Making big money from small technology

With venture-capital funds depressed, kick-starting a technology business can prove to be problematic. James C. Hsiao and Kenneth Fong offer some advice for budding entrepreneurs.

China has invested heavily in technology in recent years to lift its rapidly growing economy to a dominant position on the world stage. There is no doubt that the country is making its presence felt in the emerging fields of nanotechnology and biotechnology. But converting research into profitable products is tricky. Examining the ingredients of a successful company and looking at alternative approaches to funding should help to transform research ideas into profits.

The development of nanotechnology in China began with China's ten-year 'climbing up' project, which supported nanomaterial research between 1990 and 1999 (ref. 1). This project was very much ahead of its time — and was started many years before President Bill Clinton created the National Nanotechnology Initiative in the United States in 2000. US federal nanotechnology research funding has since increased by nearly seven times, to a budget of US$847 million in 2004 (ref. 2). China's investment level is comparable.

There are several sources of funding for new technology in China, including the National High Tech R&D Program of China, the National Natural Science Foundation, the Ministry of Science and Technology and the Chinese Academy of Science[3].

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The high number of papers at recent nanotechnology conferences in China provides evidence of the vast amount of research and development that is being carried out by Chinese researchers, and shows that significant commercialization efforts are being focused around Shanghai and Beijing. The establishment of the Nano Science and Nanotechnology Center of the Chinese Academy of Science and the Shanghai Nanotechnology Promotion Center are good indicators of the level of interest.

A robotic arm holds the plasma torch for manufacturing ceramic nanocoatings.

But what does it take to create a profitable technology business? The key principles for growing an emerging technology company are basically the same anywhere in the world — and they apply to any technology.

The first step is obvious: the new technology must work. The next steps are probably less clear but are just as important. You need to recruit a good management team and to demonstrate that consumers will want your products. This is known as 'market pull'.

Scientists and inventors tend to overestimate the value of their invention and often fail to consider whether the problem the product solves is significant enough to capitalize on market pull. As a result, they get into a situation where instead they find themselves having to 'push' their technology, a sure recipe for failure. This is why venture-capital (VC) companies invest in people rather than technology.

Badly burned by huge losses from the burst of the dotcom bubble in 2001, the VC world is playing safe and is 'keeping its powder dry'. VC investment is now mostly limited to follow-on funding to protect past investments, and is generally characterized by investment rounds in which valuations are either unchanged or reduced. Moreover, VC firms now try to hedge their bets by using complicated financing deals.

As a result, investment contracts may specify a liquidation-preference clause, in which the VC company gets a predetermined rate of return (such as twice the level of investment) in the event of sale or liquidation of the company. The investors get their money back, perhaps many-fold, before the entrepreneur sees a penny.

Another way for VCs to protect their investment is to insist on preferred shares, which give investors a fixed dividend from the company's earnings and entitle them to be paid before common shareholders.

VC funding is usually handed out in stages. One way is milestone financing, where an investor provides additional funding as long as certain conditions, or milestones, are met. Steps such as prototype development, obtaining intellectual-property protection and beta-testing of a product may be viewed as milestones.

Wealthy individual investors, known as 'angels', have become the real VC funders in today's investment scene. These investors tend to be more interested in helping start-up companies achieve organic growth (which excludes any growth from takeovers, acquisitions or mergers). Angel investors are usually in for the long haul, and terms are generally much less onerous than with VC firms.

Nevertheless, given the present funding climate, emerging technology companies are clambering for alternative approaches to fuel their growth and technology development. But before any company can think of funding, it needs to be sure of its intellectual-property rights.

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Both nanotechnology and biotechnology are receiving increased publicity globally. Marked advances in both fields are the result of years of work by scientists and millions of dollars of research funding. In addition, both nanotechnology and biotechnology tend to be highly interdisciplinary, involving scientists from widely differing backgrounds and with different skills. Intellectual property is driving the nanotechnology and biotechnology revolutions, and patent portfolios are the currency.

For instance, patent offices are now flooded with applications that are relevant to nanotechnology — and the Chinese patent office is no exception. Recent enforcement of intellectual-property rights since China joined the World Trade Organization has led to greater respect for patents in China and has improved the country's investment climate. For example, Tsinghua University Nano Center has received funds from Hon Hai, one of Taiwan's largest technology companies.

Materials science

Nanotechnology can be divided into two groups — materials and devices. Historically, venture capitalists have shied away from investing in materials, largely because of slow development times as a result of large companies having to check the performance of the material in their products. This can lead to poor return on investment, which is often exacerbated by inevitable commoditization — when the material reaches the mainstream market and other manufacturers can copy it.

But the lengthy product lifetimes of materials can make them very profitable over the long term[4]. Moreover, materials are 'disruptive', in other words they lead to new products that can replace present technology, allowing for a vast number of product opportunities in the mainstream as pricing drops because of increased production[5].

By contrast, VCs love to invest in devices, where margins are high, although product lifetimes may be short. Of course, in the nanotechnology sector, devices are still years from commercialization. The same is largely true for biotechnology. Nevertheless, VC firms such as Lux Capital (New York City) and Ardesta (Ann Arbor, Michigan) are specializing in nanotechnology and are making early-stage investments.

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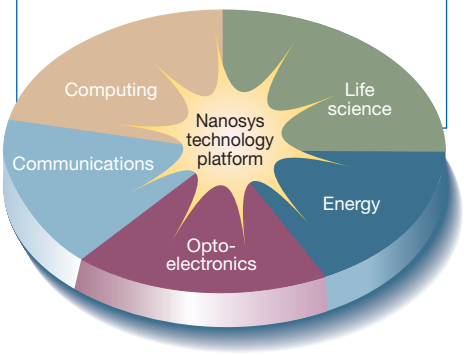
Given the difficulty in obtaining funding, particularly for materials science, start-up companies are searching for alternative sources of cash. There are three main routes that they can pursue: government contract research and development; corporate partnering through joint-development programmes; and corporate investment. As an illustration of these approaches, this article highlights the paths taken by three companies.

Nanosys, a nanotechnology company based in Palo Alto, California, has taken advantage of corporate investment opportunities thanks to its executive chairman and co-founder, Larry Bock, who has extensive experience of setting up companies. By contrast, nanomaterials firm Inframat, in Farmington, Connecticut, has used government contract research and development funding to grow organically. And Epitomics, a biotech company in Burlingame, California, has expanded by establishing corporate partnerships, following two rounds of seed financing.

Nanosys was founded in 2001 and has since benefited from the experience of Bock, a serial entrepreneur who has an excellent track record in building successful companies. Of his 12 previous start-ups, two are privately held, two were acquired, and eight now trade on the US high-technology stock market Nasdaq. So far Nanosys has raised in excess of US$70 million — and it has done this through investor confidence in a management and scientific team that has proved it can deliver.

Nanosys is building partnerships with many companies, which will allow the company to enter several sectors.



The company amply demonstrates the maxim that VC firms invest in people, not technology, as Nanosys does not expect to market any products based on its core technology for a few years, although it expects to deliver some niche-market products soon to generate revenue. But it has aggressively licensed intellectual property from a variety of sources, including Harvard University, the Massachusetts Institute of Technology, the Lawrence Berkeley National Laboratory, University of California, Berkeley, and the Hebrew University of Jerusalem, to attain dominance in the field of inorganic semiconductor nanostructures. The result is that it now holds over 140 patents). Applications for this technology include solar panels, biosensors and flexible electronics — semiconductors fabricated on plastics, for example. Interestingly, the latest round of investment in Nanosys featured funds from three Asian sources: the China Development Industrial Bank, Chiao Tung Bank and United Overseas Bank in Singapore.

Building a nest egg

The business strategy pursued by Nanosys is to commercialize technology through partnerships with other companies. The pie chart shows the range of industries with which the company hopes to set up links.

Entrepreneurs tend to think in terms of the minimum amount of funding needed to accomplish their goals. This is a mistake. There is no doubt that seasoned entrepreneurs such as Bock focus instead on building a considerable 'nest egg' of funding to take the company forwards, concentrating on valuation, rather than getting hung up on dilution (a decrease in equity). At the end of the day, it is better for the entrepreneur to maximize the value of his or her own equity position, even if that means giving away more of the company to achieve a higher overall value.

For its part, Inframat has used a non-dilutive bootstrap approach, which is when organic growth is achieved in an incremental fashion — as money comes in, some

progress is made, which then attracts more money and more progress. Inframat's approach has been based on US government contract research and development, in which the contract funding has been used to achieve organic growth without the help of outside private capital. From an investment angle, we can call this customer-based financing, and in this case the customer is the government.

Founded in 1996, Inframat has pursued opportunities in the Small Business Innovation Research Program and the National Institute of Standards and Technology's Advanced Technology Program. Inframat's core technologies are based on using aqueous chemistry to synthesize nanomaterials cheaply, and on a thermal spray that is used to produce nanostructured coatings. For example, the company has developed dense ceramic nanocoatings that can be used to prevent sea creatures from adhering to the metal bodies of ships.

As with Nanosys, forming partnerships has been essential for Inframat's growth. An early association with the University of Connecticut was key to the company winning large government contracts from the US Navy. Over $5 million in funds has resulted in nanocoatings for submarines, aircraft carriers and minesweepers.

Inframat's most important technology development is its thermal-barrier coatings for gas turbines (both flight- and land-based). This technology improves the lifetime of the turbine, and Inframat is now approaching land-based turbine manufacturers and refurbishers.

This method of gaining funding from the government has been recently adopted in China. The country now has its own small-business innovation research programme, called the Innovation Fund for Small Technology-Based Firms. The first handbook for applying for funds appeared in 2002. This funding should focus on early-stage technology development, where the benefit to mankind is potentially high, and where the risk is perceived to be too high for corporate investors.

A successful business requires an excellent intellectual-property portfolio, proof of market demand and a management team that can deliver on its promises.

Epitomics took a different funding path from Nanosys and Inframat, but once again it focused on creating strategic partnerships

The handbook for applying to China's Innovation Fund for Small Technology-Based Firms.

with large firms. The science of epitomics is new. It is the study of all epitopes of the proteome in an organism. The epitope is a functional recognition site on a protein that can be bound by a specific monoclonal antibody. Epitomics is an emerging company that is developing specific antibody technology that was first licensed from Loyola University in Chicago and the University of California, San Francisco.

The company aims to become the leader in rabbit monoclonal-antibody technology with products for research, diagnostics and therapeutics. It has a wholly owned subsidiary in Hanzhou, China, and will probably spin off a subsidiary to develop its own portfolio of products for the diagnostic market. A similar strategy will apply to the therapeutic monoclonal-antibody market.

The key strategy for growth that Epitomics has used is entering into service agreements with private and public biotechnology and pharmaceutical companies. At least ten companies have now signed up, including Genentech and SUGEN in South San Francisco, California; Cell Signaling Technology in Beverly, Massachusetts; Exelixis in San Francisco; and Upstate USA in Waltham, Massachusetts.

Clearly, this approach will enhance valuation because the company's technology has been shown to be useful — and the generation of sales revenues is always a bonus.

The main point here is that the partners generate channels of distribution for the products, which saves on marketing. Epitomics has also completed a recent Series B (second) equity round, with investment from Kenson Ventures in Menlo Park, California, and Bill Rutter (founder of biotech firm Chiron). Just as with government funding, rapid-growth companies also need to raise some private equity.

In summary, the fundamental attributes of a successful nanotechnology or biotechnology strategy in the United States and China should be based on an excellent intellectual-property portfolio, proof of market demand and a management team that can deliver on its promises. As can be seen for all the profiled companies, building partnerships with government agencies and other companies is another important route to success.

Exceptional synergies between the Chinese and US economies are evolving. China's open-door policy, which encourages US investment in China's technology sector, will no doubt lead to the active involvement of US and other Western companies in future start-ups in China. China will follow all three models presented here for starting and growing a company in the nanotechnology and biotechnology sectors. As a result, we believe that China will lead the world in both fields. No question. ■

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