

Hand in Glove:

Open Innovation and the Dynamic Capabilities Framework

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Abstract

Open innovation involves some of the most strategic functions of the enterprise, and yet relatively little has been written about how it fits into a larger strategic management framework. This article fills that gap by relating open innovation to the dynamic capabilities framework and begins by briefly summarizing the two perspectives. It then reviews the modest theoretical and empirical literature that looks at open innovation from a capabilities perspective. It identifies where open innovation fits into the dynamic capabilities framework and explores how treating open innovation as a separate construct can enrich a dynamic capabilities approach to the management of the enterprise. A case study of China's Haier then provides an example of these principles in practice.

I. Introduction

Open innovation has become one of the key approaches to technology management since its introduction to the literature some fifteen years ago (Chesbrough, 2003a).¹ Yet there is surprisingly little written about how open innovation fits into the larger strategic management of the enterprise.

The dynamic capabilities framework, which emerged a few years earlier and explicitly recognizes the concept of combining internal and external resources, can provide the required perspective (Teece, Pisano, and Shuen, 1997; Teece, 2007, 2014a). The framework provides a model of how firms can create sustainable competitive advantage. It also incorporates evolutionary and other theories of the firm and of strategic management to answer the most fundamental issues in strategy research, such as why firms differ and how they build and maintain competitive advantage (Rumelt, Schendel, Teece, 1994, p.2).

Open innovation and dynamic capabilities have a lot in common. They are both quite general and require contextual specifications. They have organizational as well as a managerial implications; and they can be applied at the business unit, enterprise, or ecosystem level. But there are also critical differences. While open innovation is essentially a set of processes, the dynamic capabilities framework is a systemic theory of strategic management that encompasses not only processes but also corporate governance, managerial decision-making, and the sources of competitive advantage.

This article analyzes in more detail how open innovation relates to the dynamic capabilities framework, and how dynamic capabilities concepts can help to achieve the goals of

¹ As discussed below, many elements of the open innovation framework have been written about and practiced for decades.

open innovation (Teece, 2014a). I begin by briefly summarizing the two concepts. I then review the modest theoretical and empirical literature that looks at open innovation from a capabilities perspective. There follow discussions of how treating open innovation as a separate construct can enrich a dynamic capabilities approach to management, and of how strong dynamic capabilities are needed to make open innovation successful. A case study of China's Haier, which has been transformed over 34 years from its origins as a failing refrigerator factory to the world's largest maker of household appliances, is then used to demonstrate how dynamic capabilities and open innovation are intertwined.

II. Open Innovation

In simple terms, open innovation means “accessing and exploiting outside knowledge while liberating ... internal expertise for others' use” (Chesbrough 2003b, p.12). The external knowledge can be accessed through a range of modes, from informal contacts with customers through R&D alliances to formal contracts for externally developed technology (Chesbrough and Brunswicker, 2014).

Open innovation concerns not only where and how technologies are sourced, but also how they're commercialized, creating the potential “to ... expand the markets for external use of innovation” (Chesbrough 2006a, p.1). Here, too, there is a range of options, from licensing out to contributing to an open source project. In short, open innovation is an approach to technology management that recognizes the value to the enterprise of external sources and markets.

Firms had long practiced external technology acquisition, but typically as a one-off transaction without ongoing collaboration (Mowery, 2009). Certain forms of openness, such as

innovation via collaborative engagement with users (Von Hippel, 1976), have also been practiced for decades.

The trend in the first half of the twentieth century was toward in-house innovation, augmented by mergers and acquisitions. After a string of U.S. Supreme Court decisions in the 1960s placed mergers under a stricter level of scrutiny, inter-organizational collaboration became more attractive. Big companies were sometimes hampered in these efforts by the bias of their in-house scientists and engineers against ideas “not invented here.”

Big companies began to “open” their research efforts in the 1980s. In studies I conducted with my graduate students at the time, we described how increased collaboration among firms in biotech and telecommunications equipment was driven by the increased dispersion of the sources of knowledge, along with other considerations such as transaction costs and appropriability (Pisano, Russo, and Teece, 1988; Pisano, Shan, and Teece, 1988). This work documented the rise of what we called “network” firms, which, to varying degrees, outsourced manufacturing and insourced new technology.

The opening up of corporate innovation processes in the last decades of the twentieth century was further spurred by the quickening pace of technological change and global competition, which shortened product life cycles; the increasingly multi-disciplinary nature of innovations, requiring multiple technologies to be mastered within narrow time frames; and the decreased willingness of shareholder activists in the U.S. to support the fixed costs and long gestation associated with centralized research activities. Firms increasingly found themselves forced to augment their internal efforts through accessing external ideas and resources as part of their R&D (Friar and Horwitch, 1985; Teece, 1992). It is no coincidence that network forms of

organization to support technological and other purposes became an important area of study around this time (Thorelli, 1986; Powell, 1990).

Chesbrough's open innovation concept effectively and brilliantly framed the strategy and, most importantly, identified the processes for implementing networked, collaborative research as a complement to (and sometimes a substitute for) in-house R&D activity. Firms that had previously eschewed the work of scanning for new technologies beyond their own R&D department now had a template and a rationale for doing so. Chesbrough and I had previously laid out the limits of this networked approach, at least at a high level of abstraction, in a Harvard Business Review article, "When is Virtual Virtuous?", in 1996.

The openness of innovation is a matter of degree. First, open and closed models will (and should) operate side by side and interact. Open innovation is often used to enhance the value of proprietary, in-house technology. Second, openness varies with intellectual property regimes; collaborating in open-source software projects might be considered a more "open" environment than working with a startup to co-develop a proprietary product.

The open innovation construct encompasses both inbound and outbound openness. This is important, because value creation without value capture is a dead end in a private-enterprise, market economy where firms face competition. However, the implicit assumption in the open innovation model is that the two directions of openness are complementary and might therefore be supported by similar capabilities. Some empirical studies are finding, however, that this need not always be the case (Cassiman and Valentini, 2016; Cheng et al., 2016).

As with value creation, the value capture side of open innovation has its roots in earlier developments. Most important was the strengthening of intellectual property rights in the U.S., beginning with the 1980 Bayh-Dole Act (Coriat and Orsi, 2002). Bayh-Dole simplified the

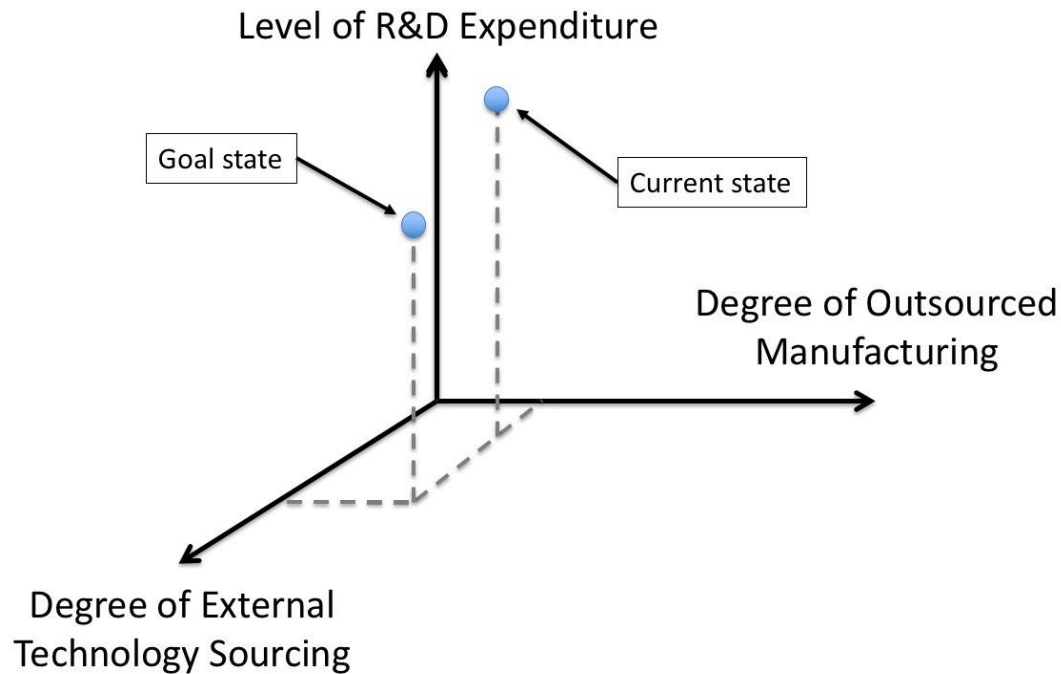
management of intellectual property (IP) developed with federal funding by universities and public labs, and it provided incentives for exploiting it. In 1982, a judicial reform created a unified appellate authority for patent cases that in practice strengthened patent rights in the United States. A series of judicial decisions gradually allowed the patenting of a wider range of innovations, including software, certain surgical procedures, living entities with “man-made” attributes, and—very occasionally—elements of business models. The Omnibus Trade and Competitiveness Act of 1988 required the executive branch to enforce US intellectual property rights with international trading partners.

While these measures improved appropriability for IP holders, thereby expanding business model choices by making licensing more viable, they didn’t quite overcome the perennial problem of “fuzzy boundaries” that affects all IP (Teece, 2000, p.150). The open innovation model takes account of these and other such complexities associated with intellectual property management (Chesbrough, 2003c). Licensing out inventions (i.e., the inventor licensing to others to enable third-party commercialization) is an important adjunct (or alternative) to internal commercialization, especially when an innovating firm either finds itself unable to develop all the potential applications for its technology or decides to not further develop a particular technology that has emerged from its research (Teece, 1986, 2006). Inter-firm technology licensing has a long history (e.g., Marconi’s radio technology). But, in recent decades, the rising cost of research and shorter product life cycles have increased the opportunity cost for firms to leave a new technology undeveloped. Outward licensing of existing technologies or spinning off peripheral lines of business can provide new sources of revenue and allow managers to focus on core activities. Moreover, standards development organizations often require licensing by their members when their inventions are deemed “standard-essential.”

An open approach to innovation permits firms with differentiated in-house capabilities to augment these by leveraging external sources of knowledge, which are now more significant and widespread than ever. Depending on the form it takes, it can also tap external capital and talent. Most writing on open innovation emphasizes these transactional elements, leaving the requisite managerial and organizational underpinnings relatively understudied.

Considerable attention has been given to the need for leadership in moving from closed (i.e., in-house) to open. Less has been said, however, about the need to coordinate across other strategic dimensions of the firm's activities. Figure 1 shows a simplified example of the problem, in which the firm's level of outsourcing is held constant and its R&D expenditure falls slightly as its technology sourcing becomes more open. There are numerous other, less quantifiable dimensions that could have been shown, such as the necessary associated shifts in engineering culture and the greater resources that would need to be devoted to the management of the firm's alliances, technology portfolio, and intellectual property.

Figure 1: Moving from “Closed” to “Open” Innovation Affects Multiple Strategic Variables



Source: Adapted from Pisano and Teece (1989), Figure 1.

Once the organizational shift to more openness has been accomplished, open innovation continues to require ongoing sensing and seizing activities. In other words, it requires dynamic capabilities, to which I turn next.

III. Dynamic Capabilities

While the open innovation model is relevant across the entire value chain, it is largely about supplementing and transforming ongoing internal processes of R&D and commercialization: external knowledge augments internal R&D, technology is licensed in as

needed, technology is licensed out where profitable, and unneeded technologies are spun-out when viable. While these activities can potentially enhance competitive advantage, they are not a complete framework for understanding how competitive advantage is built and sustained.

A more holistic perspective is provided by the dynamic capabilities framework, which takes a system-level approach to the resources, capabilities, and management of the firm and its business environment (Teece 2018). An early definition of dynamic capabilities was “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece, Pisano, and Shuen, 1997, p.516). That still applies, although the speed of change in the environment may be less relevant than the prevailing degree of uncertainty (Teece, Peteraf, and Leih, 2016).

A firm’s dynamic capabilities can be strengthened by the judicious use of open innovation processes. They increase the firm’s ability to learn about new technological opportunities and, in some cases, to leverage external resources to fill capability gaps. Put differently, how the firm builds and complements its internal R&D through technology exchanges with other agents in its environment can be an important driver of dynamic capabilities.

The dynamic capabilities framework accommodates the integration of disparate theories across disciplinary divides (Teece, 2014a). It is a form of “appreciative theory” (i.e., qualitative, observation-based) that exists in a dialectic with formal theory (Nelson, 1994). There is a need for both types of theorizing because the realm of management is not like physics; while some quantitative relationships may be shown to exist, they are unlikely to hold true in all places and times as elements excluded from the formal abstractions of statistical models deflect specific cases in unique directions.

Dynamic capabilities, as described by Teece (2014a), reside in managerial decision-making as well as organizational routines. These high-level capabilities can be broken down into three categories: sensing, seizing, and transforming.

In the framework, dynamic capabilities sit atop a capability hierarchy. Supporting them are components that Eisenhardt and Martin (2000) confusingly also called dynamic capabilities, but which I prefer to call microfoundations (Teece, 2007). These include organizational processes for alliance formation, new product development, and much more. They allow the firm to integrate, reconfigure, add, or subtract resources. But, if they are used incrementally to follow an existing trajectory, microfoundations are like ordinary capabilities.

Ordinary capabilities are processes that deploy people, facilities, and equipment to carry out the current business of the firm efficiently as opposed to looking ahead at what the firm will need to be doing in the future to be effective in competing with its rivals. Ordinary capabilities lend themselves to being measured and benchmarked, which also makes them easier for others to replicate. Since they are therefore unlikely to provide a unique advantage, strong ordinary capabilities need to be accessed, but not necessarily owned.

While strategy is part of the dynamic capabilities framework, it is analytically separate from capabilities. Dynamic capabilities provide inputs to, and then help to enact, the strategy. Firms with strong dynamic capabilities make good decisions when setting the parameters for entering into alliances and determining which new products should be developed and commercialized. Strong dynamic capabilities allow a firm to maintain continued (evolutionary) fitness vis-à-vis the external business environment and coherence among the elements of the system (Teece, 2017a).

The dynamic capabilities framework emphasizes the need for an entrepreneurial style of management to make processes such as open innovation effective. Entrepreneurial managers have the leadership skills to design organizational structures, incentives, and culture that are open to external knowledge, can rapidly absorb and apply new knowledge, can create breakthrough products and services, and can respond rapidly to changing conditions (Teece, 2016).

Returning to the three categories of high-level capabilities, “sensing” includes the identification, development, and calibration of technological opportunities, customer needs, and strategic challenges. Strong sensing requires a “vigilant organization ... able to both mind a broad periphery and mine the weak signals for relevance and meaning” (Day & Schoemaker, 2008). The top management team is responsible for combining and analyzing data from diverse sources to continuously monitor the firm’s environment, prioritize problems, and identify new opportunities.

The firm’s “Seizing” capabilities determine how quickly the organization can respond to significant opportunities and threats once they have been identified. The activities involved include investing to commercialize new technologies; identifying and deciding how to fill capability gaps; and designing (or updating) and implementing business models for various products and services (Teece, 2017b). Once deliberations around open innovation activities have led to the decision to commercialize a given technology, a whole new round of decisions arises, such as whether to acquire, license, or ally with the owners of complementary technologies in order to ensure a predictable path both for the initial commercialization and for its future development (Chesbrough and Teece, 1996).

“Transforming” capabilities, particularly asset orchestration, are responsible for keeping the elements of the organizational system internally coherent, aligned with the strategy, and competitive in the external environment. Transformation capabilities are most critical when a business model change involves a significant alteration to the organization’s design. Minor transformations must also be made periodically for a variety of reasons. Fostering an organizational culture that supports openness, flexibility, and experimentation is a challenge, but success can provide a solid foundation for quicker and easier transformations in the future, contributing to future advantage.

IV. Putting Them Together

Open innovation is a natural fit with the dynamic capabilities framework. Since their debut, dynamic capabilities have encompassed “the management capability to effectively coordinate and redeploy internal *and external* competences” (Teece, Pisano, and Shuen, 1997, p.515, emphasis added). Dynamic capabilities also foster the organizational agility and entrepreneurial nouse required for an open innovation approach, which Chesbrough has likened to playing poker because uncertainty is high and tactics must shift as new information is revealed (Chesbrough, 2004).²

This is not to say that open innovation cannot be usefully analyzed from other perspectives, such as the resource-based view (RBV) of the firm or transaction cost economics (TCE). Each has its uses. But these theories — which are forerunners of dynamic capabilities

² See Teece, Peteraf, and Leih (2016) on the need for strong dynamic capabilities in environments with high uncertainty.

thinking and still reflected in it (Teece, 2011) — are too narrow to capture the linkages between open innovation and competitive advantage. The RBV, for instance, is static and says little about the capabilities needed to maintain VRIN positioning as markets and technologies change.³ It tends to take a one-shot view of competition, ignoring the need for resources to be renewed and reorganized. Similarly, TCE focuses narrowly on governance modes, holding production activity constant even though production costs may depend endogenously on governance mode.

a. Empirical and theoretical linkages

There is already a modest literature that situates open innovation within a dynamic capabilities concept. In 2007, I noted that

Integrating know-how from outside as well as within the enterprise is especially important to success ... Good incentive design and the creation of learning, knowledge-sharing, and knowledge-integrating procedures are likely to be critical to business performance, and a key (micro)foundation of dynamic capabilities (Teece, 2007, p.1339).

This was echoed by Lichtenthaler and Lichtenthaler (2009), who elaborated a framework in which “knowledge management capacity”, the firm’s ability to reconfigure and realign capacities for exploring, retaining, and exploiting knowledge both internally and externally, is a dynamic capability that governs the associated sub-processes. Easterby-Smith and Prieto (2009), approaching the matter from a knowledge-based view of the firm, conceptualized dynamic capabilities and knowledge management as separate but overlapping concepts.

Empirical studies have confirmed the presence of strong linkages between the two concepts. Grönlund et al. (2010), studying a supplier of equipment to oil and gas fields, show

³ VRIN is an acronym for valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991).

that “opening” new product development, a dynamic capability, creates opportunities to assess and transform business models and core competences. Panel studies of European small and medium enterprises by Grimaldi et al. (2013) and by Brunswicker and Vanhaverbeke (2015) linked patterns of internal capabilities to innovation styles from closed to open.

In a study of 213 Taiwanese firms of various sizes, Cheng, Yang, and Sheu (2016) found that the linkage between knowledge openness and (self-reported) radical innovation capabilities was complex. While more openness was generally better, firms that saw openness as a bilateral (rather than a unidirectional) sourcing of knowledge showed, as expected, a stronger link between accessing external knowledge and radical innovation. In the downstream direction, though, firms that practiced bidirectional openness had a weaker link between innovation and downstream openness (licensing, etc.). In short, an ability to engage in knowledge sharing with external partners is beneficial for radical innovation but less relevant for (and possibly even harmful to) its monetization via licensing and other open business models.

b. How open innovation enhances dynamic capabilities

In the remainder of this section, I discuss some of the theoretical linkages between open innovation and the dynamic capabilities framework. The two are mutually reinforcing. The implementation of open innovation can broaden top management’s horizons for sensing and seizing. And strong dynamic capabilities will increase the effectiveness of open innovation efforts.

Sensing capabilities are enriched by the deeper technological and market understanding that comes with openness to external knowledge sources. Linkages with university researchers, for example, can be used to solve specific problems while also providing access to cutting-edge thinking not tethered to immediate commercial goals, giving management a clearer view into

potential future technological developments. More generally, technical dialogue with customers, suppliers, and complementors will not only make innovation efforts more effective but also increase the likelihood that top management will learn of issues affecting its markets, value chain, or ecosystem before they fester and reach crisis proportions.

Seizing can be enhanced by the use of open innovation to build new capabilities. When a new business model is contemplated, a good management team will identify capability gaps. Where market-based options are available, the gaps can be filled through outsourcing. However, when the missing capability is strategic for reasons such as scarcity or the need to control the technology trajectory, open innovation resources may be available to accelerate the process of capability development.

Seizing can also be enhanced by adopting an outbound open innovation perspective. This might make a firm more receptive, for example, to the pursuit of hybrid business models involving both direct exploitation and out-licensing of intellectual property to maximize the returns to innovation.

Finally, transformation is implicated because opening up the innovation process can allow a redeployment of internal resources away from non-core technologies that can be externally sourced, further enhancing flexibility. New or stronger IP management capabilities may need to be developed in order to run an inbound and outbound licensing programs.

c. How dynamic capabilities strengthen open innovation

Looking from the opposite direction, strong dynamic capabilities enable effective open innovation practices. While open innovation is simple in theory, it can be fiendishly challenging in reality, and strong dynamic capabilities are needed to make it successful. As Gassman, Enkel, and Chesbrough (2010, p.216) note, “The variance between a best practice in open innovation

and the average is huge.” When dynamic capabilities are weak, open innovation initiatives may be poorly chosen, poorly governed, and/or only weakly (or never) monetized.

The orchestration skill needed to coordinate assets and activities across the firm’s entire innovation ecosystem is a key dynamic capability. The right governance mode needs to be selected and managed carefully for each external relationship (Fey and Birkinshaw, 2005; Van de Vrande, Lemmens and Vanhaverbeke, 2006). Outside of pure open-source arrangements, contracting costs can mount rapidly (Christensen, Olesen, and Kjær, 2005). As more partnerships are established, dedicated resources such as a licensing group or relationship managers become necessary (Witzeman et al., 2006). In some instances, partners may need to be acquired to allow “unstructured technical dialog” (Monteverde, 1995).

As external knowledge is sourced, it must then be put to use within the firm. The design of the organization (a transformation capability) should permit relevant information to find its way quickly to where it will be properly assessed and handled. A key piece of market intelligence, for example, obtained as part of an open product development process, might be more useful to another business division or to a top management team setting investment priorities.

In the case of early-stage innovations, the sourcing of technology must be combined with other types of input from the firm’s ecosystem to engage another dynamic capability, sensemaking. In the presence of uncertainty and ambiguity about the value of an innovation and the evolution of markets, managers need to construct a narrative that makes sense of conflicting signals and provides expectations about the future in order to decide whether and how to proceed (Teece, Peteraf, and Leih, 2016).

Strong seizing is needed to ensure that open innovation leads to value capture. Open innovation requires special attention to business model design (a key seizing capability) because adopting external innovations is likely to drain some of the profit away from any eventual product or service (Chesbrough, 2006b). Strong seizing capabilities will also augment the value of open innovation by sharpening key decisions about IP strategy, such as deciding whether a particular piece of in-house IP is best managed as proprietary, open, or both. The use of out-licensing to monetize IP must also be considered, with royalty rates calibrated to balance short-term value capture with the maintenance of a healthy ecosystem. Other seizing capabilities such as rapid prototyping and the ability to quickly assess and integrate the most useful feedback from early adopters also help bridge the gap between open innovation and value capture.

More broadly, because the dynamic capabilities framework is a systemic approach to strategic management (Teece, 2018), it is well suited to coordinating strategic decisions across the many interdependencies and commitments in today's networked firms (Leiblein, Reuer, and Zenger, 2018). Especially relevant here is its emphasis on the managerial skills needed to orchestrate assets and activities across organizational boundaries, including the integration of diverse technologies. Collaboration presents an opportunity for learning from partners, a capability that must be actively cultivated to be effective (Hamel, 1991). At the same time, collaboration increases the risk of knowledge leaking to rivals in unintended ways (Laursen and Salter, 2014).

The holistic approach of the dynamic capabilities framework also draws attention to the complications that can arise from open innovation. For example, exposure to numerous external sources during the knowledge creation process can create liabilities, which must be addressed with careful tracking of internal knowledge accumulation. Knowledge sharing and alliances can

also raise complicated contractual issues. In the downstream direction, efforts to extract royalties from users of the firm’s intellectual property must be balanced with other business and political considerations in each location.

Table 1 summarizes these points.

TABLE 1: Strong Dynamic Capabilities Make Open Innovation Effective

SENSING	RECOGNIZING external know-how OPPORTUNITIES
	LEARNING from external sources of know-how
SEIZING	AGILE DECISIONMAKING once an external source is identified
	INITIATING COMBINATORIAL ACTIVITIES
	ADOPTING hybrid BUSINESS MODELS
TRANSFORMING	SELECTING GOVERNANCE MODE for external linkage
	INTEGRATING internal and external knowledge

V. Case Study: Haier

The complementarity and overlaps between strong dynamic capabilities and open innovation can perhaps best be understood through a case study. Under the entrepreneurial leadership of CEO Zhang Ruimin, China’s Haier has progressed from a backward maker of low-quality refrigerators in the mid-1980s to the world’s largest producer of appliances. Haier’s successful transformation, which is highly suggestive of strong dynamic capabilities, has involved both management innovation and the explicit use of open innovation.

a. Dynamic capabilities at Haier

Dynamic capabilities take time and resources to build. The Haier case demonstrates this with an ongoing process dating back to CEO Zhang's arrival as managing director in 1985. In the firm's most recent decade, it has experienced double-digit growth and launched new businesses worth more than \$2 billion (Hamel and Zanini, 2018)..

Zhang's first transformational act was to switch from a strategy of filling quotas to a strategy of raising quality and building a brand (Fischer, Lago, and Liu, 2015). This involved the improvement of the firm's ordinary capabilities, but recognizing the opportunity, determining which capability gaps need to be filled, and building a culture that supports better-quality output require good dynamic capabilities. The potential was clearly present. When the company was obliged by the government to take over other Chinese manufacturers, it successfully accomplished, which demonstrates asset orchestration skills.

The company continued to grow, diversify, and improve its commitment to quality and service, but by the late 1990s, Zhang began to feel that further transformation was needed in order to move from simply responding to customers to being so close to them that Haier could anticipate their needs. In capabilities terms, a major goal was to establish superior organizational sensing capabilities. The first step was to introduce, starting in 2005, a set of new management practices under the banner of Rendanheyi, elements of which include semi-autonomous micro-divisions, performance-based compensation, and open online user platforms (Frynas, Moll, and Mellahi, 2018).

After the successful implementation of the Rendanheyi principles of management, Zhang continued to experiment with Haier's management structure, particularly around ensuring collaboration among the micro-divisions. In 2014, Haier moved to Rendanheyi 2.0, with the

micro-divisions expanded to micro-enterprises (Frynas et al., 2014). More than 10,000 middle managers were laid off in order to flatten the hierarchy (Michelman, 2017). The new operating units, known as “xiaowei,” have decision autonomy, are expected to seek outside investors, and can have an IPO. The entrepreneurial management needed for strong dynamic capabilities was thus spread throughout the company. Haier has more than 200 of these small units, and new ones can be proposed to exploit new short- or medium-term opportunities (Michelman, 2017). Sales goals and base salaries are no longer set by the headquarters, which still plays a role in terms of allocating resources, agreeing on performance metrics for each unit, and propagating a strategic vision for the company as a whole. Most xiaowei are directly involved with developing and producing products for customers, but the concept has also been extended to internal units that provide central services to the other xiaowei. Each production line is also run as a separate unit and has to compete for work with other lines at over 100 factories in Haier’s global network (Michelman, 2017). The xiaowei can also use outside manufacturers, as was the case for a successful laptop computer for gamers. Haier has thus unleashed high-powered incentives to create and capture value throughout an enterprise with over 70,000 employees.

Parallel with these changes, Haier rapidly internationalized, successfully demonstrating a high level of asset orchestration skills needed for multinational management (Teece, 2014b). Beginning in the mid-1990s, it entered a number of markets in Asia and the Middle East through joint ventures (Duysters et al., 2009).

Next, Haier targeted the U.S. and Europe, initially with a niche strategy. In the U.S., for example, it sensed an opportunity in the market for small refrigerators for students or offices, which helped it get established through imports before committing to its own production. In

1999, it seized the opportunity by establishing a joint venture factory in Yugoslavia and building its own U.S. factory in South Carolina.

The company has also expanded through strategic acquisitions, another microfoundation of dynamic capabilities. These included Japan's Sanyo brand (2011), New Zealand's Fisher and Paykel (2012), and, for more than \$5 billion, GE Appliances in the US (2016). Haier has had to adapt its management approach for its overseas activities. Rendanheyi is now in place at subsidiaries acquired in Japan and New Zealand (Michelman, 2017). The transition at GE Appliances is still underway (Knowledge@Wharton, 2018).

b. Open innovation at Haier

One of the foundations of strong dynamic capabilities at Haier is the firm's commitment to open innovation (Hamel and Zanini, 2018). Its "Open Innovation Center" was established in 2009. Today, Haier is deeply involved in open innovation, and even has several pages about it on its English-language web site detailing its implementation.⁴

Initially, collaboration was needed to catch up to the technology frontier. Haier's first such experience was in 1985, when it was known as the Qingdao Home Appliance Company. This was one year after Zhang became the director. The company entered a short-lived joint venture with a German maker of high-quality refrigerators, Liebherr, which provided it access to better technology (Fischer, Lago, and Liu, 2015). Subsequent technology partners have included Japan's Mitsubishi for air conditioners (for which Haier has gone from zero to the world's third largest supplier), Holland's Philips for televisions, and Sweden's Ericsson for internet connected appliance know-how (Duysters et al., 2009). The company also collaborates with universities and research institutes.

⁴ http://www.haier.net/en/research_development/rd_System/, accessed January 10, 2019.

Haier transitioned from a contractual to a more collaborative approach to innovation. Haier entered the water purification field, for example, through a joint venture with an Israeli technology firm in 2011. The partner, Strauss, provided the technology while Haier focused on marketing, distribution, and service in China. Haier then sought other partners to develop its in-house technology base. It shares, for instance, more than 20 water purification patents with Dow Chemical. (Fischer et al., 2015). The joint venture with Strauss was reorganized in 2015 to incorporate Haier's own purification process, based on a different technology, and to undertake joint development with Strauss (Strauss Group, n.d.).

In 2013, Haier launched a platform (Haier Open Partnership Ecosystem) that provides tools and an online portal for turning ideas into products, or at least solutions. The platform is supported by five global R&D centers connected to over one million scientists and engineers, including many from major corporations such as Bayer and Honeywell.⁵ Users, suppliers, academics, and entrepreneurs are all able to participate (Nunes and Downes, 2016). Problems are posted to the portal. As many as 200 issues have been posted annually. Not all lead to a positive outcome. When a solution provider succeeds, the resulting intellectual property, if any, may belong to the provider or be jointly owned.

c. Summary

CEO Zhang has crafted and overseen the implementation of processes that have allowed Haier to develop strong dynamic capabilities. The company's managers, at all levels, have become adept at sensing opportunities and trends, seizing them rapidly, and transforming the relevant parts of the organization as needed. The top management team orchestrates dozens of micro-enterprises, numerous alliances, and a global network of R&D labs and factories.

⁵ http://www.haier.net/en/research_development/Ecosystem/, accessed January 10, 2019.

Open innovation is a key contributor that enhances Haier's sensing and seizing capabilities. Haier's unusual structure allows openness not only to outside knowledge but also to the serendipity and improvisation that make innovation more likely (Lewin, Välikangas, and Chen, 2016).

In short, both dynamic capabilities and open innovation are integral features of Haier's Rendanheyi structure. In a 2018 interview, Zhang encapsulated this at the start of his description of the user-facing micro-enterprises:

First, they are very entrepreneurial and very good at identifying, developing and seizing new market opportunities, so that they can develop those markets and seize the opportunities. Secondly, they are very well self-organized. They are also very open to inviting people from outside their organization to join them in their research and development. We believe the entire world can serve as your HR pool. (Knowledge@Wharton, 2018)

VI. Summary and Conclusion

In this paper, I've analyzed the role of open innovation in the dynamic capabilities framework, while underscoring the utility of open innovation as a separate construct. I also reviewed the modest theoretical and empirical literature that looks at open innovation from a capabilities perspective.

The dynamic capabilities framework takes a systemic approach to identifying the sources of sustainable competitive advantage, encompassing the organization, its strategy, and the business environment. By contrast, open innovation focuses on relevant parts of the value chain but only implicitly involves strategy formulation, organizational design, regulatory influences,

and so on. It is, in one sense, a principle, but it is also a set of processes which can be thought of as microfoundational to the high-level capabilities of sensing, seizing, and transforming.

A dynamic capabilities perspective is best suited for (but by no means restricted to) thinking about high-level issues such as how open a company's innovation process should be, how well it collaborates with and learns from partners, or how successfully it markets new products. The application of open innovation principles is most useful for addressing not only high-level, but also project-level issues specific to innovation and its exploitation.

The linkages between the two constructs are strong. An open innovation orientation enriches a company's knowledge base and hence its ability to sense and make sense of changes and trends. It highlights the potential for out-licensing as a prominent component of the bundle of potential business models for seizing. And it reinforces the more general openness that underpins the willingness to change required for ongoing transformation.

Meanwhile, strong dynamic capabilities are required to turn open innovation into a source of competitive advantage. Ideally, the routines underpinning open innovation will be honed into valuable and inimitable signature processes that build on the unique culture and practices of the company (Gratton and Ghoshal, 2005). Partnership governance must be carefully considered, potential liabilities correctly managed, new knowledge made accessible to others in the company, and business models made congruent with organizational culture.

Moreover, strong dynamic capabilities are vital for the sensing and sensemaking needed to determine the directions that open innovation efforts should pursue. They are important for ensuring the dynamism of the organization so that innovations can be rapidly exploited. And they are critical for orchestrating across the organizational, competitive, and regulatory contexts in which innovation occurs.

The Haier case was used to demonstrate these propositions. Haier is unusual in the degree to which management innovations have been both applied and publicized, but it is not unique. Other leading practitioners of open innovation, such as 3M or Procter & Gamble, have also demonstrated strong dynamic capabilities that have enabled them to sustain category leadership for extended periods.

These are rich fields for future research by scholars looking for the mechanisms that tie open innovation to organizational results. For example, is it better for a firm to have strong dynamic capabilities (e.g., experience with organizational ambidexterity) before adopting open innovation? Does the adoption of open innovation lead to stronger dynamic capabilities? Which microfoundational dynamic capabilities are most valuable as complements to open innovation? What specific sensing processes have proved best able to support an open innovation approach? How does open innovation affect the distribution of value among participants? Are there cases where strategic and/or capability imperatives make open innovation the wrong choice?

China presents a particularly complex and salient set of problems for study. China has been accused of misappropriating IP assets by leveraging the openness of Western firms and universities through means such as forced technology transfer by inward investors and convincing some engineers to illegally share trade secrets. Does the history of technology transfer to China reveal any weaknesses in how open innovation is practiced? In what ways were the dynamic capabilities of the affected companies implicated? As conflict with China potentially grows into decoupling, how can dynamic capabilities and open innovation principles be applied to bridge the divide while protecting key assets in both regions?

Because of the lack of relevant data and the complexity of the variables involved, detailed case study research remains one of the best ways to explore questions about dynamic

capabilities. There is value in documenting, for example, how an open innovation ecosystem forms a positive feedback loop with top management's sensing activities, without needing to necessarily reach conclusions about which direction of influence is most valuable for performance.

A more data-driven approach involves the use of validated questionnaires. These can allow carefully selected respondents to self-assess a firm's dynamic capabilities and other characteristics, including openness to external knowledge, along a Likert scale (e.g., Danneels, 2008; Jantunen et al., 2005). This enables the identification of regularities across companies that case studies would be unable to show.

Strategy and innovation scholars have a shared interest in understanding the processes and linkages that connect innovation activities to competitive advantage. As this paper has endeavored to make clear, dynamic capabilities and open innovation are both useful constructs for addressing these issues, promising many more years of fruitful synergies in research and practice.

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