CHAPTER 13

FINANCING STRATEGIES AND VENTURE CAPITAL

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With access to greater financial resources, established firms should be at an advantage over start-ups in financing emerging technologies. But the internal resource allocation systems of large companies often put them at a disadvantage over companies that rely on external sources. Corporate allocation is usually based on earning returns greater than the firm's cost of capital. The adoption of emerging technologies and the higher risks and potential returns usually associated with them requires a more sophisticated approach. In this chapter, the authors examine some of the obstacles for established firms, alternative models for resource allocation, and strategies for external financing.

A telecommunications company is considering a shift in strategy. Top managers feel that traditional telecommunications is not a growth business for the future. They believe that the future of the industry lies in information technologies. New ideas, not the old wired networks, will be the source of value in the future. The managers think that it is important to make a move in that direction now, before it is too late, so the company creates a new information technology division and develops a new strategy for the business.

To support the new information technology initiative, managers could provide venture capital to a separate company or create its own "external" investment through a spinoff funded by corporate capital. Alternatively, the company might employ internal financing. The telecommunications business is currently very profitable and generates a large operating cash
flow, which has historically been reinvested in the business, used to fund acquisitions to diversify out of telecommunications, or to pay dividends to shareholders. Management decides that the telecommunications business might now be used as a cash cow to fund the long-term shift in strategy to information technology.

Historically, the company has allocated resources based on its cost of capital, which in recent years has been approximately 10 percent. This number has been used as the hurdle rate, or minimal acceptable rate of return. Businesses within the old telecommunications business have been expected to earn at least 10 percent rate of return. It is expected that in the future, the information technology division will have many investments that will offer rates of return in excess of 10 percent and that resources will gradually be redeployed into the information technologies division and away from the telecommunications division.

Managers in the information technology business might argue that the new business should not be held to the 10 percent hurdle, particularly in the short run. Strategy should drive resource allocation and not vice versa. If the company’s vision is to move into emerging technologies to provide a future for the firm, then resource allocation should simply support the vision.

But the management of the old telecommunications division argues that there is a fundamental flaw in this resource allocation system. The telecommunications division has successfully earned in excess of the company’s cost of capital in spite of historical regulatory constraints. The division feels that the business has potential competitive advantages for the future as it is deregulated. The old-business managers argue further that as the company shifts to this emerging technology, the overall risk in the company’s operations will increase. This will lead to an even higher cost of capital and necessitate a higher rate of return.

Continuing to allocate capital using the current resource allocation system will, de facto, lead to the telecommunications division becoming a cash cow to feed the growth of the information technology division. That may seem appropriate given the strategic vision of the telecommunications company but it may be inappropriate if the company has no competitive advantage in information technology that will allow it to earn the likely higher cost of capital associated with this new and probably more risky activity. The risk of the emerging technology may not only be higher but also fundamentally different from the risk of the traditional telecommunications business.
FINANCING STRATEGIES AND VENTURE CAPITAL

Both the managers in the old communications business and the managers of the information technology business have valid points. How can senior managers best build for the future without undermining its past strengths? How can they provide good stewardship of shareholders’ funds while launching new strategic initiatives based on uncertain technologies? These are some of the central challenges and trade-offs facing companies as they begin to develop emerging technologies. A legitimate role of the discipline of resource allocation is to try to make sure that capital is allocated to businesses where there is a believable story that risk adjusted cost of capital will be earned and economic value created. This chapter examines these challenges for internal resource allocation and also explores strategies for external financing of new technologies, using strategies such as venture capital and initial public offerings (IPOs).

FINANCING EMERGING TECHNOLOGIES IN CORPORATIONS

The financial objective of a corporation such as our telecommunications firm should be the attempt to create sustained, and sustainable, economic value. In considering any investment, the company needs to be able to ensure that investor funds are being used responsibly. In other words, the expected returns of the investment need to be greater than some minimal return, usually referred to as the cost of capital. This cost must reflect the risk inherent in the investment and therefore will differ across different divisions. In our example, the telecommunications division should use a cost of capital reflecting risk in the telecommunications industry and the information technology division should use a cost of capital reflecting risk in that industry.

The cost of capital in a particular industry is calculated by considering “pure play” firms that are entirely focused on the industry. It is found by taking a weighted average of such companies’ current after-tax cost of borrowing and their cost of equity. In this way the management sets the cost of capital equal to the opportunity costs of investors. In other words, to justify retaining funds, the reinvested earnings must be expected to provide at least the return that the shareholders could have obtained if the earnings had been distributed in dividends and invested in another company at about the same risk.

The key to sustained value creation is earning more than cost of capital in both good years and bad in all divisions. Earning cost of capital in
competitive business requires the existence of a competitive advantage that a company can utilize to earn this rate of return. An inevitable process of change takes place in most businesses over the years as the customers, competition, economy, and technology change.

From Physical Assets to Intangible Assets

One of the greatest challenges of resource allocation in emerging technologies—and one of the reasons the telecommunications managers had trouble seeing eye to eye with managers in the new information technology business—is that the sources of value for emerging technologies tend to be quite different from the sources of value for traditional businesses. One hundred years ago, successful companies such as U.S. Steel had most of their people involved in managing physical assets. There were a few people who were looking for different ways to fuel the blast furnace, or trying different types of raw materials to see what would happen, but most of the value was derived not from knowledge but from physical assets.

Today's successful companies are firms such as Microsoft that can continuously create new ideas. Almost everyone in this firm is engaged in trying to find new formulas and better ways to do things. There are some people involved in managing physical assets, such as putting disks into boxes, but those people are a very small part of the process of value creation. By far, the greatest value is from new ideas.

Economist Paul Romer points out that the underlying quantity of raw materials used in our economy has not changed that much over time, yet we are much wealthier than we were 100 years ago.1 Where did the added value come from? In spite of limited quantity, the real prices of these raw materials have declined over the past 100 years. We have taken this raw material that was available to us and rearranged it in ways that made it more valuable. It is not the raw materials but the rearrangement that has created this wealth. Underlying this process of rearrangement are sets of instructions, formulas, recipes, and methods of doing things that are often classified as intangible assets. We need to think beyond the distinction between human capital and physical capital to the importance of these ideas.

Because of these differences, the financial snapshot of knowledge-based industries such as biotechnology and software is quite different from asset-intensive businesses. The knowledge-based firms tend to have high P/E ratios, low dividend payout ratios, low debt/capital ratios and varying levels of current profitability, as illustrated in Table 13.1. More traditional
### Table 13.1
Industry Financial Characteristics

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<tr>
<th></th>
<th>P/E</th>
<th>Payout</th>
<th>Debt/Capital</th>
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(continued)

tangible asset-based industries such as chemicals and telecommunications have low P/E ratios, high dividend payout ratios, high debt/capital ratios and more consistent levels of current profitability.

Many businesses based on traditional asset-based value (i.e., holding and using tangible physical assets such as plants and equipment) are moving to more knowledge-based value, and need to adjust their evaluation methods accordingly. Chemical companies and chemical-based pharmaceutical companies are moving into biotechnology. Telecommunications companies are moving to information technologies. Financial institutions
appear to want to make the transition to knowledge- and technology-based financial services companies. Federal Express is intent on transforming itself from an asset-based package delivery company to a knowledge-based logistics company.

The risk/return trade-offs and appropriate financial structures of these companies will need to evolve appropriately if economic value is to result from the transitions. They will need to earn higher rates of return simply to maintain value since their evolving capital structures and increased business risk will necessitate higher payoffs to obtain or retain capital to fuel growth.
Financing Strategies and Venture Capital

Sometimes, as companies move away from asset-based value, they may justify shaky investments because they are strategic or represent high-growth future markets. Strategic value and growth potential are important considerations, but for a company to earn more than cost of capital and create sustained economic value in a competitive business, more than growth possibilities are necessary. A company must have a competitive advantage to earn more than cost of capital. If the firm lacks the necessary vision, insights, skills, or core competencies, it may be unwise to invest even in the hottest growth market.

In this context, the large incumbent firm, despite greater capital at its disposal than a new entrant, may be at a disadvantage for two reasons. One problem is that it is unclear that a traditional company such as U.S. Steel will have the necessary skills, people, and knowledge to have any competitive advantage, other than the existence of capital, over start-ups focused on "recipe-based" businesses (which are easily copied). The second problem is that the risks involved in these emerging technology businesses are likely to be considerably greater than the risks in more traditional businesses.

These higher risks can be seen in the higher beta coefficients shown in Table 13.1. The beta coefficient is a measurement of risk from the point of view of an equity investor. It measures the undiversifiable, or systematic risk, that is left after an equity investment in a company that is added to a well-diversified portfolio of other investments. Thus, it does not measure the total risk of investing in the company but only the risk that cannot be diversified away by the equity investor. Thus, as the company redeploy capital away from the telecommunications business and into the emerging technology, there is reason to believe that the company's beta coefficient and therefore, perceived risk, will increase. Since these emerging technology companies also have lower levels of debt, the risk of the business clearly appears to be significantly higher than more traditional businesses.

This higher risk leads to a higher cost of capital and the requirement for a higher return to meet this new hurdle. If there is no competitive advantage that would allow a company to earn the higher required rate of return, the investment could very likely destroy value. It is important to be measuring the return properly. Certainly there is a timing element that must be considered. The return does not have to be earned tomorrow, but if the return is delayed it must be sufficient to compensate for the opportunity cost and the opportunity cost is high due to the risk.
The Red Herrings of Synergy and Diversification

Companies making the transition from stable, low-risk but low-growth businesses, often argue that any short-run inability to earn cost of capital will be compensated for by either synergy or diversification. These assumptions should be critically examined, because returns from both synergies and diversification may be difficult to realize in practice.

Companies in telecommunications, such as AT&T, that assumed there were great potential synergies between telecommunications and other information technologies seem to have been tremendously disappointed later. Often, achieving synergies requires competing with companies that used to be customers of the company and the synergy turns out to be negative. There have been large numbers of divestitures and spin-offs of non-synergistic businesses that have resulted. Managers need to carefully analyze expected synergies and determine whether they can actually be realized. There should be a believable story that the company’s competence in the emerging technology will be sufficient to earn cost of capital.

Diversification also may be wishful thinking. Forty years of academic research in finance has focused on the fallacy of reducing risk through corporate diversification. In well functioning capital markets, such as those in the United States and in the United Kingdom, such diversification usually can be achieved more easily, and less expensively, by equity investors in their own portfolios. There does not seem to be any real reason to believe that companies are rewarded with a lower cost of capital for such diversification since it is superfluous to shareholders.

If there is to be a justification for diversifying into an emerging technology, it must come from elsewhere. For example, such diversification may provide a way of participating in fast-growing opportunities, it may allow preemption of new rivals who will use the emerging technology as a beachhead or it may replace core product earnings lost to the emerging technology. These types of benefit can translate into high rates of return on investment.

Table 13.1 indicates that companies in emerging technology businesses also tend to have low dividend payout ratios, while companies in more traditional industries have higher payouts. A shift in strategy by the telecommunications company toward emerging information technologies would probably necessitate a shift in dividend policy. Telecommunications companies are cash cows already for their shareholders, because a large amount of cash is currently paid in dividends. If that cash is now to be used to feed
the growth of an emerging technology division, the shareholders will have to be convinced that they are better off with lower dividend payouts. Presumably, the justification that management will provide is that the emerging technology has more growth potential for the long run. However, the current shareholders may not be interested in trading current dividends for future growth and it may be hard to convince new equity investors that the current management has the skills to succeed in the emerging technology business. Also, the current shareholders may prefer to receive dividends and then directly invest them in emerging technology companies that have a competitive advantage.

If there is no synergy between the emerging technology and existing businesses within the mature company and if there is no reduction in cost of capital due to diversification, there will probably be pressure from shareholders to divest either the new division or the core business. The shareholders may even prefer that the company be split into several separate, independent entities. This has happened in companies such as Hewlett-Packard, IBM, and AT&T. In the absence of synergy and with no reduction in capital cost due to diversification, the corporate unit is now reduced to resource allocation as a means to create value. If the resources are not being optimally allocated, from a purely economic point of view, the result would be a situation in which the whole is worth less than the sum of the parts.

**Strategies for Balancing the Old and New Businesses**

The keys to success in emerging technologies can be very different from those in more traditional businesses. Different metrics for measuring performance may be necessary because of the very different looking income statements and balance sheets of emerging technologies. Wall Street analysts find that traditional metrics such as net income and P/E ratios need to be abandoned or interpreted very differently. Thus, it often makes sense for the emerging technology unit to be separated from the more traditional business. Among the approaches companies can use to bypass or modify their resource allocation processes are:

- *Real options.* The use of real options, as discussed by William Hamilton in Chapter 12, can help quantify some of the higher risks of the emerging technology. It adds some rigor to the general arguments of “strategic” value of the new business. It can also help to translate the
potential value of the emerging business, which may be understood intuitively by the managers there, into terms that old-line managers and investors can understand.

- *Equity carve-out*. Another way to separate the new business from the demands of the old is through an equity carve-out, essentially a subsidiary IPO. Thermoelectron and other companies have used equity carve-outs to create public subsidiaries in which the parent company typically retains majority ownership. Subsidiary IPOs do tend to result in significant increases in managerial autonomy since the public subsidiaries are generally governed by separate management teams and boards of directors. Equity carve-outs may improve the visibility of an emerging technology unit of a mature company, aiding in the ability to use equity financing. The equity carve-out itself raises new capital. If structured properly the equity carve-out may preserve the benefits enjoyed by small entrepreneurial organizations without sacrificing many of the advantages enjoyed by larger firms.

For the mature company to maximize the benefit of partial ownership of the emerging technology, the management system should include some key elements. The first is an incentive structure that is tied directly to the equity performance of both the public unit and the parent. The second is autonomy in strategic decisions and capital acquisition. The third is capital spending aimed at providing the public subsidiary with the flexibility to respond to changing market conditions.

- **Alliances**. As discussed by Jeff Dyer and Harbir Singh in Chapter 16, alliances can offer a powerful way to leverage resources of the firm by combining them with those of partners. If they are structured in a way in which synergies among the companies can be realized and shared, they offer a way to reduce the cost and risk of major investments in uncertain technologies.

- **Internal management structures**. These need to be flexible enough to not impose inappropriate policies, structures, or compensation from the parent organization, yet hands-on enough to achieve potential synergies. A few companies such as Johnson & Johnson and Merck appear to have achieved this balance.

Traditional analysis, in which similar kinds of investment are repeatedly considered, needs to be replaced by new analytical frameworks. Merck, for
example, has successfully developed new systems based upon continually developing new products and dropping old ones. It does this by better understanding risk through real options analysis but requiring higher rates of return where necessitated by increased risk.

EXTERNAL FINANCING OF EMERGING TECHNOLOGIES

Many successful emerging technology businesses do not have the benefit of internal resources. They begin their life in small companies that have no choice but to turn to external markets. Companies such as Microsoft, Apple Computer, and Amgen have shown how this funding can help entrepreneurial firms grow into giants using a combination of venture capital and IPOs. Even large firms can take advantage of external sources of capital through mechanisms such as the equity carve-out discussed earlier. Managers at established firms also need to understand the processes and logic of these external markets that shape the thinking of most of the small firms they might deal with in developing or acquiring emerging technologies.

Asymmetric Information

External financing suffers from the problem of asymmetric information. Lenders are less informed than borrowers about what is going on and, as a result, are unable to ensure that actions are taken in their interest. Borrowers have poor incentives when equity is used because they receive only a portion of the benefits arising from supplying effort whereas they bear the entire costs. They also may take risks that are undesirable from the lenders’ point of view because they receive the upside potential but do not bear the downside risk. \(^2\)

Equity will be used when insiders view future prospects as poor, because losses are shared between the new and old equity owners. In anticipation of this, lenders will discount equity when new issues are made, so this type of financing is particularly costly. \(^3\) Raising interest rates on loans may lead to a reduction in the quality of borrowers because the ones that will not care about the high rates are those that anticipate a high probability of default. \(^4\) Such asymmetric information problems provide the motivation for many contractual features that are observed in the financing of small firms.
The Challenge of Emerging Technologies

These arguments suggest that the firms that are easiest to fund externally are those with safe, predictable cash flows so there is symmetric information or assets that have multiple uses so that they provide good collateral. Emerging technology firms have neither predictable cash flows nor good collateral. There is typically considerable uncertainty about the costs associated with new technologies. There is often even more uncertainty about the revenues since the precise uses the new technology may be put to can be unclear. Borrowers are typically better informed about these costs and revenues than lenders such as banks. In addition, new technologies sometimes have minimal tangible assets that can be used as collateral. A substantial part of the value of emerging technologies, particularly initially, comes from the option value to continue if the initial development stages are successful.

External financing can take the form of debt or equity. Which one is preferable is truly in the eye of the beholder. Consider a scientist or engineer who has just discovered a new technology and wishes to set up a company to develop its commercial potential. What kind of financial structure is best for her? She will want to reap the maximum possible benefit from the discovery, so she will prefer the maximum possible amount of debt. If it is successful, she will receive the entire surplus; if it is unsuccessful, she will be able to default and walk away. The other great advantage of debt financing is that it allows her to hold all the equity and the attached voting rights. She will be able to maintain control and develop her ideas in the way she perceives to be best.

How attractive is debt finance of an emerging technology from the point of view of lenders? If collateral can be provided, then this may be an appealing alternative since lenders will be assured of repayment even if there is significant asymmetric information. Collateral is rarely available with early-state emerging technologies, so debt is not an attractive financing instrument for the lender. To compensate for the additional risk, a high interest rate must be charged. This has the disadvantage that it will trigger default in many states and the firm will incur the associated bankruptcy costs in a wide range of circumstances.

From the lender’s view, equity is a more attractive financing instrument. It allows the upside potential to be captured when the firm is very successful without triggering costly bankruptcy. It also gives the supplier of capital some degree of control because of the voting rights that are attached to this type of instrument.
Convertible Preferred Stock

There is thus a conflict between the founders of the firm who want to use debt and the suppliers of capital who want equity. In practice, neither pure debt nor pure equity is used but instead convertible preferred stock is the standard financing instrument in venture capital deals. Preferred stock is like debt in that it involves a fixed payment. However, if the payment is not made, this does not trigger bankruptcy. Should bankruptcy occur, preferred equity holders have a higher priority than equity holders but a lower priority than debt holders. The convertibility feature allows the venture capitalist to turn the security into equity at a predetermined ratio and capture the upside potential should the firm be successful.

Convertible preferred also means the founder of the firm can formally maintain control. Lenders maintain some control by staging the financing, making it contingent on continued progress that is consistent with the lenders’ goals. There may also be complex covenants attached to the convertible preferred which give significant control rights to the lenders.

Venture capitalists typically provide financing for a limited period of time. If a firm is successful, its needs for capital rapidly outstrip the capacity of limited partnerships that are the usual providers of venture capital. An important exit mechanism for venture capitalists is an IPO. The IPO provides the liquidity to allow venture capital to obtain a return on the investment and, because the return comes as a capital gain, it is taxed at a low rate. Even though IPOs are costly, they often represent the best means for initial investors to obtain a return. Another common exit mechanism is outright sale of the start-up to a large firm.

Venture Capital

Emerging technology firms have been supported by venture capital, which accounts for about two-thirds of the private-sector external equity financing of high-technology firms. Venture capital differs from standard forms of financing in that there is much more involvement of investors in an attempt to avoid the problems arising from asymmetric information. Lenders are also concerned about resolving the uncertainty of cash flows. The absence of collateral means they cannot simply leave the entrepreneurs to their own devices. They provide financing in stages to ensure that option value is maximized. These characteristics of venture capital mean that the contractual arrangements for venture capital are much more complex than is
usually the case. Typically, they have equity-type characteristics, with both
sides receiving part of the upside potential of the project.

Many high-technology companies in the United States have initially
been funded with venture capital. Although venture capital has been used
for over 50 years it is only in the past 20 years or so that it has become a
significant source of funds for new companies. Early venture capital funds
had limited success and it was not until regulatory changes in the late 1970s
that the venture capital industry started to grow dramatically. In 1979, the
Labor Department re-interpreted the “prudent man” provision of ERISA
to allow greater investments in new companies or venture capital funds.
Legislators also reduced maximum capital gains tax rates from 49.5 percent
to 28 percent in 1978 and to 20 percent in 1981. Finally, the widespread
use of limited partnerships, offering tax advantages to investors, encour-
aged the growth of venture capital firms.

The typical stages of venture capital investing are shown in Table 13.2.
Venture capitalists may provide funds for all or some of these stages.Usu-
ally, the amount invested grows through time. At each stage, the amount
invested is expected to carry the firm through until the next stage. By stag-
ing the financing in this way the venture capitalists can maximize the op-
tion value of the investment by making sure the correct continuation
decision is made. The form of security that is usually used in venture cap-
ital investments is convertible preferred stock, as discussed earlier.

Although venture capital is a commonly used strategy for start-up fi-
nance, it is by no means the only route that can be taken. In fact, venture
capital tends to be rather concentrated both geographically and by indus-
try. In 1996, 49 percent of venture funding went to firms in California or
Massachusetts while 82 percent went to firms specializing in information
technology or the life sciences.7

“Angel” investors are one of the most important alternatives to invest-
ments by venture capital funds. These are wealthy individuals who invest
directly in firms rather than through the limited partnerships used in ven-
ture capital. Some of them are very sophisticated entrepreneurs, with con-
siderable experience in the industry, who provide extensive advice. Others
have little experience and may be rather naive about what is involved in a
start-up. The primary criterion used by angel investors is whether the en-
trepreneur is known to them or to an associate whom they trust. The angel
market in the United States is estimated at between $10 billion and $20 bil-
lion annually. This is a substantial market when compared to $6.6 billion
for venture capital in 1995 and $20 billion in IPOs in 1995.
Table 13.2
Industry Financial Characteristics

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<thead>
<tr>
<th>The Stages of Venture Capital Investing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Seed investments.</strong> A small amount of capital provided to an inventor or entrepreneur to determine whether an idea deserves further consideration and further investment. This stage may involve building a small prototype but does not involve production for sale.</td>
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<td>2. <strong>Start-up.</strong> Start-up investments usually go to companies that are less than one year old. The company uses the money for product development, prototype testing, and test marketing (in experimental quantities to selected customers). This stage involves further study of market-penetration potential, bringing together a management team, and refining the business plan.</td>
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<tr>
<td>3. <strong>First stage—early development.</strong> Investment proceeds through the first stage only if the proceeds look good enough that further technical risk is considered minimal. Likewise, the market studies must look good enough so that management is comfortable setting up modest production and shipping facilities. First-stage companies are unlikely to be profitable.</td>
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<tr>
<td>4. <strong>Second stage—expansion.</strong> A company in the second stage has shipped enough of the product to enough customers so that it has real feedback from the market. It may not know quantitatively what speed of market penetration will occur later, or what the ultimate penetration will be, but it may know the qualitative factors that will determine the speed and limits of penetration. The company is probably still unprofitable, or only marginally profitable. It probably needs more capital for equipment purchases, inventory, and receivable financing.</td>
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<tr>
<td>5. <strong>Third stage—profitable but cash poor.</strong> For third-stage companies, sales growth is probably fast, and positive profit margins have taken away most of the downside investment risk. But, the rapid expansion requires more working capital than can be generated from internal cash flow. New venture capitalist funds may be used for further expansion. At this stage, banks may be willing to supply some credit if it can be secured by fixed assets or receivables.</td>
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<tr>
<td>6. <strong>Fourth stage—rapid growth toward liquidation point.</strong> Companies at the fourth stage of development may still need outside cash to sustain growth, but they are successful and stable enough that the risk to outside investors is much reduced. The company may prefer to use more debt financing to limit equity dilution. Commercial bank credit can play a more important role.</td>
</tr>
<tr>
<td>7. <strong>Bridge stage—mezzanine investment.</strong> In bridge or mezzanine investment situations, the company may have some idea of the timing of exit and still needs more capital to sustain rapid growth in the interim.</td>
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<tr>
<td>8. <strong>Liquidation stage—cashout or exit.</strong> This is the point at which the venture capitalists can gain liquidity for a substantial portion of their holdings in the company. The liquidity may come in the form of an IPO, an acquisition, or a leveraged buyout.</td>
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Sources: Adapted from Table 2. Sahmian (1990), p. 479.
**IPO Market.** As shown in Table 13.2, every venture capital investment is made with the expectation of a cashout or exit. Often this exit is facilitated by an initial public offering. It can also be accomplished through a private sale or management buyout.

The IPO market plays a critical role in encouraging venture capital investments. The primary reason venture capital is relatively successful in the United States is the active IPO market that exists there. A comparison of 21 countries found that the existence of an active IPO market is the most important determinant of the importance of venture capital in a country. The United States and United Kingdom have very different systems for venture capital than other countries, which may account for the dominance of these two nations in intellectual property industries and many emerging technologies, such as computers (both hardware and software), biotechnology, and the Internet. Many countries have attempted to spur the creation of new firms by encouraging the establishment of stock markets where IPOs of relatively small firms are possible.

IPOs involve substantial direct and indirect costs. Legal, auditing, and underwriting fees constitute the direct costs. For small issues, these can be high. The gross underwriting spread and out-of-pocket expenses as a percentage of offering price for U.S. registered public offerings during the period 1975–1995 were around 16 percent for issues under $10 million and even for larger issues they do not fall below 5 percent. This does not include indirect costs such as management time and effort necessary to undertake the offering.

IPOs initially tend to be underpriced, in the sense that the offering price is usually below the market price shortly after the IPO. This underpricing can be substantial. In the United States, United Kingdom, Germany, and France it is 15.3 percent, 12.0 percent, 11.1 percent, and 4.2 percent, respectively. In Japan it is significantly higher at 32.5 percent. There have been a large number of theories to explain this underpricing, from there being a “winner’s curse” to there being informational “cascades.” The underpricing phenomenon is a complex one and many factors are probably at work.

Although they do well in the short run, IPOs tend to underperform in the long run. In the United States during the first three years, new issues underperformed similar stocks by a total of about 15 percent when measured from the offering price. This phenomenon is less well understood than underpricing and most theories that have been put forward to explain it essentially rely on some form of irrationality.
In addition to going to the public markets, investors may exit through an outright sale to a large company, a merger, or a management buyout. One study of exits by U.S. venture capital firms found that 30 percent exited through IPOs, 23 percent through private sales, 6 percent through buyouts, 9 percent through secondary sales, 6 percent through complete liquidations, and 26 percent were complete write-offs. In contrast, a European study found that only 10 percent of exits were through IPOs, while 41 percent were through the sale of the company.

A Symbiotic Relationship

While information technology start-ups may require a few million dollars and a matter of months to produce viable products and find investors for an IPO, biotechnology typically takes much longer. These businesses can require hundreds of millions of dollars of cash “burn” and many years before a product has been developed and approved for sale. This could necessitate going to the equity market many times. It may be hard to take such a company public and may be preferable for a large pharmaceutical company to buy the biotechnology start-up.

Even for information technologies, large companies that are concerned about competition from emerging technologies often buy these potential future competitors. Thus, an ideal environment for emerging technologies to find financing may be a period of venture capital support and IPOs, followed by a combination of investments or acquisitions by large companies.

Given the challenges of allocating resources to emerging technology businesses within large corporations, as discussed at the opening of the chapter, large firms often choose to invest in or purchase start-ups rather than develop an emerging technology business internally. At times, they may take a minority equity position in a start-up to gain access to the new technology it creates. This is a popular strategy for big pharmaceutical firms who lack a biotechnology development capability, but have the necessary marketing, manufacturing, and financing skills.

Another possibility is to wait and acquire a successful start-up. As venture capitalists seek to cash out their investments, the large firm can buy its way into the emerging technology. At this point some of the greatest risks may be behind the start-up and at least some of its potential may be recognized.

There is thus a symbiotic relationship between venture capital markets and large corporations. The large firms give the venture capitalists the
funds to exit, while the venture capitalists provide access to the emerging technology.

There are still significant challenges involved. From the viewpoint of the mature firm, one problem is valuing the emerging technology properly and not overpaying. This would require objective unbiased assessments of enhanced revenue from emerging technologies and the higher level of risk involved to allow reasonable prices to be paid. It is too early to tell for sure but preliminary analysis would indicate that AOL's acquisition of Netscape and Johnson & Johnson's investment in Centocor resulted in reasonable prices for the potentially enhanced revenue. If a premium is paid and if there is no synergy, then the acquisition ends up earning less than cost of capital. Another risk of delaying these investments is the risk that the small start-up may have no interest in selling. Instead, it might go to an IPO and then become a formidable competitor against the large company. Or another established competitor may be interested in the same firm and either purchase it first or bid up the price. This strategic risk has to be factored into strictly financial calculations of whether to build the technological capability internally, make small investments in outside efforts, or wait and see and purchase a more mature emerging technology firm.

Managers need to understand both the internal allocation approaches and the way in which emerging technologies are initially financed outside large firms. Good investment decisions result from considering both approaches. By changing their method of internal resource allocation and understanding how to capitalize on the existence of external venture capital markets, managers can create approaches to financing emerging technologies that balance their need to provide sufficient returns to shareholders while investing in the future.