approaches, etc.? Next, describing the advantages of open innovation we assumed implicitly that managing open innovation was not an issue. In reality, however, open innovation poses considerable managerial challenges. Consequently, future research should investigate how open innovation can be effectively managed in order to reap the theoretical real option benefits. Finally, we should focus not only on the advantages but also on the disadvantages of open innovation compared to closed innovation. In which situations can open innovation damage a firm's fortune and how can these disadvantages be analysed in terms of real options?

References

- Adner, R. and Levinthal, D.A. (2004) What Is Not a Real Option: Considering Boundaries for the Application of Real Options to Business Strategy. *Academy of Management Review*, 29, 74–85.
- Amram, M. and Kulatilaka, N. (1999) *Real Options: Managing Strategic Investment in an Uncertain World*. Harvard Business School Press, Boston, MA.
- Block, Z. and MacMillan, I.C. (2003) *Corporate Venturing: Creating New Businesses Within the Firm*. Beard Books, Washington, DC.
- Bowman, E.H. and Hurry, D. (1993) Strategy through the Options Lens: An Integrated View of Resource Investments and the Incremental-Choice Process. *Academy of Management Review*, 18, 760–83.
- Chandler, A.D. (1977) *The Visible Hand: The Managerial Revolution in American Business*. Belknap Press, Cambridge, MA.
- Chandler, A.D. (1990) *Scale and Scope: The Dynamics of Industrial Capitalism*. Belknap Press, Cambridge, MA.
- Chesbrough, H.W. (2000) Designing Corporate Ventures in the Shadow of Private Venture Capital. *California Management Review*, 42, 31–49.
- Chesbrough, H.W. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press, Boston, MA.

- Chesbrough, H.W. (2006) *Open Business Models*. Harvard Business School Press, Boston, MA.
- Chesbrough, H.W., Vanhaverbeke, W. and West, J. (eds.) (2006) *Open Innovation: Researching a New Paradigm*. Oxford University Press, Oxford.
- Cohen, W.M. and Levinthal, D.A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35, 128–52.
- Day, G.S., Schoemaker, P.J.H. and Gunther, R.E. (eds.) (2000) *Wharton on Managing Emerging Technologies*. John Wiley & Sons, New York.
- Dushnitsky, G. and Lenox, M.J. (2005) When Do Incumbents Learn from Entrepreneurial Ventures? Corporate Venture Capital and Investing Firm Innovation Rates. *Research Policy*, 34, 615–39.
- Heimeriks, K.H. and Duysters, G. (2007) Alliance Capability as a Mediator between Experience and Alliance Performance: An Empirical Investigation into the Alliance Capability Development Process. *Journal of Management Studies*, 44, 25–49.
- Heimeriks, K.H., Duysters, G. and Vanhaverbeke, W. (2007) Learning Mechanisms and Differential Performance in Alliance Portfolios. *Strategic Organization*, 5, 373–408.
- Hoffmann, W.H. (2005) How to Manage a Portfolio of Alliances. *Long Range Planning*, 38, 121–43.
- Hoffmann, W.H. (2007) Strategies for Managing a Portfolio of Alliances. *Strategic Management Journal*, 28, 827–56.
- Huchzermeier, A. and Loch, C.H. (2001) Project Management under Risk: Using the Real Options Approach to Evaluate Flexibility in R&D. *Management Science*, 47, 85–101.
- Janney, J.J. and Dess, G.G. (2004) Can Real Options Analysis Improve Decision-Making? Promises and Pitfalls. *Academy of Management Executive*, 19, 60–75.
- Kale, P. and Singh, H. (2007) Building Firm Capabilities through Learning: The Role of the Alliance Learning Process in Alliance Capability and Firm-Level Alliance Success. *Strategic Management Journal*, 28, 981–1000.
- Kale, P., Dyer, J.H. and Singh, H. (2002) Alliance Capability, Stock Market Response, and Long-term Alliance Success: The Role of the Alliance Function. *Strategic Management Journal*, 23, 747–67.
- Keil, T. (2002) *External Corporate Venturing: Strategic Renewal in Rapidly Changing Industries*. Quorum Books, Westport, CT.
- Lane, P.J. and Lubatkin, M. (1998) Relative Absorptive Capacity and Interorganizational Learning. *Strategic Management Journal*, 19, 461–77.
- Leifer, R., McDermott, C.M., O'Connor, G.C., Peters, L.S., Rice, M.P. and Veryzer, R.W. (2000) *Radical Innovation: How Mature Companies Can Outsmart Upstarts*. Harvard Business School Press, Boston, MA.
- McGrath, R.G. and Nerkar, A. (2004) Real Options Reasoning and a New Look at the R&D Investment Strategies of Pharmaceutical Firms. *Strategic Management Journal*, 25, 1–21.
- Miller, K.D. and Arikan, A.T. (2004) Technology Search Investments: Evolutionary, Options Reasoning, and Option Pricing Approaches. *Strategic Management Journal*, 25, 473–85.
- Nooteboom, B. (2004) *Inter-Firm Collaboration, Learning and Networks: An Integrated Approach*. Routledge, London.
- O'Reilly, C.A. III and Tushman, M.L. (2004) The Ambidextrous Organization. *Harvard Business Review*, 74–81.
- Roberts, E.B. and Berry, C.A. (1985) Entering New Business: Selecting Strategies for Success. *Sloan Management Review*, Spring, 3–16.
- Schoemaker, P.J.H. (2002) *Profiting from Uncertainty: Strategies for Succeeding No Matter What the Future Brings*. Free Press, New York.
- Teece, D.J., Pisano, G. and Shuen, A. (1997) Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18, 509–34.
- Teisberg, E. (1994) An Option Valuation Analysis of Investment Choices by a Regulated Firm. *Management Science*, 40, 535–48.
- Todorova, G. and Durisin, B. (2007) Absorptive Capacity: Valuing a Reconceptualization. *Academy of Management Review*, 32, 774–86.
- Tushman, M.L. and O'Reilly III, C.A. (1996) Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *California Management Review*, 38, 8–30.
- Van de Vrande, V., Lemmens, C. and Vanhaverbeke, W. (2006) Choosing Governance Modes for External Technology Sourcing. *R&D Management*, 36, 347–63.
- Zahra, S.A. and George, G. (2002) Absorptive Capacity: A Review, Reconceptualization and Extension. *Academy of Management Review*, 27, 185–203.

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