Striking a balance: Exploration and exploitation via internal organization, alliances, and acquisitions[†]

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STRIKING A BALANCE: EXPLORATION AND EXPLOITATION VIA INTERNAL ORGANIZATION, ALLIANCES, AND ACQUISITIONS

ABSTRACT

Prior research on balancing exploration and exploitation has limited its concern to particular modes of operation. Acknowledging the interplay of tendencies to explore versus exploit via the internal organization, alliance, and acquisition modes, we claim that balancing these tendencies within each mode undermines firm performance because of conflicting routines, negative transfer, and limited specialization. Nevertheless, by exploring in one mode and exploiting in another, i.e., balancing across modes, a firm can avoid some of these impediments and enhance its performance. Thus, balance across modes is more effective than balance within modes. Analysis of 190 U.S.-based software firms furnishes support for these conjectures and reveals that exploring via externally oriented modes such as acquisitions or alliances while exploiting via internal organization enhances these firms' performance.

The exploration-exploitation paradigm has received much attention in management research. Exploration involves developing new knowledge whereas exploitation refers to refining existing knowledge (Levinthal and March, 1993). Exploration and exploitation entail distinct skills, so firms often debate whether to support one activity at the expense of the other. March (1991) conjectured that a balanced approach of pursuing both activities, i.e., ambidexterity, is essential for performance, but subsequent research has offered mixed support for this assertion. Most studies reveal positive performance effects of balance (He and Wong, 2004; Jansen, Van den Bosch, and Volberda, 2006; Lin, Yang, and Demirkan, 2007; Sidhu, Commandeur, and Volberda, 2007), yet some find insignificant (Venkatraman, Lee, and Iyer, 2007) or negative effects (Lavie, Kang, and Rosenkopf, 2011). These inconsistencies can be ascribed, in part, to the restricted focus of prior research on exploration and exploitation via particular modes of operation, such as internal organization, alliances, or acquisitions, while disregarding the tendency to simultaneously explore and exploit via multiple modes.

Scholars have debated the means by which firms strive for balance (Lavie, Stettner, and Tushman, 2010). Some suggest that a firm can balance exploration and exploitation within a single organizational unit by nurturing discipline, support, and trust (Gibson and Birkinshaw, 2004), yet most scholars call for separating exploration from exploitation. One approach involves temporal separation by which a firm manages transitions between exploration and exploitation over time (Eisenhardt and Brown, 1997). Another approach involves simultaneous exploration and exploitation by means of organizational separation (Benner and Tushman, 2003), which enables a firm to maintain distinct activities while engaging in internally consistent tasks within separate organizational units dedicated to either exploration or exploitation (O'Reilly and Tushman, 2008; Smith and Tushman, 2005). Each unit follows distinct organizational processes, with the senior management responsible for integrating the activities of these units (Tushman and O'Reilly, 1996). A third approach suggests that firms can separate exploration from

exploitation across distinct aspects of alliances, i.e., engaging in upstream activities of the value chain via recurrent alliances with the same partners, thus combining structural exploitation with functional exploration (Lavie and Rosenkopf, 2006).

Common to all aforementioned approaches is their narrow application within a single mode of operation. Although some studies focus on exploring and exploiting via alliances (e.g., Lavie *et al.*, 2011) or acquisitions (Hayward, 2002), the majority focus on the internal organization of these activities (e.g., He and Wong, 2004; Jansen *et al.*, 2006; Sidhu *et al.*, 2007; Tushman and O'Reilly, 1996). In so doing, they disregard the firm's tendencies to simultaneously explore and exploit via alternative modes of operation. This leaves open questions: To what extent do the benefits of exploring via alliances vary with the tendency to explore via internal organization or acquisitions? Will a firm be better off exploring via acquisitions while exploiting via its internal organization, or vice versa? Answering such questions is vital for gaining from balance and avoiding erroneous conclusions concerning the desirable approach for achieving it. Since firms engage simultaneously in internal organization, alliances, and acquisitions, studying a particular mode precludes accurate assessment of the balance between exploration and exploitation.

Some recent studies have begun juxtaposing alliances and internal organization (Hess and Rothaermel, 2011; Hoang and Rothaermel, 2010; Rothaermel and Alexandre, 2009; Russo and Vurro, 2010) but have not focused on the implications of balancing exploration and exploitation within versus across these modes of operation. For instance, Russo and Vurro (2010) study the interdependence between internal exploration and external exploration via alliances, yet they neither examine the performance effects of balance within either mode, nor do they compare them to those of balance across these modes. Rothaermel and Alexandre (2009) consider how internal and external sources of technology facilitate innovations incorporating known and new technologies in the internal organization mode, but don't study these activities in other modes. They highlight the benefits of mixing known and new technologies, whereas we identify some

caveats of balancing exploration and exploitation within the internal organization mode, and demonstrate how a firm can benefit from coordinating exploration and exploitation across internal and external modes. We extend Hoang and Rothaermel's (2010) study by shifting focus from the project level to the firm level and by considering the current configuration of exploration and exploitation as opposed to prior experience with these activities. Moreover, we extend Hess and Rothaermel's (2011) work that shows how downstream alliances complement the innovative contribution of star scientists, by accounting also for acquisitions and explaining how the firm can benefit from exploring externally while exploiting internally.

We contribute to research on exploration and exploitation in several ways: (1) We account for the interplay of a firm's exploration and exploitation activities across distinct modes, which enables us to effectively assess how the firm balances these activities using different means; (2) We depart from prior research that underscored the benefits of balance within the internal organization, alliance, or acquisition modes by positing that conflicting organizational routines, negative transfer, and limited ability to specialize undermine these benefits. In turn, we suggest that firms can benefit from balance while avoiding some organizational impediments when balancing exploration and exploitation across these modes; (3) We advance research on the use of alternative modes of operation by studying which mode is most beneficial when pursuing exploration versus exploitation and by uncovering the merits of exploring in one mode while exploiting in another as opposed to pursuing both activities within particular modes; and finally (4) Whereas prior research has focused on the internal organization of exploration, we suggest that firms that explore via an externally oriented mode such as acquisitions or alliances while exploiting internally can improve their performance. We find support for these conjectures using a comprehensive dataset covering all product introductions, alliances, and acquisitions of 190 pre-packaged software firms from 1990 to 2001. Our study promotes a new approach for balancing exploration and exploitation that complements established theory and practice.

THEORY AND HYPOTHESES

Exploration and exploitation can be pursued via internal organization (e.g., He and Wong, 2004; Jansen *et al.*, 2006; Sidhu *et al.*, 2007; Tushman and O'Reilly, 1996), alliances (e.g., Lavie and Rosenkopf, 2006), or acquisitions (Hayward, 2002). These are considered alternative modes of operation in the strategy literature (Dyer, Kale, and Singh, 2004; Hagedoorn and Wang, 2012; Harzing, 2002; Weilei and Prescott, 2012). In particular, given our focus on knowledge-based exploration and exploitation, acquisitions that incorporate external knowledge are distinct from the internal organization, which enables the firm to develop and leverage its own knowledge, and differ from alliances that combine internal and external knowledge (Dyer and Singh, 1998). Knowledge spillovers across modes may occur over time, but our focus is on the immediate implications of exploration and exploitation rather than on subsequent knowledge transfer.[1]

To fully understand the performance implications of balancing exploration and exploitation, we consider the various modes via which a firm pursues these activities. We assume that the tendency to explore versus exploit is not inherently related to the choice of mode, which can serve for both exploration and exploitation. Specifically, in the internal organization mode, the firm can rely on its newly developed knowledge in order to offer original products (exploration) as well as leverage its existing knowledge in order to refine its existing products (exploitation) (Cao, Gedajlovic, and Zhang, 2009; Danneels, 2002; Danneels and Sethi, 2011; Greve, 2007; He and Wong, 2004; Jansen *et al.*, 2006; Voss, Sirdeshmukh, and Voss, 2008). Introducing new products that are distinct from previous product generations entails technology development and innovation, which are consistent with Levinthal and March's (1993) notion of exploration. In turn, versions of existing products that represent mere improvements using the firm's existing

[1] One may consider additional modes of operation and alternative domains via which a firm can pursue exploration and exploitation. Although our theory can apply to different modes, we focus on the primary modes identified in the literature. In auxiliary analyses we demonstrate that our conclusions remain valid in various domains.

technologies or competencies correspond to their notion of exploitation. In the alliance mode, a firm can develop and access new knowledge by collaborating with alliance partners in upstream activities of the value chain (exploration) as well as commercialize and market products based on its existing knowledge when jointly pursing downstream activities with alliance partners (exploitation) (Koza and Lewin, 1998; Lavie and Rosenkopf, 2006; Park, Chen, and Gallagher, 2002; Rothaermel, 2001; Rothaermel and Deeds, 2004). Finally, in the acquisition mode, the firm can extend its knowledge base by taking ownership of another firm with a remotely related business (exploration) as well as leverage its established knowledge by acquiring a firm with a closely related business (exploitation) (Ahuja and Katila, 2001; Anand and Singh, 1997; Haleblian and Finkelstein, 1999; Seth, 1990; Vermeulen and Barkema, 2001). A firm's performance is expected to vary with the configuration of exploration and exploitation within and across the internal organization, alliance, and acquisition modes. Because of the distinct natures of exploration and exploitation, firms often fail to *a priori* assess their net benefits, which is even more challenging when simultaneously exploring and exploiting in multiple modes.

Balancing exploration and exploitation within modes

Prior research has underscored the complementary benefits of exploration and exploitation (He and Wong, 2004; Hess and Rothaermel, 2011; Lin *et al.*, 2007), with less regard to the impediments associated with their balance. This research has suggested that generating new knowledge enables a firm to avoid obsolescence and remain competitive, whereas leveraging existing knowledge is essential for gaining efficiency and securing the firm's market position (March, 1991). Accordingly, a firm that engages in both exploration and exploitation is expected to maintain both productivity and innovation, achieving reliability while enabling organizational renewal and thus enjoying enhanced performance. Nevertheless, organizational challenges have been observed when balancing exploration and exploitation via internal organization (Abernathy, 1978; Benner and Tushman, 2003) and may manifest in other modes as well. For instance, in the

early 2000s, 3M, which has been known for its innovative products, witnessed a decline in its revenues from new products after having introduced process improvement practices for enhancing its productivity. While acknowledging the merits of balance within particular modes, we seek to uncover some impediments associated with the use of conflicting organizational routines, negative transfer and limited specialization, which can offset the benefits of balance and undermine performance. The concept of organizational routines is central to evolutionary economics (Nelson and Winter, 1982), whereas the negative transfer mechanism has originated in cognitive psychology (Novick, 1988), and the specialization argument is rooted in organization theory (e.g., Thompson, 1967).

Exploration and exploitation are fundamentally different activities that rely on distinctive organizational routines (Dosi, Nelson, and Winter, 2000). Routines associated with exploitation leverage the firm's existing knowledge, thus facilitating consistency, stability, and control (Benner and Tushman, 2003). In contrast, exploration routines involve search for new knowledge, thus facilitating experimentation, flexibility, and risk taking (McGrath, 2001). A firm that balances exploration and exploitation within a mode simultaneously relies on both types of routines, which induces organizational tension, complexity, and coordination challenges that can undermine performance (Benner and Tushman, 2003). For instance, in the internal organization mode, a firm that exploits by refining its existing knowledge relies on routines for local search that can enhance the efficiency of product development. In contrast, exploration routines are designed for boundary spanning, experimentation with emerging technologies, and discovery of novel product features (Sidhu *et al.*, 2007). Employing both routines simultaneously impairs product development, since the firm's expertise with established knowledge conflicts with practices for discovering new knowledge. Similarly, in the alliance mode, exploration routines enable the firm to seek, assess, and incorporate its partners' knowledge, whereas exploitation routines involve integrating, applying, and fine-tuning the firm's own knowledge (Lavie *et al.*,

2011). In each mode, a firm that pursues both exploration and exploitation cannot follow persistent patterns of behavior that are essential for effective use of its routines. The inconsistency between exploration and exploitation routines is likely to persist because of the self-reinforcing nature of these activities (Levinthal and March, 1993). The success and failure traps suggest that exploitation routines drive out exploration, whereas risky exploration leads to further changes and search for new knowledge. As a result, the firm would face difficulties in furnishing resources to both activities and supporting an intermediate position on the exploration-exploitation continuum (Simsek, Heavey, Veiga, and Souder, 2009).

Moreover, a firm that balances exploration and exploitation within a mode may misapply knowledge or practices that are suitable for one activity when performing the other, thus encountering negative learning effects (Novick, 1988; O'Grady and Lane, 1996). Misapplication of knowledge can occur when managers overlook subtle yet critical differences between activities. For example, in the acquisition mode, a firm that explores by acquiring businesses beyond its industry boundaries can learn how to assess unfamiliar knowledge under uncertainty and information asymmetry. Once acquired, these businesses often require loose coordination, since the firm lacks expertise in unrelated knowledge domains (Datta, 1991). In contrast, a firm that exploits by acquiring closely related businesses relies on its familiarity with these businesses and leverages its established industry knowledge to proactively integrate the acquired firms' assets (Puranam, Singh, and Chaudhuri, 2009). Thus, a firm that engages simultaneously in both types of acquisitions is unlikely to nurture consistent acquisition practices and may experience negative learning effects when applying practices that were learned in acquisitions of related businesses in its acquisitions of remotely related businesses (Haleblian and Finkelstein, 1999).

In addition, a firm that balances exploration and exploitation within a particular mode forgoes the benefits of specialization. It relinquishes some of its ability to develop specialized resources and foster core competencies in exploration or exploitation (Madhok, 1997). The

distinctive natures of exploration and exploitation constrain the resources that can be allocated to either activity. These resources cannot be mobilized across activities, i.e., restored from one activity and redeployed to the other (Anand and Singh, 1997; Mishina, Pollock, and Porac, 2004). For example, in the internal organization mode, personnel dedicated to refining existing technologies may not be qualified to experiment with new technologies (Lepak and Snell, 1999). Consequently, a firm that simultaneously invests in developing new knowledge and refining its existing knowledge may be unable to share development costs across product lines. Similarly, in the acquisition mode, a firm that simultaneously explores and exploits by acquiring firms with various degrees of businesses relatedness undermines its ability to develop specialized skills for engaging in distinct types of acquisitions. Inability to gain expertise in target selection and due diligence can hinder the firm's ability to identify acquisition targets and generate synergies (Haleblian and Finkelstein, 1999). Thus, by simultaneously exploring and exploiting in a certain mode, the firm may fail to gain scale and scope economies otherwise attainable when concentrating on either exploration or exploitation in that mode.[2]

For example, in 2005 Delta Airlines decided to discontinue its innovative low-fare service which was added to its efficient full-service in 2003. The new service, Delta Song, suffered from

[2] A firm may apply managerial techniques to cope with the challenges of balance within modes. For instance, it may rely on separate organizational units exclusively dedicated to either exploration or exploitation (Tushman and O'Reilly, 1996). Such ambidextrous structure enables the firm to pursue consistent routines in each unit and supports specialization. Nevertheless, it creates operational redundancy and integration challenges for the top management team (Jansen *et al.*, 2008; Mom, Van den Bosch, and Volberda, 2007; Smith and Tushman, 2005). It calls for tight coordination and monitoring (Gibson and Birkinshaw, 2004) that may lead to failure because of managers' cognitive constraints (Gupta, Smith, and Shalley, 2006; O'Reilly and Tushman, 2008). Thus, even when conflicting routines are avoided and specialization is maintained, the firm may face organizational challenges and forego some economies of scale and scope. Furthermore, organizational separation within the internal organization mode is not typical of small and young firms (Lubatkin *et al.*, 2006; Tushman and O'Reilly, 1996). In the alliance mode, a firm may institute a dedicated alliance function that does not separate the managing of upstream and downstream alliances (Dyer, Kale, and Singh, 2001; Kale, Dyer, and Singh, 2002; Schreiner, Kale, and Corsten, 2009). Similarly, in the acquisition mode, a business development unit is typically put in charge of searching for targets and managing both related and unrelated acquisitions (Chauduri and Tabrizi, 1999). Hence, we do not expect organizational separation to be prevalent in our setting, but if it is adopted, it can improve the performance of balance within modes, so our study offers a conservative test of Hypothesis 1. In sum, although managerial techniques can mitigate some caveats of balance within modes, they are not without costs, and most firms are unlikely to employ them effectively in various modes. Whereas managerial techniques enable firms to cope with challenges and manage tradeoffs, balance across modes enables firms to circumvent these challenges.

Delta's cost structure and its inability to make independent pricing and scheduling decisions:

> *Delta's chief operating officer, James M. Whitehurst, said the cost of running the main Delta brand and maintaining Song was very expensive. Delta's chief marketing officer, Paul G. Matsen, added that the airline had to be careful not to overlap the operations of Delta and Song, especially in cities like New York and Los Angeles, which were served by both airlines. Beyond the expense of supporting two brands, Delta faced a compelling need to add the Song planes to its main fleet. With Song going away, Delta can use its Boeing 757's on those routes. And, with the former Song planes being outfitted with 26 first class seats apiece, Delta can potentially make more money than it did on Song flights.* (New York Times, October 28, 2005)

The organizational impediments that arise when a firm seeks to simultaneously explore and exploit in a particular mode are likely to outweigh the benefits of balancing these activities or to prevent the firm from realizing such benefits in the first place, thus diminishing its performance.

> *Hypothesis 1. Balancing exploration and exploitation within a mode of operation (internal organization, alliances, or acquisitions) will undermine firm performance relative to concentrating on either exploration or exploitation in that mode.*

Balancing exploration and exploitation across modes

A firm that balances exploration and exploitation *across* distinct modes, i.e., explores in one mode while exploiting in another, can enjoy the complementary benefits of exploration and exploitation, thus accumulating productivity gains while ensuring adaptability. In particular, balance across modes may entail focus on in-house development of innovative new products (exploration) while leveraging existing knowledge via horizontal acquisitions (exploitation) or marketing alliances (exploitation). Alternatively, the firm may incorporate new knowledge via R&D alliances (exploration) and acquire distinct businesses (exploration) while leveraging its established knowledge to refine its own product design (exploitation). For example, Cisco has relied on alliances to tap into emerging technologies and identify prospective acquisition targets that can broaden its product portfolio. Its internal organization has focused on marketing and servicing established products, while the product development teams of the acquired firms continued to operate from their local offices.

While generating benefits from balance, this approach avoids some impediments associated

with balance within modes. When balancing across modes, the organizational and contractual boundaries of alternative modes of operation can buffer exploration from exploitation by separating new knowledge development from the leveraging of established knowledge and by relying on consistent organizational routines within each mode. The underlying assumption is that personnel, assets, and facilities allocated to exploration (exploitation) via the internal organization barely overlap with those assigned to exploitation (exploration) via alliances and acquisitions. In acquisitions, the acquired firm typically relies on its own organization for conducting said activities, whereas in alliances, the collaborative agreement specifies which resources are assigned to the alliance, thus separating them from internal resources (Lavie, 2006). Indeed, an employee or an asset can serve, in principle, for performing both internal and external activities carried out by a partner or acquired firm, yet when balancing across modes, this is unlikely given the distinctive nature of assets and routines required for supporting exploration versus exploitation (Benner and Tushman, 2003). Unlike traditional approaches for ambidexterity that require integration of the outcomes of exploration and exploitation within the firm (Gibson and Birkinshaw, 2004; Jansen *et al.*, 2009), balance across modes can circumvent the need for such internal integration and thus alleviate some managerial burden. A firm can leverage internal knowledge for exploitation while relying on external knowledge of acquired firms and alliance partners, thus avoiding integration. For instance, a firm can market its legacy software applications while relying on an emerging technology of its alliance partner to enter new application domains without internalizing this external technology.

By decoupling exploration from exploitation across modes, the firm can separately pursue these activities, thus retaining the benefits of balance and specializing, while mitigating negative transfer and the tension between conflicting routines. Specifically, when balancing exploration and exploitation across modes, a firm buffers conflicting routines while maintaining operational consistency in each mode, thus avoiding potential tradeoffs. Employing routines for either

exploration or exploitation in each mode enables the firm to devise consistent rules and procedures, thus attenuating organizational tension, complexity, and coordination challenges as well as avoiding negative transfer of learning. For instance, Cisco has acquired a large number of start-up firms in order to gain access to new technologies and extend its product offering (external exploration). In turn, its internal organization provided centralized marketing and customer support (internal exploitation). Concentrating on new knowledge development via acquisitions enabled Cisco to nurture separate and consistent routines for screening targets based on their technology attractiveness, product marketability and complementarity, and the qualifications of their managers and engineers. Relying on acquisitions for both exploration and exploitation would have prevented Cisco from adopting consistent practices that enable routinization of the acquisition process and effective broadening of its product line.

Hence, a firm can both preserve a coherent learning environment (Tsai, 2002) in which routines become formalized and more efficient and at the same time avoid procedural spillover across conflicting routines. By pursuing exploration in one mode and exploitation in another, the firm can maintain consistency, control, productivity, and stability in certain modes, thereby enhancing the efficiency of exploitation (Haleblian and Finkelstein, 1999). At the same time, it can facilitate experimentation, flexibility, and risk taking in some other modes, and thus engage in effective search and discovery of new knowledge. When these activities are split across modes, the boundaries of these modes become buffers that can effectively separate exploration from exploitation.[3] For example, Cisco's practices for screening acquisition targets in emerging

[3] To the extent that firms rely on separate organizational units for managing their operations in each mode they can further mitigate potential tradeoffs between exploration and exploitation and prevent misapplication of knowledge across modes. For instance, product development carried out by a firm's internal organization may be organizationally separated from acquisitions that are executed by the firm's business development unit or alliances that are coordinated by its dedicated alliance function (Kale, Dyer, and Singh, 2002). Unlike organizational separation (Benner and Tushman, 2003), in which separate organizational units buffer exploration from exploitation, the dedicated alliance unit or business development unit helps separate one mode from another even though it can serve, in principle, for pursuing both exploration and exploitation. A dedicated alliance function or business

industries do not conflict with its routines for refining its original product design.

Finally, by balancing exploration and exploitation across modes, a firm can develop specialized resources, streamline capabilities, and enhance organizational processes in each mode. For instance, focusing on exploitation via marketing alliances does not undermine the ability to gain from specialization in exploration via new product development or unrelated acquisitions. The firm can gain efficiency and obtain scale and scope economies by specializing in either exploration or exploitation in a particular mode. These gains are ascribed to the firm's skills or expertise for performing the chosen activity in that mode. For Cisco, specializing in exploration via acquisitions generated capabilities for identifying and assessing acquisition targets and for executing acquisitions.[4] Investing dedicated resources in exploration via one mode need not limit the pursuit of exploitation via another mode. For example, a firm that concentrates on experimenting with new technologies and innovative product designs can effectively extend the market reach of its established technologies by forming marketing alliances. In fact, resources garnered via exploitation in one mode can support exploration in another mode (Rothaermel, 2001) or at least preserve their value when deployed in the same mode (Vassolo, Anand, and Folta, 2004). The benefits of specialization are derived from maintaining a dominant type of activity within each mode, so that vested resources do not need to be shared across exploration and exploitation in each mode. Concentrating on exploration in one mode, while focusing on exploitation in another, enhances performance by retaining the benefits of balance and specialization while avoiding negative transfer and the adverse consequences of conflicting organizational routines.

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development unit is desirable yet not necessary in order for our predictions to hold. When balancing across modes, the organizational boundaries of the firm (internal organization versus alliances and acquisitions) buffer exploration from exploitation irrespective of whether the firm uses dedicated units for managing alliances and acquisitions.

[4] For elaboration, see the Dartmouth College case 'Cisco Systems, Inc. and the Networking Equipment Industry' by Sydney Finkelstein (1998).

Hypothesis 2: Balancing exploration and exploitation across modes of operation will enhance firm performance relative to concentrating on either exploration in both modes or exploitation in both modes.

We have thus far argued that balance across modes is expected to be more beneficial than engaging in either exploration or exploitation within these modes. Additionally, we asserted that concentrating on either exploration or exploitation within a particular mode should enhance performance more than balancing these activities within that mode. Consequently, we conclude that balancing exploration and exploitation across certain modes of operation can enhance performance more than balancing these activities within each of the corresponding modes.

For example, facing increased R&D expenses, shortened product-life cycles and intense competition, Procter & Gamble (P&G) has witnessed 35% decline in new product development, 44% decline in market share, and $85 billion loss of market value in 2000. Its incoming CEO, A.G. Lafley, abandoned P&G's tradition of internal innovation, resorting instead to external innovation via acquisitions and alliances while leveraging P&G's marketing and manufacturing infrastructure to exploit. P&G's "Connect and Develop" approach relied on its ability to recognize consumer trends while seeking external solutions to satisfy emerging customer needs. Instead of internalizing knowledge by licensing intellectual property, P&G has opted for acquisitions. For instance, in 2000, P&G declined a patent licensing deal and instead acquired SpinBrush from Dr. John. Its acquisition of Gillette in 2005 offers another such example. A couple of years later, P&G formed Precision Diagnostics, a joint venture with Inverness Medical Innovations, to promptly enter the consumer diagnostics market. By 2006, 35% of P&G's products had originated externally and 45% of its product development initiatives contained substantial external knowledge contributions. This had led to increased productivity, reduced costs, and doubling of P&G's share price over these six years (Huston and Sakkab, 2006). This example illustrates how a firm can enhance its performance by shifting from balancing exploration and exploitation within its internal organization to balancing these activities across

modes. The underlying reasoning is that decoupling exploration from exploitation across modes can reduce the interdependence of these activities and circumvent the need to maintain conflicting organizational routines within each mode, while still enabling the firm to benefit from simultaneous pursuit of exploration and exploitation.

Hypothesis 3: Balancing exploration and exploitation across modes of operation will enhance firm performance more than balancing exploration and exploitation within the corresponding modes of operation.

Configuring exploration and exploitation across modes

A firm can pursue alternative configurations when exploring in one mode and exploiting in another. This raises the question of which mode is most effective for exploration and which offers greater value for exploitation. The inherent characteristics of distinct modes may offer differential benefits for exploration versus exploitation. We posit that externally oriented modes that transcend a firm's boundaries enable the firm to benefit from exploration, whereas internally oriented modes that confine operations to the firm's boundaries support more effective exploitation. Hence, exploration is most effective via acquisitions, which are more externally oriented than alliances. Alliances, in turn, are more externally oriented than internal organization.

Effective exploration entails flexibility and ability to dislodge from inertial pressures (Hannan and Freeman, 1984). Moving away from a firm's competencies by minimizing reliance on prior knowledge delays the formation of core rigidities that undermine the effectiveness of exploration (Leonard-Barton, 1992). Hence, exploration becomes increasingly effective as the firm distances itself from its core competencies. Since knowledge that is nurtured within the firm's boundaries is likely to be highly path dependent, knowledge that spans these boundaries can better generate new opportunities (Rosenkopf and Nerkar, 2001). Although firms can change their knowledge bases over time, externally oriented modes such as alliances and acquisitions offer more immediate means to access new knowledge and skills. The effectiveness of exploitation, in turn, is associated with reliability and stability that emerge when a firm leverages

its established knowledge (March, 1991). Such knowledge supports the refinement and application of core competencies. In turn, engaging in local search enhances efficiency and enables the firm to consistently apply compatible skills and knowledge (Danneels, 2002). Exploitation thus becomes increasingly effective as the firm moves closer to the locus of its expertise and remains within the boundaries of its knowledge base.

Internal organization. The effectiveness of exploration in the internal organization mode depends on a firm's ability to innovate using its internal knowledge. The more reliant the firm is on its core competencies, the more likely it is to develop path dependence in its operations (Danneels, 2002). This, in turn, facilitates local search rather than boundary spanning, thus restricting the accessibility of novel solutions (Rosenkopf and Nerkar, 2001) and making it difficult to dislodge from current solutions. As the firm attempts to reach beyond the scope of its current knowledge base, inevitable reliance on core competencies fosters organizational inertia and core rigidities (Leonard-Barton, 1992) that delay exploration and can impair performance. However, refining existing products based on internally available knowledge is possible under such conditions (Burgelman, 2002), since incremental improvements support organizational reliability and productivity, which characterize exploitation (March, 1991). Thus, the proximity of knowledge search within the firm's boundaries and the restrictive application of internal knowledge impair exploration effectiveness while enhancing exploitation benefits in this mode.

Alliances. Interfirm collaboration enables a firm to extend its search and engage in boundary spanning by combining its own knowledge with the complementary knowledge of partners (Das and Teng, 2000; Dyer and Singh, 1998). By partially relying on internal, path-dependent skills and established knowledge, however, exploration is somewhat restricted, since alliances cannot be completely disconnected from the firm's current knowledge base and value chain activities. At the same time, alliances do not enable the firm to fully leverage its established skills and idiosyncratic knowledge because they may be incompatible with or inapplicable when deployed

in combination with the partners' knowledge (Das and Teng, 2000). Hence, by engaging in boundary-spanning activities via alliances, the firm can effectively leverage external knowledge and distance itself from its own knowledge base (Rosenkopf and Almeida, 2003), but search and discovery of new knowledge are confined by the scope of alliance agreements. Consequently, the effectiveness of exploration is likely to be moderate, although alliances offer a more effective mode for exploration than internal organization. In turn, the effectiveness of exploitation depends on whether the firm can leverage its established knowledge and apply its competencies in familiar domains. Exploitation via alliances cannot rely exclusively on the firm's established knowledge, instead requiring adjustment of its internal processes (Dyer and Singh, 1998) and development of partner-specific relational routines (Zollo, Reuer, and Singh, 2002) that support knowledge exchange or combination. This limits the firm's ability to fully benefit from the reliability, stability, and productivity associated with its established knowledge. Consequently, compared to internal organization, alliances diminish the effectiveness of exploitation.

Acquisitions. Acquisitions enable a firm to gain immediate control of knowledge that is entirely different from its internal knowledge without calling for relatedness, resemblance, or combination of knowledge (Harrison *et al.*, 1991; Kim and Finkelstein, 2009). Specifically, boundary-spanning search via acquisitions enables the firm to seek new knowledge that is unrelated to its current knowledge (Vermeulen and Barkema, 2001). In contrast to alliances, which entail combining complementary knowledge and coordinating activities in a way that enables the firm to retain some knowledge that is unshared with its partners (Lavie, 2006), acquisitions may require more challenging integration of the acquired firm's knowledge. The acquiring firm's ability to leverage its established knowledge and skills in its acquisitions is limited when the acquired firm's knowledge is remotely related to its own (Puranam *et al.*, 2009). Hence, acquisitions relieve the firm of the need to deploy internal knowledge when engaging in exploration and increase the scope of search for opportunities beyond those available

via alliances, as the latter still require substantial reliance on internal knowledge. In turn, the more different an acquired firm from the acquirer, the more difficult it becomes to effectively integrate its knowledge with the acquirer's own knowledge in order to maintain reliability and stability throughout their operations (Finkelstein, 1997; Larsson and Finkelstein, 1999). Therefore, when the firm exploits via an internally oriented mode and explores via acquisitions, it is less likely to fully integrate acquired firms whose businesses are remotely related to its own (Datta, 1991), thus avoiding post-acquisition integration challenges. This reinforces the effectiveness of exploration via the externally oriented mode. Consequently, acquisitions maximize the effectiveness of exploration beyond that achieved via alliances and internal organization, yet limit the effectiveness of exploitation relative to these modes of operation.

Hypothesis 4. When exploration and exploitation are balanced across modes of operation, exploration will enhance firm performance more via an externally oriented mode than via an internally oriented mode; likewise, exploitation will enhance firm performance more via an internally oriented mode than via an externally oriented mode

METHODS

Research setting and sample

We tested our hypotheses with panel data on U.S.-based publicly traded firms operating in the pre-packaged software industry (SIC 7372) during 1990–2001. This context is suitable given the extensive use of various modes for pursuing exploration and exploitation. Software firms frequently innovate with new products (Campbell-Kelly, 2003), acquire firms (Gaughan, 2002), and form alliances (Hagedoorn, 1993; Lavie and Rosenkopf, 2006). Also, the software industry has been dominated by U.S.-based firms (Mowery and Nelson, 1999), making the sample highly representative. Finally, a high proportion of public firms are young and small, thus ensuring the availability of financial information and limiting sensitivity to age- and size-related biases.

We gathered data on product introductions, alliances and acquisitions since 1985 to measure experience during the preceding five years. After we excluded 53 multi-business firms, the

sample included 190 firms that operate in various market segments of the software industry but whose performance is almost insensitive to non-software businesses.[5]

We integrate four data sources. Financial information included Compustat data on firms' assets, revenues, long-term debt, cash, R&D expenses, and net income. Data on outstanding shares and stock prices were extracted from the Compustat-CRSP database. Data on introductions of software products and releases of versions of existing products were gathered from press announcements published during 1985–2001 in LexisNexis and Thompson's Dialog New Product Announcements databases. These press releases were carefully read by trained coders with extensive industry experience, who identified the relevant functionality of each product, the date of its introduction, its name, and whether it was a new product based on recently developed knowledge or a version of a previously introduced product. Each product was coded by two coders who followed meticulous guidelines. The pre-training inter-rater reliability reached 84.57 per cent. Coder disagreements were resolved via deliberation. In total, the 190 firms introduced 8,961 software products during 1985–2001, with 17,011 product functions covering 54 distinct market segments. These records were transformed to 2,503 firm-year observations by pooling the data for all products introduced by each firm in a given year. After discarding records with missing data or those referring to the first and only product (defined as exploration by default), we retained 1,952 firm-year observations during 1990–2001.

Acquisition records were compiled from Thomson's SDC database. Following Villalonga and McGahan (2005), we restricted the data to acquisitions of majority interest. For acquisition targets with a primary business in the pre-packaged software industry (SIC 7372), we used the target's business description to classify its software products to relevant categories using a typology that was developed with the help of industry experts. The typology includes 464

[5] Of the 190 firms, 88.89 percent had only a primary SIC code (7372), 5.82 percent had one secondary SIC code, 4.76 percent had two secondary SIC codes, and 0.53 percent had more than two secondary SIC codes.

distinct product functions in 54 market segments of four product classes: personal applications, system infrastructure, vertical applications, and business applications. Acquisition targets outside the pre-packaged software industry were classified using the SIC system. In total, the 190 firms engaged in 435 acquisitions during 1985–2001. For each acquisition, the following information was coded: date of acquisition, name of target, the target firm's 4-digit SIC code, and its relevant software product categories. Acquisition data were transformed to 240 firm-year observations during 1990–2001 by pooling across all acquisitions made by each firm in a given year.

Alliance records were obtained from an existing database (Lavie, 2007) that integrates data from SDC and Factiva databases, corporate websites, and Edgar SEC filings. It documents the partners' identities, the alliance announcement date, and the alliance's classification to agreements: R&D, production, marketing and service, original equipment manufacturing, value-added resale, licensing, royalties, or supply. An alliance could involve more than one type of agreement. In total, the 190 sampled firms formed 10,993 alliances during 1985–2001. By pooling across all alliances in a firm's portfolio in a given year, we transformed the data into 1515 firm-year observations during 1990–2001, after discarding records with missing data and records that report the first and only alliance (defined as exploration by default).

Dependent variable

Firm performance was measured with a function of market value that represents investors' *ex ante* expectations about a firm's future performance, thus capturing the outcomes of exploration and exploitation via alternative modes of operation. This measure is in line with prior research that has demonstrated that the firm's market value effectively captures the performance effects of nuanced aspects of publicly announced product introductions (Chaney, Devinney, and Winer, 1991; Uotila *et al.*, 2009), alliances (Chan *et al.*, 1997; Lavie, 2007; Lavie *et al.*, 2011), and acquisitions (Hayward, 2002; Kim and Finkelstein, 2009). In particular, prior research has demonstrated that abnormal stock market returns effectively predict alliances performance (Kale,

Dyer, and Singh, 2002) and post-acquisition performance several years following the announcement (Choi and Harmatuck, 2006). Market value is preferred to accounting measures, since firms follow different accounting standards (Chakravarthy, 1986; Lubatkin and Shrieves, 1986). Additionally, accounting measures are not sufficiently robust to capture the expected proceeds from exploration and from certain modes of operation such as upstream alliances (Gulati, 1998). In turn, the firm's market value can effectively capture the expected proceeds from internally developed products, alliances, and acquisitions irrespective of differences in the timing of their accrual.[6] A logarithmic growth function served for modeling performance, controlling for market value at the prior year: $\ln(MV_{i,t+1}) = \alpha \ln(MV_{i,t}) + \pi' x_{i,t} + e_{i,t}$. This function maintains desirable statistical properties under the linearity, homoscedasticity, and independence assumptions (Stuart, 2000). In this function, the annual market value $MV_{i,t+1}$ is computed by multiplying the firm's stock price by its number of common shares outstanding. Because of its volatility, $MV_{i,t+1}$ was calculated by averaging the 12 end-of-month daily values of the relevant calendar year (Lavie, 2007): $\frac{1}{12}\sum_{m=1}^{12}$ (Stock Price$_{i,t+1,m}$ × Outstanding Shares$_{i,t+1,m}$). In auxiliary analyses we incorporated accounting measures of performance, which produced consistent results. All independent variables and controls were lagged by one year relative to the dependent variable to allow for causal interpretation of the findings.

Independent variables

We operationalized exploration-exploitation with a set of continuous variables rather than with two separate measures, assuming that exploration inhibits exploitation and vice versa (Greve,

[6] To enhance the accuracy of our measure and reduce the time differential across modes of operation, we refer to the timing of product introduction rather than to the initiation of product development in the internal organization mode. Firms disclose rich information about the features and underlying technology of products in the course of product development and during the introduction of products to the market, thus enabling investors to effectively assess their prospects. We assume that investors can access information that distinguishes new products from versions of existing products, that identifies the value chain functions of alliances, and that clarifies how distinct the firm's business is from those of its acquisition targets. Such information is made available in press releases of public firms, which typically identify the sources of knowledge used in products, alliances, and acquisitions as well as the firms' motivations for undertaking these modes of operation.

2007; Lavie and Rosenkopf, 2006; Sidhu *et al.*, 2007; Simsek *et al*., 2009; Uotila *et al.*, 2009). The transition from exploration to exploitation is gradual, and the distinction between these activities is often a matter of degree rather than kind. Such transitivity and relativity call for the conceptualization of exploration and exploitation along a continuum (Lavie *et al.*, 2010). Since a firm can introduce multiple products and engage in several acquisitions and alliances, within each mode its activities vary continuously between pure exploration and pure exploitation, with exploration incorporating new knowledge and exploitation leveraging existing knowledge.

Specifically, in the *internal organization* mode, a firm exploits by relying on its established knowledge to introduce refined versions of existing products or instead explores by introducing completely new products based on its new designs and recently developed knowledge (Cao *et al.*, 2009; Danneels, 2002; Greve, 2007; He and Wong, 2004; Jansen *et al.*, 2006; Voss *et al.*, 2008). A product that draws on the firm's established knowledge and competencies that served in developing its previously introduced products is indicative of exploitation. For example, the following press release excerpt refers to a new version of an existing product by Synopsys, a software firm offering synthesis, simulation, and test applications for designers of integrated circuits. This product clearly builds on established knowledge that served in prior versions:

> *'Our team of world class synthesis experts have been very busy developing the most significant QoR and runtime improvements in the past five years'…[Synopsys will] introduce Design Compiler 1999.05(DC99), the latest version of its flagship product…The new release promises significant run-time and productivity enhancements.* (Electronic Engineering Times, March 8, 1999)

In turn, a new product that is meaningfully distinct from the firm's prior products and that draws on knowledge and competencies that the firm has not used in the past is indicative of exploration (Danneels, 2002; Danneels and Sethi, 2011), as illustrated another product released by Synopsys:

> *Behavioral Compiler, a revolutionary synthesis tool that drastically simplifies integrated circuit (IC) design…raises the level of design specification to a much higher level than logic synthesis…'This is the type of exploration designers have been looking for…our customers have been asking us for behavioral synthesis for years…Finally, it's here.'* (Business Wire, May 16, 1994)

Accordingly, for each of the firm's products, an indicator received a value of '1' if the firm had not previously released a prior version of that product using similar knowledge and '0' if a prior version of that product existed. Exploration via internal organization was calculated as the value of that indicator averaged across all products introduced by the firm in a given year.[7]

In the *alliance* mode, a firm can exploit by engaging in downstream value chain activities via marketing alliances or instead explore by pursuing upstream activities via R&D alliances (Koza and Lewin, 1998; Rothaermel, 2001). Downstream alliances rely on the firm's established knowledge and the partners' distribution channels to expand the market reach of the firm's existing products, thus classified as exploitation, as illustrated by the following example:

> *a multi-year agreement with Synopsys…to resell Synopsys FPGA and CPLD synthesis technology…'This relationship allows VeriBest to distribute and support Synopsys' leading edge technology…'* (PR Newswire, January 27, 1997)

Upstream alliances in the software industry entail moving beyond the firm's knowledge base and developing new products that integrate its partners' knowledge, thus representing exploration. Follows is an example of such alliance formed by Synopsys:

> *ATE vendor Agilent Technologies Inc. and EDA provider Synopsys Inc. are joining forces in a far-reaching partnership…the joint work will likely start by embedding Synopsys design-for-test (DFT) technology onto a line of Agilent devices…Both companies cited the advantage of internally leveraged technologies, with Agilent's large IC design staff in-house…'We see this as much broader and far-reaching in impact; the opportunity for creating solutions for different kinds of test problems…'* (Electronic Engineering Times, March 19, 2001)

Following Lavie and Rosenkopf (2006), an indicator denoted for each alliance whether it involved knowledge-generating upstream activities such as joint R&D, coded '1'; knowledge-leveraging downstream activities such as joint marketing, resale, production, or supply, coded '0'; or a combination of both activities, coded '0.5.'[8] Alliance exploration was then calculated as

[7] To avoid classifying a firm's first product as exploration by default, we excluded eight observations relating to years in which firms released their first and only product. Products originally developed by a recently acquired firm or jointly with an alliance partner were also excluded. Nevertheless, we considered the firm's introduction of new versions of products originally developed by acquired firms as exploitation via internal organization.

[8] Alliances were classified from the focal firm's perspective. Thus, when the firm marketed a solution developed by its partner without engaging in joint R&D, the alliance was considered a downstream rather than upstream alliance.

the average value of this indicator across all alliances formed by the firm in a given year.

Finally, exploration and exploitation were measured in the *acquisition* mode, in which a firm can acquire targets that operate related businesses or businesses remote from its own business (Ahuja and Katila, 2001; Anand and Singh, 1997; Haleblian and Finkelstein, 1999; Seth, 1990). The closer the resemblance between the acquired business and the firm's current business, the greater the overlap in knowledge bases, thus indicative of exploitation. The following example reports such acquisition by Synopsys:

> *Synopsys pushed deeper into the physical-design realm by acquiring startup Stanza Systems…The Stanza team will be added to the Epic Technology Group within Synopsys…'Stanza has technology that is fully complementary to what we're doing in physical design.'…Synopsys sees the Stanza acquisition as a natural continuation of its purchase of Epic Design Technology two years ago.* (Computergram International, June 25, 1999)

In turn, acquiring a business that is less related to the firm's current business is indicative of exploration because it expands the scope of the firm's knowledge base and product offering (Vermeulen and Barkema, 2001), as illustrated by the following example:

> *Synopsys Inc., the leading developer of high-level design automation software, today announced that it will acquire Silicon Architects, a private company that pioneered the Structured ASIC Methodology…'We've been working on enhancements to our basic synthesis process for the past seven years. Libraries are an area that has been, for the most part, overlooked.'…'Since 1987, I've been looking for a library that would allow synthesis to realize its full potential for quality of results. In Silicon Architects' CBA library, I've finally found it…This merger gives Synopsys another opportunity to add leading-edge technology to our portfolio…'* (Business Wire, April 17, 1995)

Based on the business descriptions of acquired firms and the product function typology, for each acquisition within SIC 7372, an indicator received a value of '0' if the acquiring firm had previously offered a similar product function, a value of '1' if that function was not offered but the firm had prior products in the same market segment, and a value of '2' if that function was not offered but the firm had prior products in the same application class.[9] For an acquired firm with a primary SIC code different from 7372, the indicator received a value of '3' if the first 3-

[9] For each acquired firm, an indicator received a value of '0.5' if the acquired product functions could not be identified but the acquiring firm had products in the same market segment, and a value of '1.5' if the acquired firm's market segment was unspecified but the acquiring firm had products in the same application class.

digit SIC code equaled 737, a value of '4' if the 2-digit SIC code equaled 73, a value of '5' if the 1-digit SIC code equaled 7, and a value of '6' if the acquired firm operated in an entirely unrelated industry. For each firm-year, acquisition exploration was calculated as the value of this indicator averaged across all acquisitions in that year.

To facilitate interpretation and maintain consistency across all exploration variables, the three measures were transformed to range between 0 and 1, with high values indicating exploration.

Control variables

We incorporated several control variables. By sampling firms in a single industry (SIC 7372), we control for inter-industry variation. Inter-temporal trends are controlled with year dummies. Firm-level controls include a firm's size, R&D intensity, solvency, product life-cycle, organizational separation, hardware experience, and mode experience. Together with the lagged performance incorporated in the growth function (Lavie, 2007; Rothaermel and Alexandre, 2009), the incorporated firm fixed effects account for unobserved heterogeneity.

Firm size can influence the firm's innovative output and performance (Ahuja, Lampert, and Tandon, 2008). It was measured with the value of total assets in the preceding year (DeCarolis and Deeds, 1999). R&D intensity reflects the extent to which the firm invests in new technologies (Christensen, 1997) and represents its absorptive capacity (Cohen and Levinthal, 1990), which can enhance the effectiveness of internal exploration efforts. It was measured by dividing the firm's R&D expenses by its total revenue in the preceding year. A firm's solvency captures the financial resources available to support exploration and exploitation activities. It represents organizational slack, which may affect innovation and performance (Nohria and Gulati, 1996). Firm solvency was measured with the log-transformed ratio of cash to long-term debt in the preceding year. We also controlled for product life-cycle, given that the contribution of a product to firm performance may vary over time, with maximum contribution expected at an intermediate stage. It was measured with the average number of years (up to three) since the

introduction of software products to the market (Harter, Krishnan, and Slaughter, 2000).

To isolate the effect of balancing exploration and exploitation from the firm's use of managerial techniques such as organizational separation, we accounted for organizational separation between units responsible for internal development and dedicated units for managing alliances and acquisitions. Such organizational separation may enable the firm to allocate specialized resources and more effectively manage its alliances and acquisitions (Kale *et al.*, 2000). Data on the firm's dedicated alliance function and business development unit responsible for acquisitions in a particular year were gathered from LexisNexis press releases and listings of relevant managerial positions in the Corporate Affiliations database. Organizational separation received a value of '0' if no dedicated organizational unit was used for managing alliances or acquisitions, a value of '1' if a dedicated unit served for managing either alliances or acquisitions, and a value of '2' if two units were used for separately managing alliances and acquisitions. High levels of this control variable are expected to improve the firm's ability to effectively separate exploration from exploitation across different modes of operation

In addition, we controlled for the firm's experience with hardware products, which may trade off with its focus on software, measuring the number of hardware products introduced in the preceding five years. Finally, we accounted for mode experience, which may enable the firm to enhance specialization and consistency of routines. This set of measures also controls for the firm's absolute level of exploration. The firm's experience with each mode was measured by counting the number of corresponding corporate events that occurred in the preceding five years (Haleblian and Finkelstein, 1999; Wang and Zajac, 2007). Thus, the firm's internal organization experience was measured with the total number of products; alliance experience was measured with the number of alliances formed; and acquisition experience was measured with the number of firms acquired in the preceding five years. Experience was modeled to persevere at 90 percent per year, using the formula $\sum_{t=1}^{5} E_{t-1} \times (1-r)^{t-1}$, where E_t represents the firm's exploration

in a particular mode in a given year and *r* represents the decay rate of 10 percent. In auxiliary analyses, we verified that our findings were insensitive to alternative memory decay rates.

Analysis

Endogeneity in a firm's tendencies to operate via particular modes is accounted for with two-stage analysis (Hamilton and Nickerson, 2003; Shaver, 1998). A firm's decision to engage in a particular mode such as alliance or acquisition may be influenced by the inherent benefits of that mode, such as accessibility of external knowledge and time to market, as well as by costs such as potential opportunistic behavior or acquisition premium. These mode-specific considerations apply irrespective of the tendency to explore versus exploit in that mode, yet influence the firm's propensity to engage in that mode. Following Heckman (1979), we used three probit first-stage models to estimate whether the firm used a particular mode in a given year. The probability of using a particular mode was regressed on the firm's size as captured by its total sales, its available cash, long-term debt, R&D investment, prior experience with hardware development, and experience with particular modes as captured by indicators that receive a value of '0' if the firm did not have any prior experience in the corresponding mode and a value of '1' if the firm had prior experience in that mode. The first-stage model accounted for the panel data structure with firm and year fixed effects. The predicted values from the first-stage models were used to calculate the inverse Mills ratios (λ), which were then incorporated as additional controls in the second stage to account for self-selection bias in engaging in particular modes.

The second-stage models served for testing the hypotheses, incorporating panel data with firm fixed affects to explain within-firm variation in performance over time. Hausman tests suggested that the fixed effects models are superior or equivalent to random effects models (Hausman, 1978). The analysis of panel data raises concerns about serial correlation of errors within cross-sections, which may deflate standard errors and inflate significance levels. Autocorrelation of errors within cross-sections was tested (Baltagi and Wu, 1999), and first-order

autoregressive errors were incorporated to account for an AR(1) process. Thus, the tested models took the form: $Y_{i,t+1} = \alpha + \beta x_{i,t} + u_i + \varepsilon_{i,t}$, where $\varepsilon_{i,t} = \rho\varepsilon_{i,t-1} + \mu_{i,t}$ and $-1 < \rho < 1$, with u_i representing the firm fixed effects and ρ the autoregressive AR(1) parameter, which has a zero mean, homoscedastic, and serially uncorrelated error term $\mu_{i,t}$. The models were estimated using maximum likelihood with missing values subject to listwise deletion.

To test Hypothesis 1, we introduce a quadratic function of exploration. The estimated performance function takes the form $\hat{Y} = b_0 + b_1 \times X + b_2 \times X^2 + b_i \times K_i$, with X denoting exploration and K indicating a vector of control variables. A negative linear effect and a positive quadratic effect of exploration (a U-shape) is consistent with the predicted negative effect of balance within a particular mode (Lavie *et al*., 2011; Rothaermel and Alexandre, 2009), as long as the minimum falls within the applicable 0–1 range. If the performance function is monotonic and the maximum is reached at an exploration value of either 0 or 1, this is still consistent with the hypothesis as long as this maximum is significantly higher than the performance achieved at a representative balance point corresponding to an exploration value of 0.5. This point serves as a conservative choice that shows no preference for either exploration or exploitation. Our analysis relies in part on graphical depiction of the dependent variable at meaningful levels of the covariates (Hoetker, 2007). Performance at the balance point (exploration level 0.5) is compared to performance at the focus point that yields the highest performance (either exploration level 0 or 1). A two-sided t-test is then used for assessing the performance difference between this focus point and the balance point. This analysis is repeated for each mode. Figure 1 illustrates a U-shaped performance function for balance within mode. In this example, the inflection point falls within range, so that the balance point is indicated by Point A. Focusing on exploration (Point C) produces better performance than focusing on exploitation (Point B), i.e., $\hat{Y}_C > \hat{Y}_B$, so that Point C is selected for testing Hypothesis 1. Hypothesis 1 gains support if the performance difference between the focus point (C) and the balance point (A) is positive ($\Delta\hat{Y}_{CA} > 0$).

To test Hypothesis 2, we introduce the interactions of corresponding exploration variables (Hess and Rothaermel, 2011; Hoang and Rothaermel, 2010; Lavie *et al.*, 2011; Russo and Vurro, 2010). Positive main effects and a negative interaction effect suggest favorable performance implications of balance across modes, since performance is maximized when a firm explores in one mode and exploits in another. Nevertheless, to find support for this hypothesis, it is sufficient that one of the balance points offers better performance than the two focus points. Thus, comparison tests and graphical representations serve for evaluating these differences and interpreting the interaction effects at meaningful levels of the covariates (Hoetker, 2007). Figure 2 illustrates a performance function defined by $\hat{Y} = b_0 + b_1 \times X_1 + b_2 \times X_2 + b_3 \times X_1 \times X_2 + b_i \times K$, where X_1 and X_2 are the corresponding exploration variables in modes 1 and 2. The two balance points E and D correspond to maximum exploration in one mode and minimum exploration in the other mode. Focus points C and B represent exploration (Point C) or exploitation (Point B) in both modes. Hypothesis 2 is supported if there is a balance point that produces better performance than at least one focus point, as long as the other focus point is not significantly superior to that balance point. These comparisons are carried out using two-sided t-tests. Hypothesis 2 gains support if ($\Delta\hat{Y}_{EC} > 0$ and $\Delta\hat{Y}_{EB} >= 0$) or ($\Delta\hat{Y}_{EC} >= 0$ and $\Delta\hat{Y}_{EB} > 0$) or ($\Delta\hat{Y}_{DC} > 0$ and $\Delta\hat{Y}_{DB} >= 0$) or ($\Delta\hat{Y}_{DC} >= 0$ and $\Delta\hat{Y}_{DB} > 0$).

Hypothesis 3 gains support if two-sided t-tests indicate that a balance-across-modes point (D or E) reaches better performance than at least one focus point (B or C), which in turn is superior to the corresponding balance-within-mode point (A) in each of the respective modes. Finally, to test Hypothesis 4, we compare Point E (representing maximal exploration in the externally oriented mode) to Point D (representing maximal exploration in the internally oriented mode) using a one-sided t-test. Hypothesis 4 gains support if the performance difference between the balance points is positive ($\Delta\hat{Y}_{ED} > 0$). These analyses are repeated for all mode combinations.

Model fit was evaluated with log likelihood ratio tests comparing each model to its baseline

model. The second-stage models incorporated Mills ratios from the first-stage models (results available from the authors). The λ parameters are insignificant in models estimating balance within modes (Table 2), so the ability to balance exploration and exploitation in a particular mode is unaffected by the inclination to use that mode. When balancing across modes (Table 4), some λ parameters are significant, so the propensity to engage in internal organization and alliances affect the ability to effectively balance exploration and exploitation across these modes.

********* Insert Figures 1-2, Table 1, Figures 2-8, and Tables 2-6 about here *********

RESULTS

Table 1 reports descriptive statistics. The relatively low correlations of the three exploration variables suggest their independence, which justifies the operationalization of exploration-exploitation along separate modes. The high correlation between the tendency for internal organization (λ internal organization) and tendency to form alliances (λ alliance) suggests that a firm that develops more products also tends to collaborate extensively. Models estimating the performance effects of balance within modes are reported in Table 2. The baseline models show that in the internal organization mode (Model 1a), performance is positively related to firm solvency and internal organization experience, yet declines with product life-cycle and alliance experience. In the acquisition mode (Model 2a), performance increases with internal organization experience, yet declines with product life-cycle and acquisition experience. In the alliance mode (Model 3a), performance increases with solvency and internal organization experience, yet declines with the firm's inclination to form alliances and its alliance experience.

Table 3 reports t-tests for Hypothesis 1 based on models 1b–3b. Model 1b introduces the linear and quadratic terms of exploration in the internal organization mode. The linear effect is negative (β = -0.56, $p < 0.05$), and the quadratic term is positive (β = 0.50, $p < 0.05$). Maximum performance is reached when focusing on exploitation (X = 0). In support of Hypothesis 1, a two-sided t-test shows significant improvement in performance for exploitation relative to the

balance point ($\Delta\hat{Y} = 0.65$, $p < 0.05$). The performance difference between the balance point and focus on exploration (X = 1) is also significant in favor of the latter point. Hence, balance within the internal organization mode undermines performance. Model 2b introduces the linear and quadratic terms of exploration in the acquisition mode. The linear term of exploration is negative ($\beta = -1.16$, $p < 0.05$), while the quadratic term is positive ($\beta = 1.37$, $p < 0.01$). Per Hypothesis 1, maximum performance achieved at exploration (X = 1) is significantly better than performance at balance ($\Delta\hat{Y} = 1.61$, $p < 0.01$). Model 3b reveals no significant effects of exploration in the alliance mode. The predicted performance function reaches maximum performance at the highest level of exploration (X = 1). Accordingly, exploration is superior to balance (X = 0.5) in the alliance mode, yet the corresponding performance difference ($\Delta\hat{Y} = 0.1$) is insignificant.

The significant findings of negative performance implications of balance within the internal organization and acquisition modes are obtained while controlling for organizational separation. Table 2 reveals that organizational separation enhances the performance of balance within these modes as evident by the negative coefficients of the '0' and '1' levels of this variable relative to the baseline '2' level. Evidently, a firm needs to operate both a dedicated alliance unit and a business development unit to gain from organizational separation in the acquisition mode ($\Delta\beta_{02} = 1.06$, $p < 0.01$) and alliance mode ($\Delta\beta_{12} = 0.80$, $p < 0.10$).

Table 4 estimates the performance effects of balance across the internal organization and acquisition modes (Model 4), the internal organization and alliance modes (Model 5), and the acquisition and alliance modes (Model 6). The baseline models reveal that performance improves with internal organization experience. When exploration and exploitation are balanced across the internal organization and acquisition modes (Model 4a), performance declines with product life-cycle and acquisition experience; when exploration and exploitation are balanced across the internal organization and alliance modes (Model 5a), performance increases with solvency; and when they are balanced across the acquisition and alliance modes (Model 6a),

performance declines with product life-cycle, acquisition experience and R&D intensity.

Model 4b (Table 4) reveals that when exploration and exploitation are balanced across the internal organization and acquisition modes, the interaction effect is negative (β = -1.45, p < 0.001), and the main effects are positive yet significant only for exploration in the acquisition mode (β = 0.62, p < 0.01). The performance function indicates that exploring in the acquisition mode while exploiting in the internal organization mode (Point E) offers better performance than focusing on either exploration (Point C) or exploitation (Point B) in both modes. Table 5 reports t-tests for Hypothesis 2. In support of Hypothesis 2, balance point E is superior to focus points C ($\Delta\hat{Y}$ = 1.09, p < 0.001) and B ($\Delta\hat{Y}$ = 0.62, p < 0.05). When exploration and exploitation are balanced across the internal organization and alliance modes (Model 5b), the interaction effects are insignificant. Consistent with Hypothesis 2, balance point E is superior to focus points B ($\Delta\hat{Y}$ = 0.24) and C ($\Delta\hat{Y}$ = 0.16), although these differences are insignificant. Model 6b is used for testing the performance effects of balancing exploration and exploitation across the acquisition and alliance modes. Per this model, the linear and interaction effects of exploration in these modes are insignificant. Consistent with Hypothesis 2, balance point E is superior to focus point C ($\Delta\hat{Y}$ = 0.50), although this difference is insignificant. These findings hold while controlling for organizational separation, which also improves performance. Specifically, when the firm maintains both a dedicated unit for managing alliances and a business development unit in charge of acquisitions, its performance improves when balancing exploration and exploitation across the internal organization and acquisition modes ($\Delta\ \beta_{02}$ = 1.00, p < 0.01), across the internal organization and alliance modes ($\Delta\ \beta_{12}$ = 0.78, p < 0.10), and across the acquisition and alliance modes ($\Delta\ \beta_{02}$ = 0.91, p < 0.05).

Table 6 reports corresponding results from tables 3 and 5. In support of Hypothesis 3, balance across the internal organization and acquisition modes is superior to focus on exploration ($\Delta\hat{Y}_{EC}$ = 1.09, p < 0.001), which in turn is superior to balance within the acquisition mode ($\Delta\hat{Y}_{CA}$

= 1.61, $p < 0.01$). Similarly, balance across these modes is superior to focus on exploitation ($\Delta\hat{Y}_{EB} = 0.62$, $p < 0.05$), which in turn is superior to balance within the internal organization mode ($\Delta\hat{Y}_{BA} = 0.65$, $p < 0.05$). Finally, in support of Hypothesis 4 (see Table 5), a one-sided t-test for performance differences confirms that exploring via the externally oriented mode (acquisition) generates better performance than exploring via the internally oriented mode (internal organization) ($\Delta\hat{Y} = 0.26$, $p = 0.10$). Although this difference is marginally significant, exploring via the externally oriented mode (alliance) generates better performance than exploring via the internal organization ($\Delta\hat{Y} = 0.27$, $p < 0.05$). Further support for Hypothesis 4 is found when balancing exploration and exploitation across the acquisition and alliance modes, showing enhanced performance when exploring via acquisitions ($\Delta\hat{Y} = 0.49$, $p < 0.05$).

We ran several auxiliary analyses to test the robustness of our findings. For example, we considered alternative operationalizations of the dependent variable using absolute market value, return on assets, Tobin's Q, net profit, and revenue growth. We also examined alternative measures of exploration, such as exploration in the internal organization mode that incorporated information on the support of new system platforms or measured the diversity of the firm's products (Stern and Henderson, 2004; Tanriverdi and Lee, 2008) using a three-level typology of software products. We considered alternative measures of exploration in the acquisition mode based on the cross-national distance between the firm and its acquisition targets' headquarters locations as well as based on the firm's prior experience in particular foreign countries where these targets operate (Doukas and Lang, 2003; Harzing, 2002; Hennart and Reddy, 1997). In addition, we considered an alternative measure of exploration in the alliance mode based on whether alliances were formed with new or prior partners (Lavie and Rosenkopf, 2006). We also incorporated additional controls such as the firm's current number of software products. Moreover, since balance is achieved at an intermediate point that may vary depending on industry- and firm-specific conditions (Lavie *et al.*, 2010), we considered exploration values of

0.25 and 0.75 as alternative balance points for testing Hypotheses 1 and 3. Finally, we considered alternative model specifications based on random effects. These tests revealed consistent findings that reaffirm our operationalizations and model specifications.

DISCUSSION

Prior research has taken for granted that firms independently balance exploration and exploitation within particular modes of operation, while disregarding the possible interplay of exploration and exploitation across multiple modes. We fill this gap in the literature by offering insights into the benefits of exploring in one mode while exploiting in another. In so doing, we extend the domain separation approach (Lavie *et al.*, 2011; Lavie and Rosenkopf, 2006), which has advocated decoupling of exploration from exploitation in the alliance mode. We, in turn, examine how internal organization, alliances, and acquisitions serve as alternative modes for exploration and exploitation. We assess the merits of balancing these activities across modes as opposed to within each mode and identify the most effective mode for pursuing either activity. Thus, we advance research on exploration and exploitation by refuting the traditional view concerning the merits of balance within modes and by introducing balance across modes as an effective approach for coping with the ambidexterity challenge.

Our findings reveal that the traditional form of balance within modes is disadvantageous. Specifically, a firm does not benefit from balancing exploration and exploitation via internal organization. Performance suffers when the firm introduces products based on newly developed knowledge while simultaneously refining its previously developed products that rely on established knowledge. We ascribe this performance decline to inability to gain expertise and develop core competencies as well as to reliance on inconsistent routines that instigate tension and impair coordination, thus undermining marketing and product development (Danneels, 2002). Firms face similar performance consequences when balancing exploration and exploitation by means of acquisitions. A firm that simultaneously extends its knowledge base by

acquiring firms with distinct businesses and leverages its established knowledge by acquiring firms with closely related businesses suffers performance decline. This decline is ascribed to reliance on fundamentally different acquisition capabilities, limits to resource transfer and redeployment across acquired businesses, and negative transfer effects (Haleblian and Finkelstein, 1999). Eventually, the resulting operational inefficiency, hindrance of scale and scope economies, and ineffective learning weaken performance. Hence, counter to established research on balancing exploration and exploitation within particular modes (e.g., He and Wong, 2004; Jansen *et al.*, 2006; Lin *et al.*, 2007; Sidhu *et al.*, 2007; Uotila *et al.*, 2009), we reveal negative performance consequences of such balance.

In turn, our findings show how a firm enhances its performance when exploring in one mode while exploiting in another, especially when balancing these activities across the internal organization and acquisition modes. The boundaries of these modes serve as buffers for decoupling exploration from exploitation. Consequently, balance across modes can limit some of the impediments associated with balance within modes and enhance firm performance. Our main finding is therefore that balance across modes is more beneficial than balance within modes. This finding redirects attention from the question of whether balance is desirable to the means by which the firm can effectively balance exploration and exploitation.

Our findings demonstrate that irrespective of the relative benefits and costs of acquisitions versus alliances and internal organization, exploring via externally oriented modes while exploiting via internally oriented modes enhances performance more than vice versa. Specifically, it is more beneficial to develop new knowledge by acquiring firms with distinct businesses (exploration) while relying on established knowledge to internally refine existing products (exploitation). Alliances serve as an intermediate alternative, since they enhance performance when serving for exploratory R&D while the firm exploits via internal organization. Additionally, a firm can enhance its performance when leveraging existing knowledge in

marketing alliances (exploitation) while expanding its knowledge base via acquisitions of firms with distinct businesses (exploration). These findings are in line with Rothaermel and Alexandre's (2009) finding that underscores the contribution of external sourcing of unknown technologies and internal use of known technologies to the firm's innovative performance.

By revealing the merits of separating exploration from exploitation across modes, we complement research that has studied the challenges of knowledge transfer when a firm leverages experience in external exploration via alliances in its internal exploitation efforts (Hoang and Rothaermel, 2010). Even though the firm's experience with internal exploration and external exploitation can contribute to its product development capabilities, at any given time, external exploration and internal exploitation can better enhance its overall performance. Our study also complements corporate strategy research that has underscored the disruptive consequences of integrating recently acquired innovative firms within the acquirer's organization (Paruchuri, Nerkar, and Hambrick, 2006). The positive performance implications of exploration via acquisitions can be ascribed to the fact that lack of interdependence between the acquirer and target probably leads to preservation of the acquired firm's independence rather than to its structural absorption within the acquirer's organization (Puranam *et al*., 2009).

Importantly, we show that the merits of exploring or exploiting in a particular mode depend on the firm's activities in other modes. Whereas Lavie *et al.* (2011) claim that a firm should decide whether to pursue exploration or exploitation based on its relative strength and past experience, we offer more systematic guidance that relates the effectiveness of activity in a certain mode to the extent to which that mode is externally oriented relative to other modes via which the firm operates. Indeed, firms are unlikely to use a particular mode exclusively for exploration or exploitation. Also, firms initiate acquisitions and alliances for other reasons besides seeking new knowledge or leveraging existing knowledge, such as increasing market share, meeting regulatory requirements, and ensuring survival. Nevertheless, our study offers

insights into the merits of alternative configurations of exploratory versus exploitative activities, without making assumptions about firms' motives for pursuing alliances or acquisitions.

Our study advances the notion of balance across modes. We refute the latent assumption of mode independence in prior research by acknowledging the interplay of activities across the internal organization, alliance, and acquisition modes. By uncovering this interplay we help reconcile the mixed evidence in prior research relating to March's (1991) balance hypothesis. One implication is that besides strategic fit (Jemison and Sitkin, 1986; Singh, 1986) and relational mechanisms (Dyer and Singh, 1998; Kale, Singh, and Perlmutter, 2000), a firm's success with acquisitions or alliances is ascribed to their use for exploration. A particular mode is not universally preferable to another (Brouthers and Brouthers, 2000; Hennart and Park, 1993; Villalonga and McGahan, 2005). Rather, its value depends on the firm's activity in that mode. Hence, even though firms tend to independently pursue exploration and exploitation across internal organization, alliances, and acquisitions, we call for coordinating such efforts.

Our study extends research on ambidexterity, which has proposed alternative approaches for balancing exploration and exploitation using the separation principle. Whereas organizational separation (Jansen et al., 2009; Tushman and O'Reilly, 1996) calls for separate units within the firm that simultaneously engage in either exploration or exploitation, temporal separation (Eisenhardt and Brown, 1997) divides these activities over time by having the firm concentrate on either exploration or exploitation at a certain period. In turn, balance across modes separates exploration from exploitation by pursing one activity within the firm and the other via alliances or acquisitions. Each approach necessitates different managerial intervention. Organizational separation requires integration of outputs across units, whereas temporal separation calls for managing transitions, while mode separation involves identifying the mode of operation that is most suitable for pursuing either exploration or exploitation and overcoming inertial pressures.

Our study advances understanding of the conditions under which firms can benefit from

balancing exploration and exploitation within and across organizational boundaries, yet also leaves room for future research. First, we have theorized about organizational routines, negative transfer, and specialization as mechanisms that drive the performance implications of balance, yet we have not measured them directly. Future research can attempt to measure these latent variables that impede the effectiveness of balance within modes. It can also identify organizational challenges incurred when firms attempt to balance exploration and exploitation across modes, such as inertial pressures. In the same vein, future research can study the costs associated with the mechanisms underlying the balancing of exploration and exploitation in order to reveal how they account for the relative advantages of certain modes that serve as a platform for either exploring or exploiting. It can also consider the costs of modifying firms' balancing approaches. For example, a firm that initially balances exploration and exploitation within its internal organization may incur costs when ceasing to explore internally and starting to develop skills needed for exploring externally via acquisitions. The costs of switching from balance within mode to balance across modes may outweigh the expected benefits in the short term.

More generally, scholars can study the dynamics of exploration and exploitation, for instance, by considering how over time exploration turns into exploitation as a firm becomes proficient in leveraging knowledge that has been learned from alliance partners and acquisitions in its product development efforts (Rothaermel and Deeds, 2004). Such research can elucidate how exploration shifts to exploitation across modes of operation over time. Moreover, we have examined the *ex-ante* performance effects of balance, while future research can also consider *ex post* implications such as post-merger integration and alliance management that may influence knowledge spillover across modes. We have studied such knowledge flows in acquisitions that lead to subsequent product releases via the internal organization, but even though 8.26 percent of the alliances in our sample include licensing agreements we have not accounted for knowledge spillover via alliances (Lavie, 2006). Indeed, combining internal and external knowledge can

contribute to balance between exploration and exploitation (Rothaermel and Alexandre, 2009).

Finally, future research can generalize our findings to other industries and countries. For instance, in the pharmaceutical industry product development is relatively slow, and alliances serve primarily for leveraging complementary assets (Rothaermel, 2001), which may affect the benefits of exploring in particular modes. Although the desirable balance point may vary, our conjectures should still hold in most industry and national contexts. An exception may be a scientific industry such as biotechnology in which firms nurture internal core competencies in innovation and proprietary asset protection limits the benefits of accessing external knowledge via alliances, so that firms may benefit from internal exploration and external exploitation (Hess and Rothaermel, 2011). Also, in the software industry we observe only few manufacturing and supply alliances (2.6% in our sample) that tend to be managed at the business unit level. Another characteristic of the software industry is its modularity and the use of alliances and acquisitions to complement internally developed products. Future research may study balance in other industries in which firms tend to be generalists and the boundaries between modes are blurred.

Irrespective of these conceivable extensions, we advance research on exploration and exploitation by demonstrating the merits of coordinating a firm's efforts to explore versus exploit across multiple modes of operation. We contribute to the learning literature and to research on ambidexterity by challenging the received wisdom about the merits of simultaneous pursuit of exploration and exploitation within particular modes, such as in the firm's internal organization. We demonstrate that an optimal configuration involves pursuing exploration in an externally oriented mode while exploiting via an internally oriented mode. By following our guidance, firms can enhance their knowledge management skills and improve their corporate development efforts across the internal organization, alliance, and acquisition modes.

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Table 1. Descriptive statistics and correlations for the sampled firms, 1990–2001

Variables	N	Mean	Std	Min	Max	1	2	3	4	5	6	7	8	9	10
1. ln Market Value $_{t+1}$	1257	4.49	1.87	-4.61	10.74										
2. ln Market Value $_{t}$	1164	4.60	1.74	-0.94	10.74	0.89***									
3. Internal Organization Exploration $_{t}$	1410	0.55	0.35	0.00	1.00	0.02	0.02								
4. Acquisition Exploration $_{t}$	240	0.47	0.44	0.00	1.00	0.05	0.04	-0.08							
5. Alliance Exploration $_{t}$	1260	0.39	0.30	0.00	1.00	0.13***	0.13***	0.03	-0.03						
6. Firm Assets $_{t}$	1485	0.12	0.61	0.00	19.20	0.31***	0.36***	0.02	0.05	0.05†					
7. Firm Solvency $_{t}$	1482	5.15	4.21	-7.23	13.04	0.21***	0.25***	-0.07*	-0.08	0.08**	0.03				
8. Firm R&D Intensity $_{t}$	1377	0.70	8.00	0.00	237.86	0.01	0.02	0.05	-0.05	0.06*	-0.01	0.04			
9. Product Life-Cycle $_{t}$	1240	1.49	0.19	1.00	2.00	-0.02	0.04	-0.08**	0.002	0.04	0.02	-0.05	0.02		
10. λ Internal Organization Mode $_{t}$	1255	0.40	0.09	0.29	0.78	-0.36***	-0.47***	0.06*	0.17*	-0.03	-0.17***	-0.31***	0.02	-0.01	
11. λ Alliance Mode $_{t}$	1255	0.34	0.11	0.29	0.75	-0.20***	-0.25***	0.10**	0.14*	-0.02	-0.09**	-0.20***	-0.02	-0.04	0.63***
12. λ Acquisition Mode $_{t}$	1255	0.76	0.07	0.31	0.80	-0.35***	-0.38***	-0.01	-0.03	-0.05†	-0.26***	-0.09**	0.03	-0.01	0.39***
13. Hardware Experience $_{t}$	1952	0.28	1.59	0.00	21.17	-0.01	-0.02	-0.01	-0.03	0.01	-0.02	0.06*	0.07**	0.02	0.12***
14. Internal organization Experience $_{t}$	1952	8.46	11.11	0.00	141.10	0.27***	0.35***	-0.20***	0.04	0.05†	0.26***	0.20***	-0.03	0.08**	-0.45***
15. Alliance Experience $_{t}$	1952	16.53	27.26	0.00	294.02	0.22***	0.34***	-0.09***	0.11†	0.03	0.32***	0.19***	-0.02	0.08**	-0.43***
16. Acquisition Experience $_{t}$	1952	0.40	1.45	0.00	19.20	0.24***	0.28***	0.01	0.10	0.04	0.21***	0.003	-0.01	0.04	-0.24***
17. Organizational Separation $_{t}$	1952	0.09	0.29	0.00	2.00	0.13***	0.22***	-0.07**	0.06	0.01	0.13***	0.01	0.02	0.05†	-0.23***

Variables	11	12	13	14	15	16
12. λ Acquisition Mode $_{t}$	0.19***					
13. Hardware Experience $_{t}$	-0.02	0.11***				
14. Internal Organization Experience $_{t}$	-0.32***	-0.41***	-0.03			
15. Alliance Experience $_{t}$	-0.34***	-0.25***	0.004	0.56***		
16. Acquisition Experience $_{t}$	-0.13***	-0.68***	-0.03	0.38***	0.26***	
17. Acquisition Experience $_{t}$	-0.18***	-0.16***	-0.01	0.29***	0.33***	0.26***

Table 2. Balance within modes

Fixed effects panel AR (1) second-stage models for firm performance

	Balance within internal organization		Balance within acquisition		Balance within alliance	
D.V.: ln market value $_{t+1}$	Model1a	Model1b	Model2a	Model2b	Model3a	Model3b
Intercept	2.30** (0.83)	2.44** (0.83)	3.86** (1.48)	2.45 (1.57)	2.93*** (0.79)	2.88*** (0.78)
Firm and Year Fixed Effects	Included	Included	Included	Included	Included	Included
ln Market Value $_{t}$	0.69*** (0.03)	0.70*** (0.03)	0.51*** (0.08)	0.58*** (0.08)	0.66*** (0.03)	0.66*** (0.03)
Firm Size $_{t}$	-0.02 (0.04)	-0.02 (0.04)	-0.03 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
Firm Solvency $_{t}$	0.02* (0.01)	0.02† (0.01)	0.01 (0.02)	0.01 (0.02)	0.02* (0.01)	0.02† (0.01)
Firm R&D Intensity $_{t}$	-0.03 (0.02)	-0.03 (0.02)	-0.83 (0.53)	-0.63 (0.54)	-0.03 (0.02)	-0.03 (0.02)
λ Int. Org. Mode $_{t}$	0.85 (0.67)	0.72 (0.67)				
λ Acquisition Mode $_{t}$			-0.23 (0.98)	0.20 (0.99)		
λ Alliance Mode $_{t}$					-0.89† (0.53)	-0.86† (0.53)
Product Life-Cycle $_{t}$	-0.30* (0.13)	-0.29* (0.13)	-1.04** (0.40)	-0.61 (0.45)	-0.21 (0.14)	-0.21 (0.14)
Hardware Experience $_{t}$	0.02 (0.02)	0.01 (0.02)	0.19 (0.40)	0.23 (0.40)	0.01 (0.02)	0.01 (0.02)
Int. Org Experience $_{t}$	0.02*** (0.004)	0.01** (0.004)	0.02* (0.01)	0.01† (0.01)	0.01** (0.004)	0.01* (0.004)
Acquisition Experience $_{t}$	-0.01 (0.02)	-0.01 (0.02)	-0.06* (0.03)	-0.04† (0.03)	0.01 (0.02)	-0.00 (0.02)
Alliance Experience $_{t}$	-0.003† (0.002)	-0.003 (0.002)	0.003 (0.003)	0.003 (0.003)	-0.003† (0.002)	-0.003† (0.002)
Organizational Separation $_{t}$ (0)	-0.41 (0.43)	-0.40 (0.43)	-0.96** (0.36)	-1.06** (0.34)	-0.44 (0.43)	-0.52 (0.43)
Organizational Separation $_{t}$ (1)	-0.65 (0.43)	-0.65 (0.43)	-0.67* (0.32)	-0.69* (0.30)	-0.72† (0.43)	-0.80† (0.43)
Organizational Separation $_{t}$ (2)	-	-	-	-	-	-
Int. Org Exploration $_{t}$		-0.56* (0.26)				
Int. Org Exploration $_{t}^{2}$		0.50* (0.25)				
Acquisition Exploration $_{t}$				-1.16* (0.48)		
Acquisition Exploration $_{t}^{2}$				1.37** (0.50)		
Alliance Exploration $_{t}$						0.19 (0.25)
Alliance Exploration $_{t}^{2}$						-0.01 (0.27)
AR(1)	-0.20	-0.19	-0.42	-0.51	-0.13	-0.13
Number of Firm-Years	799	799	162	162	750	750
Number of Firms	177	177	77	77	177	177
-2 Log Likelihood	1319.50	1314.80	138.00	130.90	1191.70	1187.60
χ^2 (-2ΔLL)		4.70		7.10†		4.10

Significance levels: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.

Table 3. T-tests for Hypothesis 1 (balance within modes)

D.V.: ln market value $_{t+1}$	Maximum performance difference
Focus vs. balance in the internal organization mode	$\Delta\hat{Y}_{BA}$ = 0.65* (0.31), t = 2.11
Focus vs. balance in the acquisition mode	$\Delta\hat{Y}_{CA}$=1.61** (0.61), t = 2.64
Focus vs. balance in the alliance mode	$\Delta\hat{Y}_{CA}$ = 0.1 (0.32), t = 0.3

Significance levels: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.

Table 5. T-tests for Hypotheses 2 and 4 (balance across modes)

Performance difference	Balance across internal organization and acquisition	Balance across internal organization and alliance	Balance across alliance and acquisition
Points E vs. C (H2)	$\Delta\hat{Y}$ = 1.09*** (0.24), t = 4.52	$\Delta\hat{Y}$ = 0.16 (0.17), t = 0.89	$\Delta\hat{Y}$ = 0.50 (0.37), t = 1.36
Points E vs. B (H2)	$\Delta\hat{Y}$ = 0.62** (0.23), t = 2.65	$\Delta\hat{Y}$ = 0.24 (0.16), t = 1.52	$\Delta\hat{Y}$ = 0.11 (0.23), t = 0.47
Points D vs. C (H2)	$\Delta\hat{Y}$ = 0.83*** (0.24), t = 3.43	$\Delta\hat{Y}$ = -0.12 (0.15), t = -0.80	$\Delta\hat{Y}$ = 0.01 (0.30), t = 0.03
Points D vs. B (H2)	$\Delta\hat{Y}$ = 0.36 (0.28), t = 1.29	$\Delta\hat{Y}$ = -0.03 (0.13), t = -0.24	$\Delta\hat{Y}$ = -0.38 (0.24), t = -1.54
Points E vs. D (H4)	$\Delta\hat{Y}$ = 0.26 (0.21), t = 1.28	$\Delta\hat{Y}$ = 0.27* (0.13), t = 2.15	$\Delta\hat{Y}$ = 0.49* (0.25), t = 1.94

Significance levels: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.

Table 4. Balance across modes

Fixed effects panel AR (1) second-stage models for firm performance

	Internal organization and acquisition modes		Internal organization and alliance modes		Acquisition and alliance modes	
D.V.: ln market value $_{t+1}$	Model4a	Model4b	Model5a	Model5b	Model6a	Model6b
Intercept	2.87† (1.49)	2.40 (1.47)	2.34** (0.83)	2.40** (0.83)	4.04** (1.48)	3.22* (1.58)
Firm and Year Fixed Effects	Included	Included	Included	Included	Included	Included
ln Market Value $_{t}$	0.55*** (0.08)	0.55*** (0.08)	0.67*** (0.03)	0.67*** (0.03)	0.53*** (0.09)	0.56*** (0.09)
Firm Size $_{t}$	-0.05 (0.03)	-0.07* (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
Firm Solvency $_{t}$	0.02 (0.02)	0.02 (0.02)	0.02* (0.01)	0.02* (0.01)	0.01 (0.02)	0.01 (0.02)
Firm R&D Intensity $_{t}$	-0.69 (0.53)	-0.31 (0.51)	-0.03 (0.02)	-0.03 (0.02)	-1.11† (0.60)	-1.24* (0.59)
λ Int. Org. Mode $_{t}$	3.40** (1.18)	4.97*** (1.21)	1.49* (0.72)	1.41† (0.72)		
λ Acquisition Mode $_{t}$	-0.57 (0.97)	-0.41 (0.94)			-0.39 (1.02)	0.87 (1.05)
λ Alliance Mode $_{t}$			-1.17* (0.54)	-1.12* (0.54)	-2.17* (1.08)	-2.32* (1.08)
Product Life-Cycle $_{t}$	-1.21** (0.39)	-1.61*** (0.42)	-0.20 (0.14)	-0.21 (0.14)	-1.05** (0.40)	-0.96* (0.43)
Hardware Experience $_{t}$	0.19 (0.39)	-0.02 (0.38)	0.02 (0.02)	0.02 (0.02)	0.13 (0.40)	0.30 (0.40)
Int. Org. Experience $_{t}$	0.02* (0.01)	0.01† (0.01)	0.01** (0.004)	0.01** (0.004)	0.02* (0.01)	0.03** (0.01)
Acquisition Experience $_{t}$	-0.06* (0.03)	-0.06** (0.02)	-0.01 (0.02)	0.01 (0.02)	-0.06* (0.03)	-0.06* (0.03)
Alliance Experience $_{t}$	0.001 (0.003)	0.001 (0.003)	-0.002 (0.002)	-0.003 (0.002)	-0.01 (0.004)	-0.01 (0.004)
Organizational Separation $_{t}$ (0)	-0.86* (0.35)	-1.00** (0.33)	-0.41 (0.43)	-0.51 (0.43)	-1.03** (0.37)	-0.91* (0.37)
Organizational Separation $_{t}$ (1)	-0.58† (0.31)	-0.47 (0.29)	-0.68 (0.43)	-0.78† (0.43)	-0.69* (0.32)	-0.54 (0.33)
Organizational Separation $_{t}$ (2)	-	-	-	-	-	-
Int. Org. Exploration $_{t}$		0.36 (0.28)		-0.03 (0.13)		
Acquisition Exploration $_{t}$		0.62** (0.23)				0.11 (0.23)
Alliance Exploration $_{t}$				0.24 (0.16)		-0.38 (0.24)
Int. Org. Exploration $_{t}$ × Acquisition Exploration $_{t}$		-1.45*** (0.38)				
Int. Org. Exploration $_{t}$ × Alliance Exploration $_{t}$				-0.12 (0.25)		
Acquisition Exploration $_{t}$ × Alliance Exploration $_{t}$						-0.12 (0.45)
AR(1)	-0.47	-0.47	-0.14	-0.14	-0.43	-0.42
Number of Firm-Years	162	162	750	750	159	159
Number for Firms	77	77	177	177	76	76
-2 Log Likelihood	130.10	110.20	1187.50	1182.50	133.40	128.90
χ^2 (-2ΔLL)		19.90***		5.00		4.50

Significance levels: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.

Table 6. T-tests for Hypothesis 3 (balance across vs. balance within)

Modes	Balance-across vs. focus	Focus vs. balance-within
Int. org. and acquisition	$\Delta\hat{Y}_{EC}$ =1.09***, $\Delta\hat{Y}_{EB}$ =0.62*	$\Delta\hat{Y}_{BA}$ = 0.65* (int. org), $\Delta\hat{Y}_{CA}$=1.61** (acquisition)
Int. org. and alliance	$\Delta\hat{Y}_{EC}$ =0.16, $\Delta\hat{Y}_{EB}$ =0.24	$\Delta\hat{Y}_{BA}$ = 0.65* (int. org), $\Delta\hat{Y}_{CA}$ = 0.01 (alliance)
Alliance and acquisition	$\Delta\hat{Y}_{EC}$ =0.50, $\Delta\hat{Y}_{EB}$ =0.11	$\Delta\hat{Y}_{CA}$ = 0.01 (alliance), $\Delta\hat{Y}_{CA}$=1.61** (acquisition)

Significance levels: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.

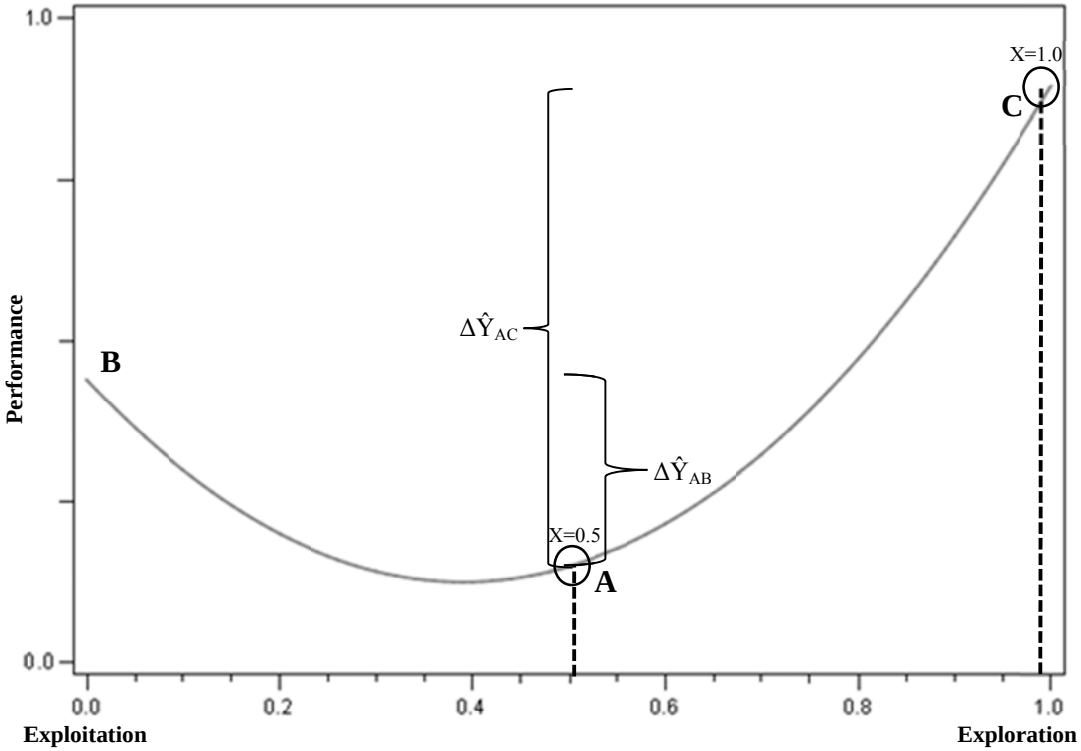

Figure 1. Balance within modes

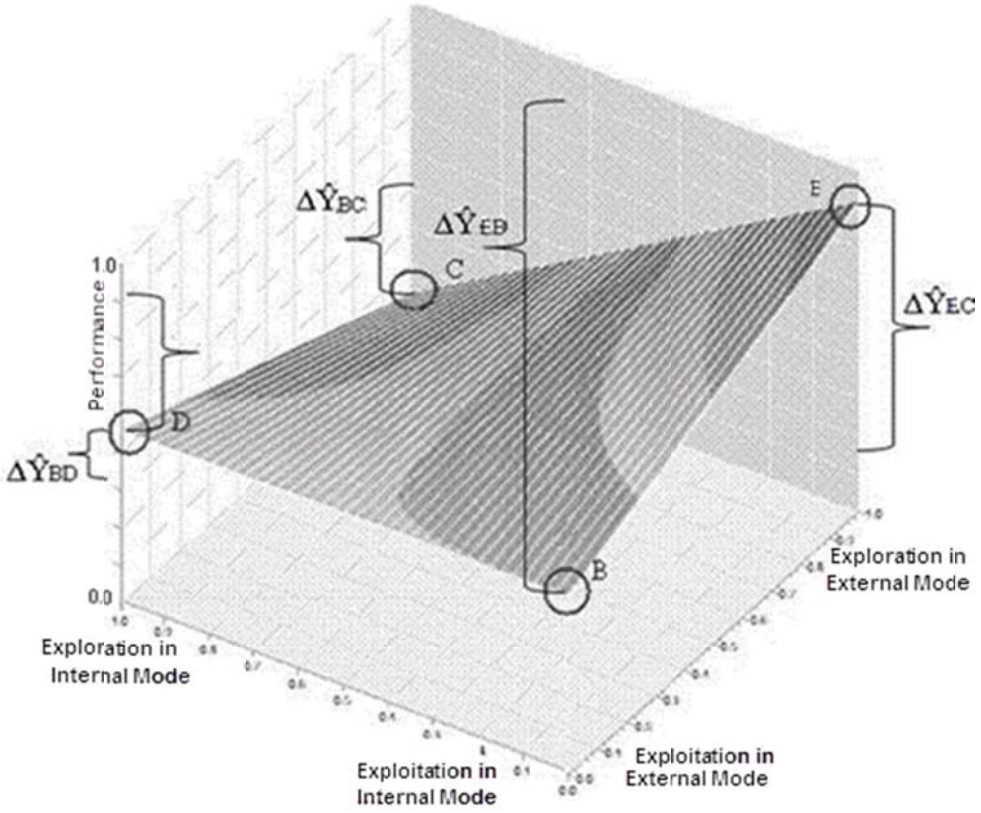

Figure 2. Balance across modes

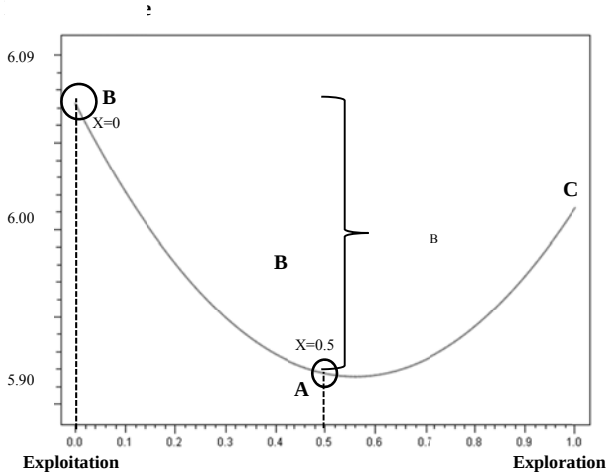

Figure 3. Balance within internal organization

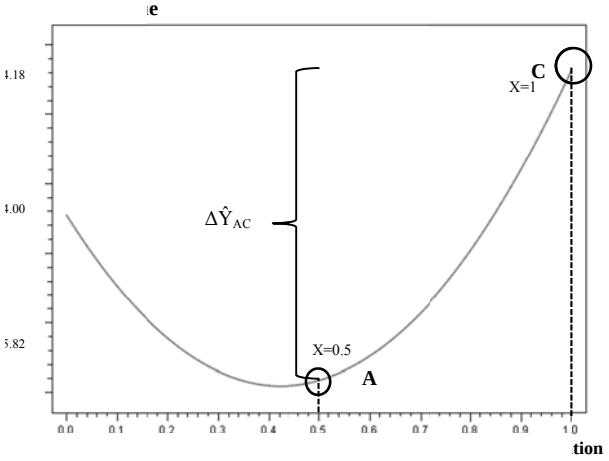

Figure 4. Balance within acquisition

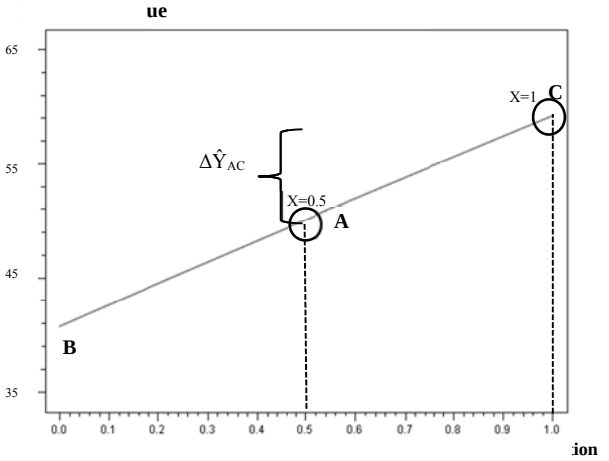

Figure 5. Balance within alliance

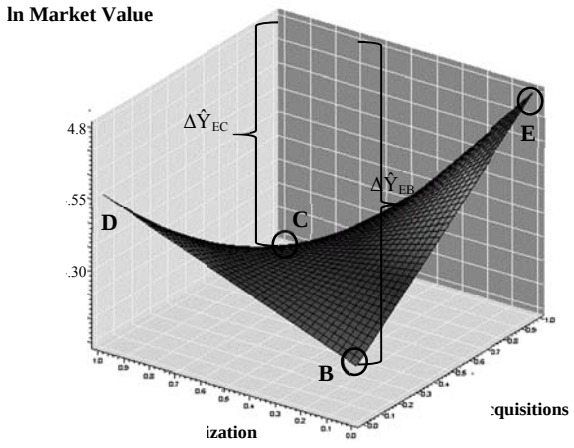

Figure 6. Balance across internal organization—acquisition

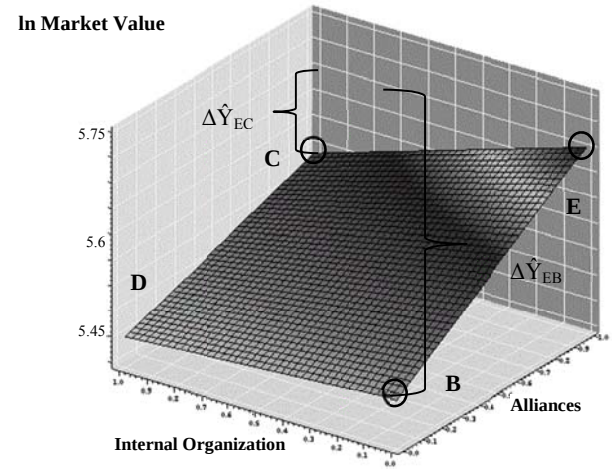

Figure 7. Balance across internal organization—alliance

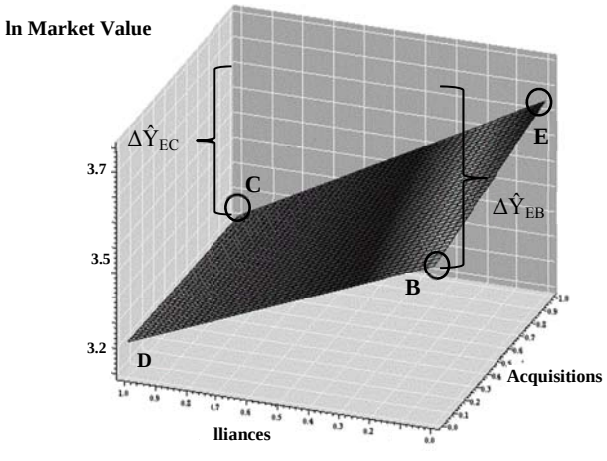

Figure 8. Balance across alliance—acquisition