

Investment Banks and Credit Assignment: Managing Selection of International Biotechnology Start-ups

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Abstract

This paper uses grounded theory (Glazer and Strauss, 1967; Glazer, 1998) based on in-depth interviews of biotechnology investors and entrepreneurs to investigate financing as a tool of evolution. Financing determines long-term firm and technology development, particularly in biotechnology start-ups. Start-ups face a selection environment, i.e. a market that rewards firms as a holistic entity. The actors in the selection environment, i.e. investors, have general expectations or selection criteria. It is the role of mediators, like investment banks, to match overall selection criteria to the specifics within the firm through credit assignment. Through credit assignment, firms allocate resources in ways that result in positive feedback from the selection environment through obtaining financing, i.e. the selection mechanism whereby the selection environment pressures firms to adapt or perish.

Key Words: Biotechnology, Start-ups, Investment bankers, Selection, Financing

Recent statistics indicate that not only are developed countries like U.S., Canada, UK, and those of the EU building life sciences hubs, but also the BRIC (Brazil, Russia, India, China) countries have surged in foreign capital investments relating to life sciences. In May 2007, the Wall Street Journal reported that San Francisco-based Burrill & Co. is raising as much as \$200 million for an India-focused health-care fund. Additionally, Apax created a \$100M India fund in 2003-04 focused on life science and technology investing, and Warburg Pinkus continues to be predominant source of financing in India since the 1980's. As the influx of capital fuels significant growth and focus on early-stage life sciences businesses in both developed and developing countries, a number of fundamental questions arise. What are investor expectations regarding the creation of value in biotechnology start-ups? How do these expectations act as an evolutionary selection mechanism to shape a firm and its technology?

Financing is a fundamental constraint to technology development. The scarcity of financing is exacerbated as investors – who are naturally skeptical or cautious about choice and timing of investments – grapple with the ever exploding set of technology opportunities. This gap is heightened by the divide created by multiple disciplines (science, engineering, business, and finance) across multiple geographies. However, financing is not just a resource. Financing determines the survival of new firms. It is a selection mechanism whereby investors pick the winners and losers.

This paper especially focuses on the contribution of investment banks in developing biotechnology innovation strategy and managing this selection. Managing selection is especially important as biotechnology firms and their resulting products have great potential to directly affect human well-being. As Gary Pisano (2006) in his

book, *Science Business*, puts it: “The latest digital camera may delight you, but it is unlikely to save your life. A buggy piece of software may aggravate you, but it is unlikely to kill you (although it may raise your blood pressure!) Because drugs have the power to save or improve your life or the potential to harm you, the stakes are higher than for other kinds of products.” However, a great innovation quite often does not win in and of itself. Innovations need to find markets and applications to address, they need to be financed, then developed, validated (often through partnerships), productized, and commercialized by capable management teams. All of this against a backdrop of uncertain capital markets and financing availability, threats from competing technologies and therefore risk of obsolescence, and a dynamic market environment. Investment firms provide burgeoning firms the link between ultimate success in the market and internal maneuverings, especially in emerging international markets.

This paper does not investigate the impact of investing in general but specifically explores the nature of investing in biotechnology start-ups. The term biotechnology refers to any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.¹ Thus, the biotechnology industry consists of all firms that apply the principles of engineering and technology to life sciences. First, the concepts of selection environments and credit assignment are explored further and then applied to the financing of biotechnology start-ups. Using grounded theory (Glaser and Strauss, 1967; Glaser 1998) based on in-depth open-ended interviews, through a snowball sampling method (Biernacki and Waldorf, 1981) of players in biotechnology start-up financing, this paper develops a better understanding of their role in developing burgeoning start-ups and their

¹ United Nations Convention on Biological Diversity as found on Wikipedia.

technologies. The emphasis of grounded theory is on exploration and investigation. Findings are inductively and empirically derived directly from the data, rather than from interpreting the data in light of some existing theory. Hence, the analysis resulting from grounded theory is intimately and directly linked to the data in explicating themes, patterns and categories.

Selection Environments and Credit Assignment

To truly understand the role of investment bankers, we must understand the situation of a biotechnology start-up as a “living” entity interacting with its environment. Like biological organisms, the firm shapes its own representation of the environmental feedback. Thus, the firm internalizes the effects of “environmental selection”. Environmental selection is the natural process that results in the survival and propagation of some firms but not of others (Aldrich 1979; Baum and Singh 1994; Levinthal 1991). Firms adapt to the selection pressures. Namely, selection takes place through a selection mechanism or method whereby the environment can influence the firm’s outcome. Selection pressures are usually brought to bear on firms through financial payoffs. These payoffs could be in the form of profits and losses for a mature firm.

For start-ups, the form of payoff is primarily financing of the new venture. Selection operates at the level of the organization or, in the terminology of biology, at the level of the phenotype. Individual initiatives, i.e. genotypes, within firms such as writing business plans or hiring the right executive do not receive rewards per se. Through “credit assignment” (Minsky 1961) or the assigning of credit for an overall

outcome or sequence of actions to each of the antecedent actions, firms can develop in ways that are believed to be rewarded by the selection environment (Denrell et al. 2004). Credit assignment has been described to be performed by the firm as a self-critical exercise where resources are allocated based on immediate response to feedback or over time through developing mental models (Denrell et al. 2004). For example, a firm can respond to environmental feedback regarding negative organizational image by changing its organizational identity (Tripsas 2007). Changing organizational identity requires allocation of resources dedicated to altering the shared understanding about what the firm represents. Once those resources are allocated and the change is made, the environment will react positively if initial feedback was understood by the firm.

Most often, firms that change and adapt do change in a positive manner. It is those firms that experience organizational inertia and do not change in response to negative feedback from the selection environment that do not survive (Levinthal 1991). In smaller, newer firms, credit assignment might be a hard capability to achieve internally. Firms are building new capabilities but are also resource-constrained (Aldrich 1999). In order for these firms to survive and adapt to their selection environment, the credit assignment capability needs to be obtained externally, through strategic partnerships. In particular, for biotechnology start-ups the role of credit assignment can be achieved by interacting with investment banks.

The Role of Investment Banks

Investment banks and investment bankers have been investigated in-depth for their roles in issues of firm financing, accounting, and strategic advisory services (for example, see Sirri 2004). In relation to start-ups, investment banks have also been looked at for their ability to assist the firms they are connected with in obtaining financing (for example, see Hayward 2003; Higgins and Gulati 2003; Palmer and Quinn 2003). In particular, these papers look at aspects of how investment banks use their influence or networks to obtain rewards from the environment.

However, prior literature has overlooked the capability of investment banks to mobilize start-ups to reap rewards justly earned. Investment banks also provide specialized feedback, which allows firms to adjust internal actions and adapt. It seems that investment banks are involved in about 10-15% of private transactions (and the majority if not all of public transactions) in life sciences. Those private transactions that investment banks are involved in are primarily those that have high search or information costs because a) lack of time; b) complexity of the underlying technology and an investor marketing prowess; and c) lack of relationships. When investment banks do get involved, it is the most interesting scenario for selection processes because the investment bank acts as an agent or go-between.

Investment banks are highly regulated by the Securities Exchange Commission (SEC) so the interaction between each function of each bank is restrained to certain functions. As seen in the Figure below functional silos are created within the investment bank. These functional silos have limited access to the rest of the firm. The trading desk is the place of execution regarding shares and money, distributions, and other market

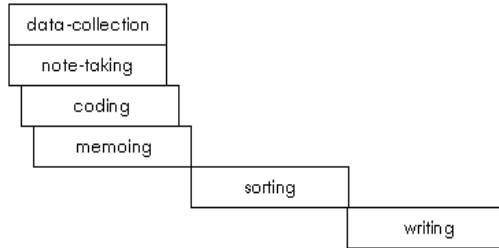
clearing trades. The sales desk is the place of marketing, taking in trading commitments, and sending out ideas about potential investments.

Research Analysts are where the research and development (R&D) is performed. Analysts take in calls and subscriptions, and send out reports, publications, and firm ratings. Corporate Services is responsible for helping client companies manage compliance issues, adhere to regulatory requirements, and manage distribution of shares by insiders and other major shareholders. The capital markets desk is the where pricing takes place by taking in market feedback and determining trend information. Corporate finance and mergers and acquisition (M&A) is where actual investment bankers sit and the daily transactions take place.

Methodology

From nine in-depth open-ended interviews with investment bankers (in the corporate finance and M&A silo) and other players in biotechnology start-up financing, the role of investment bankers in credit assignment was clarified. The research method is based on grounded theory (Glaser and Strauss, 1967; Glaser 1998) from interviews conducted through a snowball sampling method (Biernacki and Waldorf, 1981). Each interview was treated as a “case” (Eisenhardt, 1989) where the process is inductive and emergent. Validity in its traditional sense is not an issue, which instead is judged by fit, relevance, workability, and modifiability (Glaser & Strauss 1967, Glaser 1978, Glaser 1998).

Figure 1: Research Method



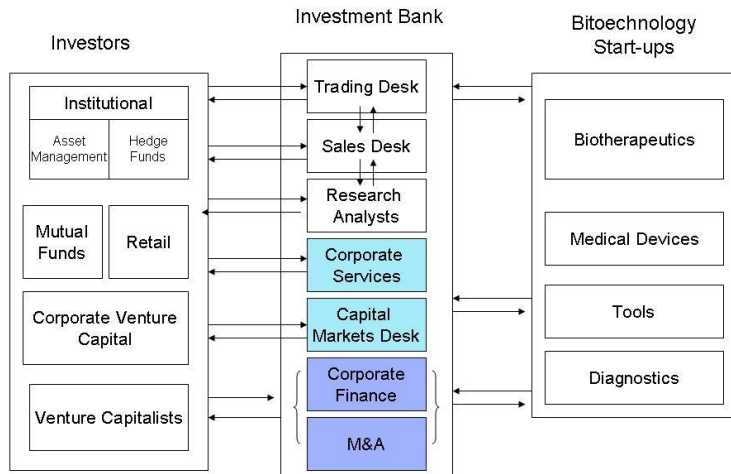
Investment bankers and Credit Assignment

Bankers do seem to help the firm decide how to allocate resources in order to receive positive feedback from the selection environment. Additionally, firm seem do change internal firm behavior that results in positive responses by the selection environment through the selection mechanism of financing. Interviews made clear the wide variety of actors in the environment, i.e. sources of financing (Figure 2). Sources for financing include, for example, angel or seed-stage investors, venture capital firms, corporations, institutional investors. Each actor brings expectations of value for their investment, i.e. financing of the biotechnology firm.

Sourcing the credit assignment capability in investment bankers is especially important for life-science start-ups as most investment firms are largely constrained by their investment mandates to finance companies at pre-defined stages of maturity. For example, Catalyst Health & Technology Ventures in Boston, MA was founded with the mandate from their Limited Partners to invest in seed-stage technologies as the initial institutional founder. Therefore, Catalyst invests only in Series A funding (first round of institutional financing) and takes dominant ownership positions (>40%) in their portfolio companies. Conversely, Skyline Ventures in Palo Alto, CA was founded with the mandate to finance mezzanine life science companies gearing up for product commercialization. Therefore, Skyline invests primarily in Series C+ funding (third round

and beyond of institutional financing) and is usually the “last money” into an investment prior to liquidity via the public markets or via sale of the company.

Figure 2: Investment Banks Feedback with Environment and Start-ups



Investors and Expectations in Financing Biotechnology Start-ups

Investment bankers describe three primary investment players when discussing the financing of biotechnology start-ups: institutional investors, corporate investors, and venture capitalists. Each group requires that a firm meet general expectations, i.e. selection criteria, in order to finance the firm.

- Institutional investors: Institutional investors and stockholders, which includes most mutual funds, seek out investments that are likely to provide liquidity through either a public offering of stock or via sale (Hansen and Hill 1991; Kochhar and David 1996; Lukas 2002; William 2003). Institutional investors are also called Qualified Institutional Buyers (QIBs), defined as an institutional public fund with more than \$1M in assets.

- Corporate Investors: Corporate or “strategic” investors are large public/private pharmaceutical or biotechnology companies that provide a range of financing alternatives to biotechnology companies at all lifecycle stages. These financing alternatives (described later) range from technology development project financing in early-stage companies, strategic equity or debt investments in private or public companies (for example, see Dushnitsky and Lenox 2005), as well as licensing (for example, see Arora et al. 2001) and merger/acquisition activity (for example, see Rothaermel and Deeds 2004). Corporate investors usually seek out a portfolio of investments with strategic coherence and that retains an option value on products and technology for future corporate activity. Corporate investors have flexibility in the range of companies, stage of development and amount invested (for example, as little as \$1M-\$3M in strategic investments, up to \$1B+ in licensing or royalty arrangements). In the last 10 years, most pharmaceutical and biotechnology companies have established independent corporate investment or corporate venture groups.

- Venture Capitalists (VC): VCs typically represent the earliest stage backers of companies once an underlying technology has been proven (Clercq et al. 2006; Kaplan and Stromberg 2001). In other words, VCs seek out ventures that may be high risk (although lower risk than angel investors) with some level of validation. However, like Angels, VCs expect disproportionate returns – including the cost of failures. Expecting a 10x-100x return on investment over a multi-year span, even if only 10% of a VC portfolio is successfully “flipped,” represents performance success. VCs typically demand large stakes (>40% ownership) in their portfolio companies and bring capabilities, access to management talent, and industry know-how in addition to

financing sources. Over the past 10 years, venture capitalists have continued to move into later-stage opportunities recognizing upside opportunities in the capital markets.

Tying Selection Criteria to Firm and Technology Development

Investment bankers link general selection environment expectations to specific decisions that create value to the start-up. Coding and categorization of interviews resulted in three main areas in which investment bankers perform credit assignment and link the general investor expectations to recommend specific actions to biotechnology start-ups: 1) focus and priority among products, technologies and target markets, 2) commercialization and marketing activities including speed to market, and 3) selection of management capabilities and assets that are perceived as valuable to external constituents.

One case study that demonstrates all the characteristics of credit assignment involves the management team that founded both Peninsula Pharmaceuticals and Cerexa Pharmaceuticals, both biotechnology startups founded in Alameda, CA. In April 2005, the management team of Peninsula Pharmaceuticals, a leading startup biotechnology company with a development-stage antibiotic compound called doripenem, accepted an offer to be acquired by Johnson & Johnson (J&J) for \$245million in cash. Credit Suisse was the investment bank that advised the Peninsula management team on its sale to J&J. The management team used the sale proceeds as well as venture funding from Frazier Ventures, Domain Ventures and New Leaf Partners (also investors in Peninsula) to found a new company, Cerexa Pharmaceuticals.

Cerexa's lead compound was a development-stage antibiotic compound called ceftaroline for the treatment of drug-resistant hospital-based infections, one of the fastest growing issues in public health today. Cerexa had initially in-licensed and owned all the rights to ceftaroline from Takeda, a Japanese pharmaceutical company. Early clinical data suggested ceftaroline had what in pharmaceutical parlance is called "blockbuster potential," meaning potential peak sales over \$1 billion globally, on the basis of the mechanism of the drug class, accepted safety profile, broad spectrum activity (ability to address multiple resistant bacterial organisms), and clinical efficacy scores. However, there were questions as to which series of indications – or diseases – ceftaroline should target for FDA approval that would maximize its potential while minimizing development time and cost. The question for Cerexa, more broadly, was what level of critical scale would Cerexa need to achieve in its pipeline – as it now stood out as a "one drug company" – in order to attract strong strategic interest from potential buyers or to prepare to become a stand-alone public company.

Several investment banks advised Cerexa on these questions. First, investment banks advised Cerexa on the clinical development plan for ceftaroline, to pursue a lead indication for complex skin and soft structure infections (cSSSI) which is typically the most broad claim that antibiotics can achieve. Second, several investment banks advised Cerexa to pursue additional high value indications such as bacteremia, endocarditis, spinal meningitis, and surgical prophylaxis as these were historically markets with high unmet need and therefore receptive to a drug like ceftaroline. In response to this feedback, Cerexa launched an aggressive and broadbased clinical development plan to drive ceftaroline through a rapid phase 2 clinical trial to

demonstrate the efficacy of the drug in multiple indications and settings. Third, several banks advised Cerexa on the need to expand the early-stage pipeline with the addition of a second antibiotic drug candidate, which Cerexa acquired in Fall 2006 from a small Japanese pharmaceutical company. With the addition of the second compound, positive Phase 2 data on ceftaroline, and the full management team from Peninsula in place, Cerexa had the look of a full commercially-capable specialty biotechnology company preparing for large-scale trials and potential to commercialize a blockbuster. And, despite multiple requests from public market investors interested to see Cerexa become a public entity, the Cerexa management team in December 2006 agreed to be acquired by Forest Labs for \$580million in cash and earn-outs. In total, less than \$50 million had been invested into Cerexa since March 2005, and the venture investors realized an 11x return in approximately 20 months.

Similar to the case of Cerexa, there are many other examples where investment bankers advise biotechnology start-ups in regards to products and underlying technologies, commercialization, and selection of management capabilities and assets. For example, in regards to products and underlying technologies, investment bankers may advise biotechnology start-ups to lower costs of development, speed up time to market, invest in intellectual property rights, and create a prototype or a beta version. In regards to commercialization, advice may pertain to understanding market need, sizing the actual market and its growth potential, solidifying distribution channels, and creating customer portfolios for product use. The role of credit assignment is predicted on biotechnology start-ups meeting the general expectations of investors so the firm gets

credit for a good product that customers will buy even though the product might not yet be completed.

Managing Selection Environments

Biotechnology start-ups can control their selection environment by seeking third-party validation. Start-up firms can find mediators who perform the role of credit assignment, traditionally found in more mature firms. This paper articulates the implications for entrepreneurs of managing their selection environment. By employing investment bankers, firms can understand the selection criteria, or expectations, of actors in the selection environment.

Not only can they understand the selection criteria in general, but they can specifically map these criteria to day-to-day activities within the firm. First, most entrepreneurs view financing as a means-to-an-end, however, the breadth of company financing options available today have pervasive implications for direction of technological development, company and business model evolution, management expertise and required capabilities, as well as fundamentally the markets that companies can or should be targeting.

This paper also articulates the implications for investors in understanding their impact on firm and technology development. This is an especially important paper for investors to understand their social responsibility. Investors have to look beyond short-term profits to long-term development and value creation. Financing of private stage companies – particularly in the life sciences arena, where companies are developing the next generation of drugs, therapeutics, devices, tools and diagnostics for curing human disease – is an important “public goods” problem. Policymakers, regulators, government

agencies such as the FDA, academic universities and their affiliated entrepreneurial engines (e.g., licensing offices, etc.) as well as the international trade community must also be cognizant of strategies to manage selection environments to anticipate business, scientific and social consequences of these ventures.

Credit Assignment and Emerging Markets

The financial markets in emerging markets are booming. For example, since December 1987 through June 2006, emerging markets outperformed developed international stocks and only slightly underperformed U.S. large-cap stocks (Chukumba and Parbhakar, 2007). The Indian financial sector has grown at roughly 15% and has displayed remarkable stability over the years even when other markets in the Asian region have faced a crisis (Singh, 2004). From analyst reports it appears this growth in financing is especially evidenced in biotechnology, after a significant gap from the 2000 genomics bubble burst, there has been an emergence in late 2003. Compared to US biotechnology revenues which have grown 16% since 1989 (Figure 3) and are 78% of global revenue in 2004 (Figure 4), India has proven to be a growth market (Figure 5), making up 1.1% of global revenue in 2004 (Figure 4). Beginning with the 1978 establishment of Biocon in Bangalore, the biotechnology industry growth is primarily focused in pharmaceutical applications (76.7%) but also in applications including industrial (9.8%), agricultural (11.1%), and bioinformatics (1%).

Figure 3: Growth in Biotechnology Financing

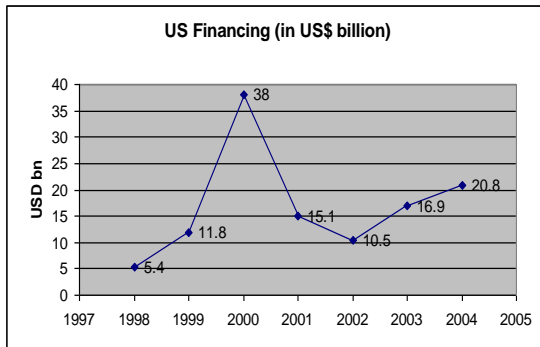


Figure 4: Worldwide share of Biotech Revenue in 2004

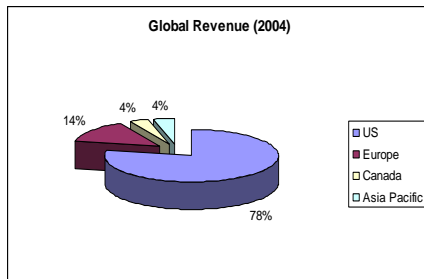
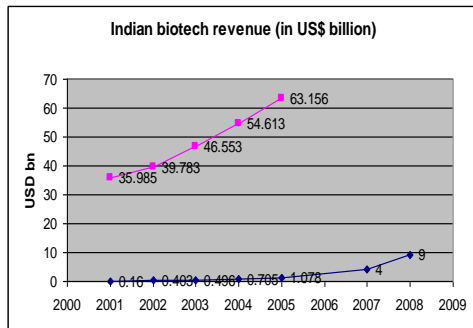


Figure 5: Indian biotechnology revenue compared to worldwide growth



In the midst of this growth, investment banks help companies and governments (or their agencies) raise money by issuing and selling securities in the capital markets (both equity and debt). Almost all investment banks also offer strategic advisory services for mergers, acquisitions, divestiture or other financial services for clients, such

as the trading of derivatives, fixed income, foreign exchange, commodity, and equity securities.

The credit assignment role of investment bankers is relevant not only to the U.S. and developed markets, but also to emerging markets such as India in two primary ways. First, it is important for entrepreneurial firms in India to utilize knowledge about the importance of credit assignment in navigating tough environments. If the entrepreneurial firm does not have the credit assignment capabilities, then the firm should seek the appropriate investment bankers to fulfill this role to maximize success. Second, as described above India is developing a strong financial market. Investment banks can utilize the understanding about how credit assignment builds better firm to their country's advantage.

Lessons for New Ventures in India

Entrepreneurial firms need to understand this important role of investment bankers in acting on environmental feedback. Therefore, if a burgeoning new venture does not hold the credit assignment capability in-house, it should source the capability in more relationship-oriented banks. For example at Jefferies, being client-focused is not just a goal, it is a necessity. As CEO Rich Handler says: "It is not our focus on mid-market and growth companies that makes us different; it is the character of the relationship that we have with our clients. By the nature of our clients' businesses and ours, executing their deals means more to our business, and we have more of an impact on theirs" (Lambe, 2007).

Likewise, burgeoning new ventures in India that lack credit assignment capabilities will want to find investment banks where more of the deals are CEO-led from start to finish. Lately, with the increase of new entrants and possibilities for financing, firms have been looking for cash on the table from investment banks (Nayak, 2007). However, the quality of advice should be more welcome than the amount of cash. Firms need to think of the long-term and the development opportunities offered by a knowledge bank that understands and can help assess the business environment, i.e. provide credit assignment capabilities.

Lessons for Investment Banks in India

On the flipside, as developing countries' financial markets grow, they must meet the growing needs of the companies that depend and fuel this growth. For investment banks, India represent one of the worlds' great opportunities as the economy is growing about 8 percent annually (Leahy, 2006). Investment banks are not in the business of buying or selling businesses, but rather get buyers and sellers together. They also help companies raise equity and debt, paid by a commission for their efforts. In this light, the role of Indian investment banks is helping India in a global market, achieving size and scale and raising billions for Indian firms.

India's investment bankers earned a little over three-fourths of the fees that the industry earned in the whole of 2006, taking home about \$1.23 billion from 2,060 deals (Nayak, 2007). On the Asia-Pacific landscape India now ranks fourth, behind China, Japan and Australia; and the average fee per deal in 2007 has risen to \$0.95 million from \$0.59 million in 2006. Primarily in capital raising where fees are 2 to 3 percent,

DSP Merrill Lynch earned \$28.3 million; Citibank earned \$20 million; Morgan Stanley earned \$16.1 million; Kotak Mahindra earned \$12.7 million; ICICI Bank earned \$10.3 million; and UBS earned \$7.6 million.

Early forays into the Indian investment banking had been through joint ventures; however, two of the three largest of such ventures have been unwound in 2006 – only DSP Merrill Lynch remains (Leahy, 2006). Local banks such as JM Financial (once tied with Morgan Stanley) and Kotak Mahindra (once tied with Goldman Sachs) are, now, going it alone. However, there is a challenge in balancing size and brand with attention to customers and details. Investment banks have to be more willing to work with emerging companies that hold promise. These investment banks can position themselves as providers of growth capital either through private equity or pre-IPO placement. All these activities involve the investment bank holding the companies hand and providing advisory services, i.e. credit assignment capabilities.

Local investment banks utilize credit assignment capabilities in India as a platform to build. As Sanghi, Managing Director of Investment Banking at YES Bank, says “Our aim is to stay with the customer and grow with him from his initial stage of growth, such that in the future the client approaches you before he thinks about others (Nayak, 2007).” YES Bank did exactly that with Suzlon Energy, managing its IPO, raising capital for growth and advising it during its acquisitions, the most recent one being \$1.35 billion purchase of Repower.

Conclusion

Financing is a tool of evolution. It determines long-term firm and technology development, particularly in biotechnology start-ups. Start-up firms must manage their

selection environment, i.e. the market that rewards firms as a holistic entity. However, actors in the selection environment, i.e. investors, have expectations or selection criteria. It is the role of mediators, like investment banks to match specifics within the firm to overall selection criteria through credit assignment. In emerging markets, the role of Investment Bankers are as important, if not more so, as demonstrated by recent activity in the Indian financial market. This credit assignment capability is important both for entrepreneurial firms and for investment banks in developed and emerging markets, alike, to build successful firms.

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