ADVANTAGES OF COLLABORATING

Collaborating on development projects can offer a firm a number of advantages. First, collaborating can enable a firm to obtain necessary skills or resources more quickly than developing them in-house.[6] It is not unusual for a company to lack some of the complementary assets required to transform a body of technological knowledge into a commercial product. Given time, the company can develop such complementary assets internally. However, doing so extends cycle time. Instead, a company may be able to gain rapid access to important complementary assets by entering into strategic alliances or licensing arrangements.[7] For example, when Apple was developing its LaserWriter, a high-resolution laser printer, it did not possess the technological expertise to produce the printer's engine, and developing such capabilities in-house would have taken a long time. Apple persuaded Canon, the market leader in printer engines, to collaborate on the project.[8] With Canon's help, Apple was able to bring the high-quality printer to market quickly.

Second, obtaining some of the necessary capabilities or resources from a partner rather than building them in-house can help a firm reduce its asset commitment and enhance its flexibility. This can be particularly important in markets characterized by rapid technological change. High-speed technological change causes product markets to rapidly transform. Product life cycles shorten, and innovation becomes the primary driver of competition. When technology is progressing rapidly, firms may seek to avoid committing themselves to fixed assets that may rapidly become obsolete. They may choose to become more narrowly specialized and to use linkages with other specialized firms to access resources they do not possess in-house.

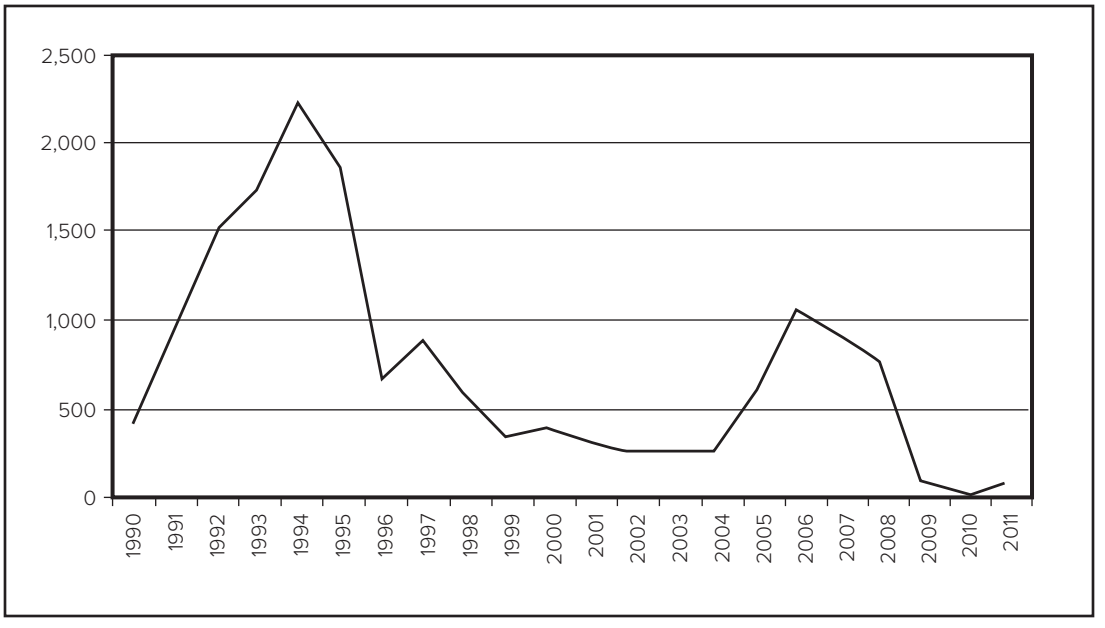
Third, collaboration with partners can be an important source of learning for the firm. Close contact with other firms can facilitate both the transfer of knowledge between firms and the creation of new knowledge that individual firms could not have created alone.[9] By pooling their technological resources and capabilities, firms may be able to expand their knowledge bases and do so more quickly than they could without collaboration.

Fourth, one primary reason firms collaborate on a development project is to share the costs and risks of the project. This can be particularly important when a project is very expensive or its outcome highly uncertain.[10]

Finally, firms may also collaborate on a development project when such collaboration would facilitate the creation of a shared standard. Collaboration at the development stage can be an important way of ensuring cooperation in the commercialization stage of a technology, and such cooperation may be crucial for technologies in which compatibility and complementary goods are important. For example, in 1997 Nokia, Motorola, and Ericsson formed a nonprofit corporation called the WAP Forum to establish a common wireless telecommunication format. WAP stands for Wireless Application Protocol. It is an open, global communication standard that is intended to enable users of mobile devices such as cell phones, pagers, and smart phones to easily and quickly access information from the Internet. By establishing the WAP Forum, the companies hoped to prevent the emergence of multiple competing standards. In 2002, the WAP Forum merged with the Open Mobile Architecture initiative to form the Open Mobile Alliance (OMA). By early 2003, more than 200 mobile operators, equipment producers, and software developers had signed on to the standard.[11]

FIGURE 8.4
Worldwide Formation of New Technology or Research Alliances, 1990–2011

Source: Data from Thomson's SDC Platinum Database.



joint venture
A partnership between two or more firms involving a significant equity stake by the partners and often resulting in the creation of a new business entity.

Not all such ventures are so successful, however. For example, in 1992, IBM, Apple, and Hewlett-Packard formed a **joint venture** called Taligent to jointly develop and promote an operating system that could overthrow Microsoft's Windows as the dominant standard in personal computer operating systems. After spending three years and $50 million developing and promoting the new operating system standard, the venture had failed to meet expectations and was ultimately dissolved.

Worldwide, use of technology or research alliances (joint R&D agreements, cross-technology transfer, or cross licensing) climbed to a sharp peak in the mid-1990s (see Figure 8.4), driven in large part by dramatic increases in alliance activity by firms in the information technology industries (computers, communication equipment, and software). Alliance activity then subsequently declined to very low levels at the turn of the decade, but began to climb again in the mid 2000s.[12]

TYPES OF COLLABORATIVE ARRANGEMENTS

Collaboration can include partnering with suppliers, customers, competitors, complementors, organizations that offer similar products in different markets, organizations that offer different products in similar markets, nonprofit organizations, government organizations, universities, or others. Collaboration can also be used for many different purposes, including manufacturing, services, marketing, or technology-based objectives.

In North America, as many as 23 percent of all alliances are for research and development activities, compared to 14 percent in Western Europe and 12 percent in Asia.[13]

Collaboration arrangements can also take many forms, from very informal alliances to highly structured joint ventures or technology exchange agreements (**licensing**). The most common forms of collaborative arrangements used in technological innovation include strategic alliances, joint ventures, licensing, outsourcing, and collective research organizations.

licensing
A contractual arrangement whereby one organization or individual (the licensee) obtains the rights to use the proprietary technology (or trademark, or copyright, etc.) of another organization or individual (the licensor).

Strategic Alliances

Firms may use strategic alliances to access a critical capability that is not possessed in-house or to more fully exploit their own capabilities by leveraging them in another firm's development efforts. Firms with different capabilities necessary for developing a new technology or penetrating a new market might form alliances to pool their resources so that collectively they can develop the product or market faster or less expensively. Even firms that have similar capabilities may collaborate in their development activities in order to share the risk of a venture or to speed up market development and penetration. Large firms might form alliances with small firms in order to take a limited stake in the smaller firm's development efforts, while small firms might form alliances with large firms to tap the larger firm's greater capital resources, distribution and marketing capabilities, or credibility.[14] For example, many large pharmaceutical firms have allied with small biotechnology firms for their mutual benefit: The pharmaceutical firms gain access to the drug discoveries of the biotechnology companies, and the biotechnology companies gain access to the capital resources, manufacturing, and distribution capabilities of the pharmaceutical firms.

capability complementation
Combining ("pooling") the capabilities and other resources of partner firms, but not necessarily transferring those resources between the partners.

Alliances can enhance a firm's overall level of flexibility.[15] Through an alliance, firms can establish a limited stake in a venture while maintaining the flexibility to either increase their commitment later or shift these resources to another opportunity.[16] Firms can use alliances to gain an early window on emerging opportunities that they may want to commit to more fully in the future. Alliances also enable a firm to rapidly adjust the type and scale of capabilities the firm can access, which can be very valuable in rapidly changing markets.

Alliances are also used to enable partners to learn from each other and develop new competencies. Alliance partners may hope to transfer knowledge between the firms or to combine their skills and resources to jointly create new knowledge. However, alliance relationships often lack the shared language, routines, and coordination that facilitate the transfer of knowledge—particularly the complex and tacit knowledge that is most likely to lead to sustainable competitive advantages.[17] To use alliances for learning requires a serious commitment of resources, such as a pool of dedicated people willing to travel between the home firm and partner firm, test-bed facilities, and active procedures for internalizing what has been learned.[18]

capability transfer
Exchange of capabilities across firms in such a manner that partners can internalize the capabilities and use them independently of the particular development project.

Yves Doz and Gary Hamel argue that it is useful to categorize a firm's alliance strategy along two dimensions.[19] The first dimension is the degree to which alliances practice **capability complementation** versus **capability transfer**. The second dimension is whether the firm manages each alliance individually or manages a collective network of alliances (see Figure 8.5).

FIGURE 8.5
Technology Alliance Strategies

Source: From Y. Doz and G. Hamel, 1997, "The Use of Alliances in Implementing Technology Strategies." In M. L. Tushman and P. Anderson, *Managing Strategic Innovation and Change,* 1997. By permission of Oxford University Press, Inc.

	Individual Alliance	Network of Alliances
Capability Complementation	A GE-SNECMA alliance	B Corning Glass alliances
Capability Transfer	C Thomson-JVC alliance	D Aspla

In quadrant A are firms that forge an individual alliance to combine complementary technologies or skills needed for a project. For example, in the mid-1970s, General Electric (GE) and SNECMA (a French jet engine producer) formed a joint venture called CFM International to develop a new jet engine. The venture would combine GE's F101 turbojet with SNECMA's low-pressure fan expertise to create a powerful and fuel-efficient engine. Because the F101 was considered a sensitive military technology by the U.S. Air Force, the venture was set up to carefully avoid the exchange of proprietary technology between the firms. GE would build the F101 portion as a sealed "black box," which could then be shipped to a separate assembly location. The resulting engine, the CFM-56, became the most successful jet engine in the history of aviation.[20]

In quadrant B are firms that use a network of alliances to combine complementary skills and resources. For example, Corning, known primarily as a producer of glass products, has created a web of alliances with partners that have complementary skills in order to extend its glass technology into fields as diverse as medical products, computer products, and fiber optics. Instead of attempting to internalize its partners' technologies, Corning views its relationships with its partners as a form of extended enterprise that forms a flexible and egalitarian network of independent businesses.[21]

In quadrant C are firms that use individual alliances to transfer capabilities between them. Doz and Hamel provide the example of the alliance between JVC and Thomson. While both companies produce VCRs, Thomson wanted to glean product technology and manufacturing expertise from JVC, whereas JVC needed to learn how to penetrate the European market from Thomson. Both sides perceived an equitable opportunity for gain from exchanging capabilities.

In quadrant D are firms that use a network of alliances to exchange capabilities and jointly develop new capabilities. The collective research organizations described later in the chapter (including Aspla and the National Center for Manufacturing Sciences) are examples of alliance networks in which a formal body has been created to govern the network. These organizations are designed to enable their member organizations to collectively create, share, and utilize knowledge. In building an alliance portfolio, managers should think carefully about competitive effects, complementing effects, and network structure effects. First, if multiple alliances are serving the same strategic needs, there is a risk of redundant resources investment, or competitive

conflict between partners. The costs and benefits of this should be carefully weighed as alliance partners could become adversaries. Second, complementary alliances can be super-additive if carefully managed. For example, a pharmaceutical firm might be using an alliance to develop a drug target with one partner, and another alliance to develop a delivery method for that same drug, enabling it to bring the product to market faster.[22] In this situation, the benefits of each alliance are accentuated by the benefits of the other. Finally, managers should consider how their portfolio of alliances positions them in the web of relationships that connects their firm, their partners, and their partners' partners.[23] Such networks can be very influential in the diffusion of information and other resources, and being positioned well in an alliance network can confer significant advantages (see the Research Brief on "Strategic Positions in Collaborative Networks" later in this chapter).

The opportunities and flexibility that can be gained through using alliances can come at a cost. The potential for opportunism and self-interest exists for all parties of an alliance due to limited levels of mutual commitment.[24] Studies suggests that between 30 percent to 70 percent of alliances fail by neither meeting the goals of the partners, nor delivering the operational or strategic benefits for which they were intended.[25] Firms need to be constantly on guard to ensure that the alliance does not inadvertently result in giving too much away to a potential competitor. According to Doz and Hamel, while collegiality between partners can facilitate trust and communication, *too much* collegiality may be a warning sign that information gatekeepers within the firm are not being sufficiently vigilant.[26] Employees at all levels should be regularly informed about what information and resources are off-limits to the partner, and the firm should stringently monitor what information the partner requests and receives.[27]

Joint Ventures

Joint ventures are a particular type of strategic alliance that entails significant structure and commitment. While a strategic alliance can be any type of formal or informal relationship between two or more firms, a joint venture involves a significant equity investment from each partner and often results in establishment of a new separate entity. The capital and other resources to be committed by each partner are usually specified in carefully constructed contractual arrangements, as is the division of any profits earned by the venture.

For example, in 2005, New Life Scientific (of the United States) and InvaPharm LLC (of the Ukraine) announced that they would form a joint venture called Invamed Pharma Incorporated to manufacture prescription pharmaceuticals for the United States market. New Life Scientific would provide funding for the project while InvaPharm would supply technical know-how and intellectual property. Each party would have a 50 percent stake in the venture.

Licensing

Licensing is a contractual arrangement whereby one organization or individual (the *licensee*) obtains the rights to use the proprietary technology (or trademark, copyright, etc.) of another organization or individual (the *licensor*). Licensing enables a firm to rapidly acquire a technology (or other resource or capability) it does not possess.

For example, when Microsoft realized it had lost precious time to Netscape and needed to get a Web browser to market fast, it licensed the software it needed to produce Internet Explorer from Spyglass Inc. Microsoft also bought several companies (including Vermeer Technologies, Colusa Software, and eShop Inc.) to provide other Internet utilities.

For the licensor, licensing can enable the firm's technology to penetrate a wider range of markets than it could on its own. For example, Delphi Automotive, a supplier to the automotive industry, had developed a software program that can simulate various aspects of machining, including turning, milling, and drilling. The software enabled manufacturers that do high-volume machining to identify ways of improving their machining processes. Delphi had developed the software for its own use, but then realized it could make more money by licensing the software to others.[28]

Licensing a technology from another firm is typically much less expensive for a licensee than developing a new technology in-house. As discussed in earlier chapters, new product development is both expensive and risky; through licensing, a firm can obtain a technology that is already technically or commercially proven. Though it is often presumed that a technology available for license is an unlikely source of advantage (because it is typically available to many potential licensees), Procter & Gamble's experience shows that this need not be the case. Through its "Connect and Develop" program, it focuses on sourcing ideas and technologies external to the firm that it can then add value to in its labs. Thus while a licensed technology provides the foundation for a new product, the product that arrives to market typically draws on the deep (and difficult to imitate) expertise and other resources P&G possesses.[29] This approach is emblematic of the "Open Innovation" approach now being used by many firms.[30]

Licensing agreements typically impose many restrictions on the licensee, enabling the licensor to retain control over how the technology is used. However, over time, licensees may gain valuable knowledge from working with the licensed technology that can enable them to later develop their own proprietary technologies. In the long run, the licensor's control over the technology may erode.

Sometimes firms license their technologies to preempt their competitors from developing their own competing technologies. This can be particularly important if competitors are likely to be able to imitate the primary features of the technology or if the industry has strong pressures for the adoption of a single dominant design (see Chapter Four). By licensing out the technology to potential competitors, the licensor gives up the ability to earn monopoly rents on the technology. However, doing so may prevent potential competitors from developing their own proprietary technologies. Thus, licensing enables a firm to opt for a steady stream of royalties rather than gambling on the big gain—or big loss—of having its technology compete against others for market dominance.

Outsourcing

Firms that develop new technological innovations do not always possess the competencies, facilities, or scale to perform all the value-chain activities for the new innovation effectively or efficiently. Such firms might outsource activities to other firms.

contract manufacturing
When a firm hires another firm (often a specialized manufacturer) to manufacture its products.

One common form of outsourcing is the use of contract manufacturers. **Contract manufacturing** allows firms to meet the scale of market demand without committing to long-term capital investments or an increase in the labor force, thus giving the firm greater flexibility.[31] It also enables firms to specialize in those activities central to their competitive advantage while other firms provide necessary support and specialized resources the firm does not possess. Contract manufacturing further enables a firm to tap the greater economies of scale and faster response time of a dedicated manufacturer, thereby reducing costs and increasing organizational responsiveness to the environment.[32] For example, when Apple redesigned a screen for its iPhone just weeks before it was due on the shelves, it was able to call a foreman at a Chinese factory it was working with, who woke up the 8,000 workers sleeping in dormitories. The workers were given biscuits and tea, and immediately started a twelve-hour shift fitting glass screens into beveled frames. Within 96 hours, the plant was manufacturing more than 10,000 iPhones a day. "The speed is breathtaking," an Apple executive noted. "There's no American plant that can match that." Whereas Apple directly employs 43,000 people in the United States and 20,000 people in other countries, an additional 700,000 people work for Apple's contractors, engineering, building, and assembling Apple products. In response to a query from U.S. President Barack Obama of "What would it take to make iPhones in the United States?" Steve Jobs replied, "Those jobs aren't coming back." Apple executives noted that the vast scale of overseas factories, and the flexibility, diligence, and industrial skills of their workers had outpaced American counterparts. But in response to criticisms about what this had done to employment in the United States, the executives explained, "We sell iPhones in over a hundred countries . . . . Our only obligation is making the best product possible."[33]

Other activities, such as product design, process design, marketing, information technology, or distribution can also be outsourced from external providers. For example, large contract manufacturers such as Flextronics and Solectron now often help firms design products in addition to manufacturing them. Companies such as IBM or Siemens will provide a company with a complete information technology solution, while United Parcel Service will take care of a company's logistics and distribution needs. Outsourcing can have a number of downsides, however. Reliance on outsourcing may cause the firm to forfeit important learning opportunities, potentially putting it at a disadvantage in the long run.[34] By not investing in development of in-house capabilities, a firm might not develop many of the skills and resources related to its products that enable the development of future product platforms. The firm risks becoming hollow.[35] In fact, Prahalad and Hamel argue that Korean firms such as Goldstar, Samsung, and Daewoo have explicit missions to capture investment initiative away from potential competitors by serving as contract manufacturers for them. This allows the Korean firms to use would-be competitors' funds to accelerate their own competence development, while the competitors' competencies erode.[36]

Outsourcing can also impose significant transaction costs for a firm.[37] Contract manufacturing, for example, requires a well-specified contract: Product design, cost, and quantity requirements must be clearly communicated and generally specified up front. The contracting firm may also have to go to great lengths to protect itself from having any proprietary technology expropriated by the contract manufacturer. In addition, the contract manufacturer may bear significant costs in ramping up production for

a particular firm, and must therefore specify the contract to avoid being held up by the contracting firm after the manufacturer has made investments specific to the contract.[38]

Collective Research Organizations

In some industries, multiple organizations have established cooperative research and development organizations such as the Semiconductor Research Corporation or the American Iron and Steel Institute.[39] Collective research organizations may take a number of forms, including trade associations, university-based centers, or private research corporations.

Many of these organizations are formed through government or industry association initiatives. For example, the National Center for Manufacturing Sciences (NCMS) was formed in 1986 by the U.S. Defense Department, the Association for Manufacturing Technology, the Manufacturing Studies Board, General Motors, and 20 other manufacturing companies. Its purpose was to promote collaborations among industry, government, and academic organizations. By 2012, the center had 175 U.S., Canadian, and Mexican corporate members. Typical NCMS projects involve 15 to 20 organizations and run for two to four years.[40]

Other collective research organizations have been formed solely through the initiative of private companies. For example, in 2002, six Japanese electronics manufacturers (Fujitsu, Hitachi, Matsushita Electric Industrial, Mitsubishi Electric, NEC, and Toshiba) set up a collective research company called Aspla to develop designs for more advanced computer chips. Global competition had driven down margins on chips, resulting in major losses for many of the major Japanese electronics makers. Furthermore, research in advanced chip designs had become extremely expensive. The collaborative research organization would enable the companies to share the development expense and help the Japanese semiconductor industry retain its competitive edge. Each of the companies initially invested 150 million yen ($1.3 million) in the organization, and plans were for each to contribute about $85 million annually toward joint research.[41] The Japanese government also agreed to contribute $268 million.

CHOOSING A MODE OF COLLABORATION

Figure 8.6 summarizes some of the trade-offs between solo internal development and various modes of collaboration. Solo internal development is, on average, a relatively slow and expensive way of developing a technology. The firm bears all the costs and risks, and may spend considerable time learning about the new technology, refining its designs, and developing production or service processes to implement the new technology. However, a firm that engages in solo internal development retains total control over how the technology is developed and used. Solo internal development also offers great potential for the firm to leverage its existing competencies and to develop new competencies, but offers little to no potential for accessing another firm's competencies. Therefore, solo internal development might make sense for a firm that has strong competencies related to the new technology, has access to capital, and is not under great time pressure.

Because strategic alliances can take many forms, the speed, cost, and degree of control they offer vary considerably. Some strategic alliances may enable a firm to relatively quickly and cheaply gain access to another firm's technology, but give the firm

FIGURE 8.6
Summary of Trade-offs between Different Modes of Development

	Speed	Cost	Control	Potential for Leveraging Existing Competencies	Potential for Developing New Competencies	Potential for Accessing Other Firms' Competencies
Solo Internal Development	Low	High	High	Yes	Yes	No
Strategic Alliances	Varies	Varies	Low	Yes	Yes	Sometimes
Joint Ventures	Low	Shared	Shared	Yes	Yes	Yes
Licensing In	High	Medium	Low	Sometimes	Sometimes	Sometimes
Licensing Out	High	Low	Medium	Yes	No	Sometimes
Outsourcing	Medium/High	Medium	Medium	Sometimes	No	Yes
Collective Research Organizations	Low	Varies	Varies	Yes	Yes	Yes

a low level of control over that technology. Other strategic alliances might be aimed at utilizing the firm's own technology in a broader range of markets, which can be fast and cost-effective, and still enable the firm to retain a considerable amount of control. Most alliances offer opportunities for leveraging existing competencies or developing new competencies. Strategic alliances may or may not offer potential for accessing another firm's competencies, depending on the alliance's purpose and structure.

By comparison, a joint venture is much more structured. While a joint venture typically involves developing a new technology and can take almost as long as solo internal development, it may be slightly faster due to the combination of the capabilities of multiple firms. Joint ventures enable partners to share the cost of the development effort, but they must also share control. Because joint ventures typically entail a long-term relationship between two or more firms that results in the development of a new product or business, joint ventures offer great potential for leveraging a firm's existing competencies, developing new competencies, and accessing its partners' competencies. Joint ventures may be more appropriate than a strategic alliance or solo internal development when the firm places great importance on access to other firms' competencies.

Licensing in technology offers a fast way to access a new technology that is typically lower in cost than developing it internally. The firm typically has limited discretion over what it can do with the technology, however, and thus has a low degree of control. Depending on the firm's capability mix and the nature of what it has licensed, licensing can sometimes offer the potential of leveraging a firm's existing competencies, developing new competencies, and accessing another organization's competencies. For example, many potential drugs or medical therapies are first developed in university research centers or medical schools. Pharmaceutical and biotechnology firms then license the right to explore whether the discovery has potential as a commercially viable medical treatment using their own drug development, testing, and manufacturing capabilities. Licensing the promising compounds or therapies enables

the pharmaceutical and biotechnology firms to obtain drug targets quickly, thus helping them keep their pipelines full. It also helps the firms focus their development efforts on projects that have already demonstrated some treatment potential.

Licensing can also be a good way for a firm to obtain enabling technologies that are necessary for its products or services, but that are not central to the firm's competitive advantage. For example, while producers of digital cameras need to be able to incorporate batteries that are long-lasting, light, and affordable in their camera designs, most camera producers do not perceive battery power as being central to their competitive advantage, and thus rely on externally sourced technology to meet this need. Licensing can also be an effective way for a firm that lacks technological expertise to gain initial market entry and experience that it can later build upon in developing its own technological capabilities.

Licensing out a technology offers a fast way for a firm to extend the reach of its technology that is nearly free and offers the potential for royalties. The firm relinquishes some control over the technology, but also retains a moderate amount of control through restrictions in the license agreement. Licensing out a technology explicitly leverages the firm's existing competencies by enabling the technology to be deployed in a wider range of products or markets than the firm participates in itself. It offers little opportunity for developing new competencies, however. Sometimes licensing out a technology is a way of accessing another firm's competencies, as when a firm uses licensing to expand its technology into products or markets in which it has little expertise.

When a firm outsources design, production, or distribution of its technology, it is intentionally giving up a moderate amount of control to rapidly gain access to another firm's expertise and/or lower cost structure. While the firm pays to outsource activities, it typically pays less than it would to develop the capability of performing those activities in-house, and it gains access to those activities more quickly than it could develop them in-house. While outsourcing offers little opportunity for building new competencies, it can leverage the firm's existing competencies by enabling it to focus on those activities in which it earns its greatest returns. For example, Nike's strategy of outsourcing nearly all its athletic shoe production to contract manufacturers in Asia enables Nike to focus on its competitive advantages in design and marketing while tapping the lower labor and capital costs of its manufacturers. Thus, outsourcing might sometimes be appropriate for (*a*) firm activities that are not central to its competitive advantage, (*b*) activities that would cause the firm to give up crucial flexibility if performed in-house, or (*c*) activities in which the firm is at a cost or quality disadvantage.

Participation in a collective research organization is typically a long-term commitment rather than an effort to rapidly access capabilities or technology. As with strategic alliances, the nature of a firm's participation in a collective research organization can take many forms; thus, cost and control can vary significantly. Collective research organizations can be very valuable ways for the firm to leverage and build upon its existing competencies, as well as to learn from other participating organizations. Though collective research organizations may not yield immediate returns in the form of new products or services, participating in collective research organizations can be extremely useful in industries that have complex technologies and require considerable investment in basic science. By pooling their knowledge and effort, firms in collective research organizations can share the cost and risk of basic research, while accelerating the rate at which it yields useful new solutions.

CHOOSING AND MONITORING PARTNERS

Gaining access to another firm's skills or resources through collaboration is not without risks.[42] It may be difficult to determine if the resources provided by the partner are a good fit, particularly when the resource gained through the collaboration is something as difficult to assess as experience or knowledge. It is also possible that a collaboration partner will exploit the relationship, expropriating the company's knowledge while giving little in return. Furthermore, since managers can monitor and effectively manage only a limited number of collaborations, the firm's effectiveness at managing its collaborations will decline with the number of collaborations to which it is committed. This raises the possibility of not only diminishing returns to the number of collaborations, but also negative returns as the number of collaborations grows too large.[43] These risks can be minimized if the company limits the number of collaborations in which it engages, chooses its partners very carefully, and establishes appropriate monitoring and governance mechanisms to limit opportunism.[44]

Partner Selection

The success of collaborations will depend in large part on the partners chosen. A number of factors can influence how well suited partners are to each other, including their relative size and strength, the complementarity of their resources, the alignment of their objectives, and the similarity of their values and culture.[45] These factors can be boiled down to two dimensions: resource fit and strategic fit.[46]

Resource fit refers to the degree to which potential partners have resources that can be effectively integrated into a strategy that creates value.[47] Such resources may be either complementary or supplementary. Most collaborations are motivated by the need to access resources the firm does not possess; such collaborations are based on the combination of complementary resources. Most of the examples in this chapter have entailed complementary resources, such as the combination of Apple's computer technology with Canon's printer engine technology, or the combination of Sangamo's gene editing technology with the clinical testing and manufacturing expertise of larger biotechnology and pharmaceutical firms. Other collaborations seek supplementary stocks of resources that are similar to those possessed by the firm. The pooling of supplementary resources can enable partners to achieve market power or economies of scale. For example, British Petroleum and Mobil consolidated many of their operations in Europe to gain economies of scale and lower their cost structure.[48]

Strategic fit refers to the degree to which partners have compatible objectives and styles. The objectives of the partners need not be the same as long as the objectives can be achieved without harming the alliance or the partners. Not knowing a partner's true objectives or forging an alliance with a partner with incompatible objectives can result in conflict, wasted resources, and forfeited opportunities. Das and Teng provide an example of an alliance forged between General Motors and South Korea's Daewoo. While GM desired to use the alliance to drive down costs on its existing automobile models, Daewoo's objective was to develop new technologies and design new models. The alliance ultimately failed because of the incompatibility of GM's cost orientation and Daewoo's R&D orientation.[49]

Firms can also evaluate potential partners using many of the same tools used to evaluate the firm's own position and strategic direction (for a review of these, see

Chapter Six). This includes assessing how collaboration with the partner is likely to impact the firm's opportunities and threats in its external environment; its internal strengths, weaknesses, or potential for sustainable competitive advantage; and the firm's ability to achieve its strategic intent.

Impact on Opportunities and Threats in the External Environment

Assessing the collaboration's impact on the firm's opportunities and threats includes asking such questions as:

- How would the collaboration change the bargaining power of customers or suppliers?
- Would the collaboration impact the threat of entry? For example, is the partner likely to become a new competitor? Does the partnership raise barriers to entry for other potential entrants?
- Would the collaboration impact the firm's position vis-à-vis its rivals?
- Would the collaboration influence the availability of complementary goods or the threat of substitutes?

Impact on Internal Strengths and Weaknesses

Assessing the collaboration's impact on the firm's strengths and weaknesses includes asking such questions as:

- How would the collaboration leverage or enhance the firm's strengths? Does the collaboration put any of those strengths at risk?
- How would the collaboration help the firm overcome its weaknesses?
- Is the collaboration likely to yield a position of competitive advantage that is difficult for competitors to imitate? Is such a competitive advantage achievable without collaborating?
- Would the collaboration leverage or enhance the firm's core capabilities?
- Is the collaboration likely to impact the firm's financial strengths or weaknesses?

Impact on Strategic Direction

Assessing the fit of the collaboration with the firm's strategic direction includes asking such questions as:

- How does this collaboration fit with the firm's statement of strategic intent?
- Is the collaboration likely to help the firm close any resource or technology gap between where it is now and where it would like to be?
- Are the objectives of the collaboration likely to change over time? How are such changes likely to be compatible or incompatible with the firm's strategic direction?

Partner Monitoring and Governance

governance
The act or process of exerting authority and/or control.

Successful collaboration agreements typically have clear, yet flexible, monitoring and **governance** mechanisms.[50] Not surprisingly, the more resources put at risk by the collaboration (for example, the greater the upfront investment or the more valuable the intellectual property contributed to the collaboration), the more governance structure partner firms are likely to impose on the relationship.[51] There are three main types of

Research Brief Strategic Positions in Collaborative Networks[a]

A growing body of research suggests that a firm's position within a collaborative network influences its access to information and other resources, and its influence over desired outcomes. For example, a firm with a highly central position in the network is typically expected to have access to a greater amount of information and to be able to access that information more quickly than a firm in a more peripheral role. A firm that occupies a key brokerage role in a network (e.g., a firm that serves as a bridge between two otherwise disconnected groups of firms) is thought to benefit both by having exposure to diverse information (assuming the two groups of firms have quite distinct information resources) and by occupying a key gatekeeping position that controls the flow of information between the two groups. A firm's position within the network may also serve as a valuable signal to other potential partners about the value of its resources. For example, if a firm is young or small but has alliances with important and innovative firms, these alliances can serve as reputation endorsements when the quality of the firm is otherwise difficult to assess.[b] Such endorsements may enhance the firm's likelihood of receiving financing or attracting other important alliances.

Consider Figure 8.7, which shows the "main component" (the largest connected group) of the global technology collaboration network in 1998 (based on R&D alliances, cross-technology transfer agreements, and cross-licensing agreements formed from 1996 to 1998, as reported by SDC's alliance database).[c] The large group on the top of the network is mostly composed of organizations in industries whose underlying technology is electronics-based (computer hardware and software, communication equipment and service, transportation equipment, etc.), and the group on the bottom is dominated by organizations in the chemical and medical-based industries (pharmaceuticals, chemicals, health services, medical equipment, etc.). This grouping also includes a large concentration of educational organizations (primarily universities). As can be seen, some firms (e.g., IBM, Toshiba, Eli Lilly) have significantly more alliances than others. The number of links an organization has in a network is known as its "degree centrality." In general, the degree centrality of an organization tends to be strongly related to its size and prominence. The size and prominence of an organization help to determine how attractive it is to potential partners, and only large organizations typically have the resources necessary to manage a large number of alliances. An organization does not, however, have to be large or prominent to occupy a key brokerage position. Brokerage refers to how crucial an organization is to the transmission of information or other resources through the network. It is often measured with "betweenness centrality," which is the number of times an organization lies on the shortest path between other pairs of organizations. The three organizations with the highest betweenness centrality scores in this network are IBM, Eli Lilly, and PPD (Pharmaceutical Product Development Inc., a contract research organization). PPD had only three alliances during the 1996–1998 time period, but Figure 8.7 shows just how important those alliances were to the overall connectivity of the network. IBM's link to PPD and PPD's link to Eli Lilly provide a bridge from the center of the electronics group to the center of the chemical/medical group. This link is one of only three observed bridges between the two groups, and is the most central of those three.

There is still considerable debate about the relative benefits of centrality and brokerage. While many scholars argue that highly central firms have the greatest access to information and influence over information transmission, others argue that highly central firms are constrained by their many relationships to other organizations and suggest that it is better to occupy a brokerage role. There are similar debates about brokerage—while a broker is likely to have access to diverse information and serves as a key gatekeeper for the transmission

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