

[Research Paper]

Four Case Studies of High-Tech Startups In Cambridge

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Abstract

We suggest that the global strategy of high-tech startups can be categorized into two types. One pursues technological originality; the other offers greater customer convenience. We present two propositions, which are related to resource acquisition and target market, for each type and examine four case-studies of firms located in Cambridge, U.K.

Startups of the type that pursue technological originality target the global market and strive to become a de facto standard from the start. They are highly globalized in acquiring core technology, financial and human resource.

Startups of the type that offer greater customer convenience start from a limited local market and acquire core technology, financial and human resources from local sources. If they develop their competitive advantage, they can expand their business to the global market.

1. Research Objectives

Entrepreneurship has been defined as a mechanism by which entrepreneurs discover and exploit opportunities to recombine existing resources to enhance wealth (Kirzner, 1973; Schumpeter, 1934). Entrepreneurial success depends on an entrepreneur's finding and utilizing an opportunity well (Shane and Venkataraman, 2000). Having to

overcome numerous difficulties to achieve this goal is predictable. Today, however, the hurdles are higher than ever. With globalization affecting whole industries, small as well as large firms must compete in the global marketplace over the country boundary. This paper examines how high-tech startup¹⁾ globalization strategies affect procurement of key resources (core technology, financing, management team, alliance and client networks).

High-tech startups, seen as the seeds of new industries, are launched as global companies and must thus, from the very beginning, consider how best to enter the global market and how best to position development manufacturing and sales from a global perspective. They do not have the luxury of developing domestic markets before they go global. From the very beginning they are engaged in what McDougall and Oviatt (2000) call international entrepreneurship “a combination of innovative, proactive and risk-seeking behavior that crosses national borders and is intended to create value in organizations-” International entrepreneurs seek business opportunities in the global marketplace based on their understanding of current market and technology trends. They pursue innovation in the global market to differentiate themselves from existing companies. Their global activities create intersections where differences in customary business practice, technological climate and culture meet, knowledge is exchanged and recombined to stimulate innovation

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and new business creation.

This is, however, only an ideal image of international entrepreneurship. Startups find it difficult to acquire the financial and human resources that global activities require. Silicon Valley has been an exception, in that these resources are concentrated and accessible there. But what happens in other regions and countries? How do startups not based in Silicon Valley acquire the resources global growth requires?

This paper partially answers this question. It proposes a theoretical model in which resource acquisition is dependent on global strategy and tests it by examining a small set of startups located in the region around Cambridge in the UK. Since all of the firms share the possibility of utilizing existing resources, output from university laboratories, alumni networks, angels and VCs, all clustered around Cambridge University, we are able to control these factors and focus on the relation between global strategy and resource acquisition.

2. Proposition – Types of Global Strategy

2.1. Industry and market

First, we consider what industries and markets are easiest for startups to enter as a basis for classifying global strategies.

Many startups enter the market just after new industries emerge. New challengers are eager to participate in the market because there are few existing companies that meet customer needs (Geroski, 1995). Then, however, as time goes by, it becomes more difficult for new entrants. Malbera and Orsenigo (2000) explain: If an existing firm having gradually climbed the learning curve develops its product / service effectively, new firms cannot catch up with it. Thus, as an industry becomes more mature, a startup is at a growing disadvantage. While an industry is still infant, however, its immaturity stimulates entrepreneurship. Data has been presented showing that the rate of failure of startups rises in proportion to the

maturity of the industry (Barnett, 1997; Wade et al, 1998). This research does not, however, concern high-tech industries.

Several studies that have discussed the relation between entrepreneurship and maturity of high-tech industry have pointed to dominant design as a critical factor in industry maturity. Utterback (1994), Tushman and Anderson (1986), and Murmann and Tushman (2001) have shown that the number of new entrants increases until a dominant design solidifies its position.

In markets where a dominant design is established, it is difficult for startups to find business opportunities anywhere except in extreme niches. Here I suggest that high-tech startup strategies begin with the assumption that the present market is immature, and that it will grow and be global.

2.2 Types of Startup Strategies

We suggest that high-tech startup global strategies can be categorized into two types. One pursues technological originality; the other offers greater customer convenience. Offering greater customer convenience requires simplification of product or payment. In contrast, technological originality may include radical innovation which render existing technology obsolete. Technological originality allows startups to develop products or services which other companies find difficult to imitate. Figure 1 shows a matrix in which these strategic options are rated high or low.

The strategy which includes both high customer convenience and high technological originality (H-H) is ideal but difficult to implement. It places a heavy burden on startups, especially those that lack managerial resources. Low customer convenience and low technological originality (L-L) is ruled out because it adds no value. Only two strategies, then, are realistic approaches for startups to pursue: high customer convenience and low technological originality (H-L) or low customer convenience and high technological originality (L-H).

Figure 1: Types of Startup strategy

		Customer Convenience	
		High	Low
Technological Originality	High	Difficult	Possible
	Low	Possible	Unattractive

2.2.1 Pursuit of technological originality

Startups with L-H strategies display the following characteristics.

1. Established expertise in a particular field.
2. Commercialization of technology seeds owned by universities and large companies.
3. Efficient R&D through licensing or collaborative research with existing companies

These are typically academic startups, which use intellectual property from universities and national labs or spin-offs which exploit technology whose development has been interrupted at the companies that own the seeds. As these startups require huge amounts of time and money to be able to supply concrete products or services, they must try to obtain funding through licensing or compensate for the lack of resources through collaborative research. By creating new intellectual property, they make themselves hard to imitate. We expect this kind of startup to emerge in such cutting-edge technology fields as clean-tech, life science and semiconductors.

Shane (2004) has suggested that there are seven characteristics of technology seeds that make them fundamental resources for academic startups. They are radical, tacit, early stage, versatile, high in customer value, dramatic advances in technology, and firmly protected by intellectual property rights. While technology seeds with these characteristics may spur the growth of large new markets in the future, the immature markets in which they appear allow immediate growth and offer room for new entrants.

These considerations suggest two propositions

about high-tech startups that pursue technological innovation.

Proposition 1: Startups that pursue technological originality target global markets and aim from the start to become a de facto standard.

Proposition 2: They are highly globalized in acquiring core technology, financial and human resources.

2.2.2 Offering greater customer convenience

Startups that pursue a greater customer convenience strategy display the following characteristics.

1. targeting niche products or market segments untapped by existing companies
2. agile and flexible response to customer needs
3. simplifying procedures; technology offer or payment
4. fast and secure commercialization through collaboration with lead-users

While total market size for the product or service may be substantial, the target market is comparatively small. Because it does not attract large companies, there is room for startups targeting niche among existing technology. These startups emphasize service tailored to customer needs or localization of product design instead of low price or high performance. Their product delivery and payment systems save their customers trouble and contribute to high convenience. For startups adopting these strategies, priority number one is to identify customer needs. Thus we see a pattern of commercialization that involves collaboration with lead users at the design stage. Building business models which offer high convenience even without advanced technology can become these startups' competitive edge. Initial offerings are commonly commercialized locally, with globalization following at a later stage.

We offer the following propositions about the globalization strategies of high-tech startups that pursue customer convenience.

Proposition 3: Startups offering customer convenience target initially target local markets, develop their competitive advantage, and then expand into global markets.

Proposition 4: These startups are not highly globalized in acquisition of core technology, financial and human resources.

While our propositions emphasize differences between startups that pursue technological originality and startups that pursue customer convenience, we

should also note similarities. Both pursue alliances, both to supplement available resources and to speed development through collaborative R&D with existing companies or lead-users.

3. Four Cambridge Startups

The subjects of this study of entrepreneurship in the Cambridge region of the UK where many independent, high-tech startups are clustered are four firms in the life science, semiconductor, or ICT fields.²⁾

Figure 2 shows the overview of startups pursuing technological originality and Figure 3 shows the overview of startups offering customer convenience.

Figure 2. Overview of Two Cases (Pursuit of technological originality)

	Semiconductor	Life Science
Name	CDT	Astex
Spin-off Type	Academic Startup	Academic Startup
Technology Seeds	Professor & Researcher of Cambridge Univ. (Founders)	Professor of Cambridge Univ. (Founders)
Product & Service	Developing material and devices of PLEDs	Offering a drug discovering tool & Developing a new drug
Founded	1989	1999
Raised capital before exit	\$360M (Estimated)	£70M (Estimated)
Initial investor	Cambridge Univ. Local VC	Abingworth Management (UK), Oxford Biosciences Partners (US), Cambridge Univ.
Main investor	Lord Young of Grafham (UK) Intel (US) etc.	Other ten private VCs in US & UK
Exist	Listed in Nasdaq in 2004 Sold to Sumitomo Chemical in 2007	Sold to an American company in 2011
Alliance partner	Sumitomo Chemical (Japan), Philips, Seiko Epson (Japan)	AstraZeneca, Pfizer, GlaxoSmithKline, Janssen Research Foundation, Fujisawa Pharma, Mitsubishi Pharma (Japan)
How to alliance	Licensing, R&D Collaboration	Offering an analyzing tool, R&D collaboration, Delegated research
Connection	Alliance partner	Alliance partner
Founders	Professor & postdoctoral fellow of Cambridge Univ.	Two professor of Cambridge Former CEO of big pharm, Venture capitalist
Academic degree and position	Science adviser (PhD), CTO (PhD)	CEO (PhD), Science adviser (PhD)
Management team	CEO: Former CEO of an American chemical company Professionals of Phillips and Dow Corning, Former CFO of startups going public	PhD, Professionals of big pharm Former CFO of Startups going public
Channel of management	Related industry and VC	Academy, VC, Network of founders

3.1 Cambridge Display Technology (Semiconductors)

Cambridge Display Technology (CDT) develops materials and produces devices using polymer organic light-emitting diodes (P-OLEDs). This core technology has raised high expectations since the 1990s as a possible replacement for liquid-crystal display. The year 2011 saw electronics manufacturers begin test production of large screen displays using this technology. CDT was founded in 1992 using the research results of Cambridge University professor Richard Friend and researcher Jeremy Burroughes. In 2004 it was listed on NASDAQ, and in 2007 was bought out by Sumitomo Chemical. In 2006, the last year for which sales figures were disclosed, total sales had reached US\$8 million, and the company's employees numbered 120.

(1) Capital Procurement

CDT was launched with university funding, then looked for ways to develop the business and fund production through connections with local angels. Since it came to require large sums for those purposes, however, the company's strategy changed to supplying technology to other firms. In 1996, a CEO was recruited from Siemens and in 1997, on the strength of success in supplying technology to Philips, it was able to raise US\$9.7 million from one of the UK's largest venture capital firms, Lord Young of Grafham, and to secure additional funding from Intel's investment arm. That was followed by a joint venture with Seiko-Epson to develop ink jet technology for printing polymer-OLED's on fabrics. Then, in 1999, an additional capital infusion of \$133 million was received from US investment funds Kelso Investment and Hilman Capital. These funds were used to build the firm's R&D center and to buy out other startups. In 2004, CDT was listed on Nasdaq, and in 2005 an energy-saving technology project was begun with Sumitomo Chemical. That project led to Sumitomo Chemical's acquisition of CDT in 2007 (for an estimated \$360 million).

(2) Alliances

Besides the firms mentioned above, CDT's business partners also include Matsushita Electric, Dai Nippon Printing, and Delta Optoelectronics, to all of which CDT supplies technology. CDT technology is used in products ranging from mobile phones and miniature cameras to MP3 players.

(3) Management Team and HR

The inventor-professor has become an advisor on technology. The other inventor, after working for Toshiba for six years, became Chief Technology Officer (CTO) in 1997. In 1999, anticipating the need for large-scale investment, David Fyfe took over as CEO. A Cambridge University Ph.D. in electronics, he had previously been CEO of a large American chemical company. Two vice-presidents are specialists in OLED technology with experience at large electronics or chemical firms. The CFO had experience supporting other listings on the London and Nasdaq stock exchanges. The management team is, thus, composed of top professionals in their fields from both inside and outside the UK.

3.2 Astex Therapeutics (Life Science)

Astex Therapeutics has combined X-ray crystallography and magnetic resonance imaging to develop a drug development support technology for drug design using fragment-based analysis of molecular structures, a technology that makes possible more efficient isolation of promising new pharmaceuticals. It both supplies this technology to other pharmaceutical firms and develops its own new drugs, constantly aiming to maintain a full pipeline. Founded in 1999, Astex had, in its first decade, produced numerous new drug candidates that reached stage 1 clinical testing.

Astex is an academic startup whose founders include Sir Tom Blundell, head of the biochemistry department at Cambridge University, Chris Abell, a professor in the same department, Harren Jhoti, who was both a former chair of Glaxo Wellcome and chair of the UK Structural Biology Association, and

Robert Solari from Abingworth, the first VC to invest in the firm. Sales figures are unavailable, but as of 2010, the firm had 75 employees. In 2011, Astex was bought out by U.S.-based Supergen and renamed Astex Pharmaceuticals.

(1) Capital Procurement

One of Astex's founding partners was Abingworth Management, a private sector VC with an office in Cambridge. (Its headquarters are in London.) Seed money was procured from Abingworth Management and Boston-based Oxford Biosciences Partners. Two years later, Astex raised 28 million British pounds from five entities in a private placement. Estimates suggest that Astex had procured a total of 70 million British pounds as of 2007

Astex's aggressive approach to capital procurement reflected not only a desire to develop and sell systems that would shorten the lead time for new drug development, but also its intention to discover and develop drugs itself, a goal for which large amounts of capital were needed. It was also necessary to raise funds to buy out a German bioventure, to expand its pipeline. Apart from Cambridge University, where two of the founders were employed, all funds were raised from VCs specializing in life science and investing globally.

(2) Alliances

The year after Astex was founded, it reached an agreement with Janssen Biotech, followed the year after that by an agreement with AstraZeneca. In addition to technology licensing agreements with some 20 pharmaceuticals companies and research foundations, Astex also participates in joint and commissioned research projects. Partners in these projects include most of the world's largest pharmaceuticals companies, including many based in Japan.

(3) Management Team and HR

Examining Astex's efforts to strengthen its management team during the decade after its

founding, we identify three distinct periods: from founding to 2003, when the company was focused on developing and testing its basic technology, a middle period when it actively developed alliances on the basis of that technology, and a third period during which it was focused on preparation for an IPO. During the first, technology-oriented period, it recruited experts in computational chemistry, proteins, high-throughput screening, and NMR to join its executive team. The focus during this period was on talent that could help create new drug development technologies and accelerate their use in drug discovery. During the middle period, the focus shifted to lawyers and individuals experienced with clinical trials, to support internal drug development efforts. Then, in 2006, it added a CFO with IPO experience in anticipation of the IPO. The successful timing of these efforts can be attributed to the founders' stature as leaders in their fields in the UK, their networks of connections through academic associations and with pharmaceutical industry firms, and the global reach of their VCs, which facilitated recruitment, in particular in the USA.

3.3 Abcam (Life Science)

Abcam was founded in 1998 by three men who shared a common vision, to use the Web to market antibodies worldwide. The first was Jonathan Milner, a postdoctoral fellow at Cambridge University, the second his academic mentor, and the third an angel investor, David Cleevly, famous for his contributions to growing a telecommunications business. Abcam was founded in the same year as Google. As the Internet became more pervasive, Abcam grew by expanding its Web-based catalogue. As of 2010, annual sales had reached 72 million British pounds, operating profit was 35%, and the company's employees numbered 250 worldwide.

Figure 3. Overview of Two Cases (Offering customer convenience)

	Life Science	ICT
Name	Abcam	Bango
Spin-off Type	Academic Startup	Third startup
Technology Seeds	Postdoctoral fellow of Cambridge (founder & CEO)	Developing after founding
Product & Service	Development and procurement antibody	Charge and payment system of mobile
Founded	1998	1999
Raised capital before exit	£250K	Unknown
Initial investor	Famous angel (founder), Local angels	Local VC, Local investment bank
Main investor	Angels	ET Capital, Wood Side Capital (UK)
Exist	Listed in AIM in 2005 (£15.5M raised)	Listed in AIM in 2005 (£6.2M raised)
Alliance partner	Universities	—
How to alliance	Procurement by academic labs	—
Connection	University labs, National labs, Biotech company	Broad casting and mobile communication companies (Discovery Channel, Yahoo, MTV, NTT Docomo etc.)
Founders	Professor & postdoctoral fellow of Cambridge Univ., Famous angel	Alumni of Cambridge
Academic degree and position	CEO (PhD), Chairman (PhD), Non executive director (PhD)	CEO (Bachelor)
Management team	VP (PhD of Cambridge or alumni)	CFO & Chairman (professionals of startups), VP invited from US, Part-time director assigned by VC
Channel of management team	Network of founders	Former co-workers, Network of related industry

(1) Capital Procurement

Seed money and Series A funding were provided by angels, including one of the founders, who was already well known in Cambridge for investing in startup businesses. The initial seed money was only 250 thousand British pounds. A business that required only the procurement of antibodies and the announcement on the Web that they were available for sale did not require a heavy investment. Like Google, which was founded in the same year, Abcam grew along with the Internet. It was unable to procure additional capital from VCs, but, instead, accumulated profits from successful sales in North America. Its 2005 IPO raised 15.5 million British pounds, which were used to develop new business in Japan and Hong Kong.

(2) Alliances

Basic research on antibodies is conducted in university and government laboratories. Applied research is typically joint research involving universities and biotech companies, and the resulting antibodies are used in pharmaceutical company laboratories. Abcam sales are 48% to universities, 24% to biotech companies and government laboratories, and 23% to pharmaceutical companies. Its suppliers include many university and government laboratories; in all, Abcam does business with 250 companies. Only 4% of the antibodies it sells are produced near Abcam's headquarters. Its initial customers were in the UK, but it has gradually expanded to reach a global customer base.

Five years after the company's founding, it set

up an office in Cambridge, Massachusetts, in the USA, followed by offices in Japan and Hong Kong. Its online catalogue lists more than 60,000 items. Because the amounts supplied are small, only a few CC, global purchasing, storage, and shipping costs are low. Speedy delivery and technical support that ensures that the antibodies supplied are optimized for the customer's research are the strengths of the Abcam business model. Sales are now 44% to North America, 30% to Europe, 9% to Japan, 8% to the UK, and 5% to China.

(3) Management Team and HR

Besides the founders, the managers in charge of business development, logistics, and Web system design all have doctorates in biochemistry or pathology from Cambridge. They do not feel uncomfortable in being responsible for areas outside their R&D specialties. They joined the firm in their twenties, were in their thirties at the time of the IPO, and have reached the rank of general manager or vice president. Most other employees, especially those involved in R&D, are graduates of Cambridge University.

3.4 Bango (ICT)

Bango provides billing, payment and analytics solutions for the mobile Internet. Founder Ray Anderson is a serial entrepreneur. After graduating with a degree in computer science from Cambridge University, he founded and managed several startups, which he then sold to other companies. He founded Bango in 1999. Co-founder Anil Malhotra had been in charge of tie-ups and licensing for Anderson's second startup. As of 2010 Bango's annual sales were approximately 26 million British pounds, with operating profit at 10% and 50 employees.

(1) Capital Procurement

The bulk of the seed money for Bango's founding was capital gains from the sale of the two founders' previous startups. Following the company's IPO,

the three managing directors continue to own more than 30% of its shares. Subsequent efforts to raise funds did not go as well as expected, and the founders have ended up continuing to own a high proportion of the shares. Partners in two local VCs, ET Capital and Electric and General Investment Trust, serve as non-executive directors of Bango and have also invested personally in the firm. Herald Ventures and Chase Nominee, two local VCs, are the only corporations that hold more than 5% of the the firm's shares. The 6.2 million British pounds raised by the 2005 IPO were used to set up the firm's data center.

(2) Alliances

Bango has two types of customers, content providers and mobile telecoms. To solidify its position in the European market, the firm opened offices in Germany and Spain. Then, entering the larger US market, it developed services for U.S.-based broadcasters (Discovery Channel, Yahoo, MTV). The firm now has a bipolar structure, with European operations concentrated in London and US operations concentrated on the US east coast.

(3) Management Team and HR

Founders Ray Anderson and Anil Malhotra have continued to be in charge after the IPO. Five years after the founding, they added an experienced CFO whose background included serving as managing director in charge of finance for a large corporation in the same industry. The company's ability to attract two highly experienced vice-presidents from Silicon Valley to manage sales and administration was rooted in the fact that the CEO had lived in the US following the sale of a previous startup to an American corporation. The network he built during that time made it possible to construct an international management team and develop business in the US. All of the firm's management team had global experience and substantial achievements in telecommunications,

electronic trading, or software, and were able to contribute to the expansion of Bango's business.

4. Conclusions — Examining the Propositions

Of the four firms described in Part 3, Astex and CDT are in the technology originality category; Abcam and Bango focus, instead, on greater customer convenience. Since Astex and Abcam are both life science-related businesses, they provide a good contrast. Let us review briefly the evidence for these classifications.

Astex's drug-screening tools support drug design using fragment-based drug discovery. By making it possible to analyze interactions between fragments of larger molecules, its technology makes it possible to analyze the structures of proteins more accurately, in a clear departure from existing tools. The seeds of CDT's technology have been featured in the prestigious scientific journal *Nature*, and it has been a major player in OLED development. Both companies' technologies are based on cutting-edge science and are extremely distinctive. In contrast, Abcam is involved in developing and marketing antibodies, a business with a much lower threshold. It has secured its present position by being the first mover in putting its catalogue on the Web. Bango's mobile Internet billing and payment services compete in a market where the spread of mobile devices has led to ferocious competition. Its edge is maintained by carefully tailored customization. These two companies have succeeded by offering superior customer convenience.

Starting from this classification, let us turn now to propositions 1-4.

Proposition 1: Startups that pursue technological originality target global markets and aim from the start to become a de facto standard.

Both Astex and CDT build on core technologies

based on discoveries by Cambridge University faculty members. Aiming to commercialize these discoveries, they are classic examples of academic startups. From the beginning, both looked for joint research partners and customers worldwide.

If we look at the nationalities of the firms with which Astex has tie-ups, we find that its first joint-research tie-up was with Janssen Biotech, a firm based in Belgium. Next came UK-based AstraZeneca, followed by Mitsubishi Well Pharma (Mitsubishi Tanabe Pharma since 2007) in Japan. CDT first licensed its technology to Philips and Uniax, companies based in the Netherlands and the United States. Both Astex and CDT have aimed to establish their own technologies as the global default standards as quickly as possible. That both used the exit strategy of a buyout by major corporations outside their home country was a demonstration of the value put on their highly sophisticated advances, which have, in fact, been accepted as global standards.

Proposition 2: They are highly globalized in acquiring core technology, financial and human resources.

While still at the growth stage, both firms formed numerous alliances. While participating in joint research and undertaking commissioned research, they supplied development tools and know-how. In the process, they were able to integrate a variety of component technologies and strengthen their core technologies. Astex is on public record as a participant in 26 joint research projects and technology licensing agreements. Its partners include pharmaceuticals companies and laboratories scattered across Europe, the US and Japan. CDT is on public record as having entered into tie-ups with nearly 10 electronics and printing equipment manufacturers, most of which are Japanese companies. It also bought out a local startup that specialized in development of component technology for OLEDs.

Turning to capital procurement, we see that from the seed money stage through subsequent rounds of financing, Astex procured funds from multiple VCs, including some American sources. CDT's seed money came only from local VCs, but following its success with licensing, it succeeded in procuring additional capital from Intel and a US-based investment fund.

On the HR front, both firms have sought out the best possible members for their management teams, from the UK, Europe or even the USA. Their ability to fill CEO and CFO slots with individuals who brought with them deep industry experience depended on introductions from globally active VCs and the management team's own personal networks. Their ability to recruit talented engineers may also reflect the global networks of Cambridge University and the academic societies to which their founders belong.

Thus, we can confirm that, at least in these two cases, these unique technology startups adopted from the very beginning a highly globalized approach to procuring the resources they needed, including core technologies, capital, and talent.

Proposition 3: Startups offering customer convenience target initially target local markets, develop their competitive advantage, and then expand into global markets.

During the startup phase, Abcam's suppliers and customers were confined to the UK, primarily the region around Cambridge. As the business grew, it expanded its market to Europe, the USA, and Asia. Global expansion was possible because customers could place orders on the Web and because the small size of shipments minimized shipping costs. It has also opened branches in the USA, Japan, and Hong Kong to improve the efficiency of both product procurement and distribution.

Since Bango's business is IT services provided via the Internet, global expansion incurred no

additional shipping or delivery costs. The CEO's business experience had been in the USA, but the firm's first target was Europe. Only later did it enter the larger US market. At that point, recruiting American vice-presidents spurred success in the global market. Here we glimpse the necessity for globalization even in customer convenience-oriented businesses.

Thus we can confirm that in both these cases, the initial target market was local. Global expansion came later.

Proposition 4: These startups are not highly globalized in acquisition of core technology, financial and human resources.

With respect to core technologies, Abcam began by selling antibodies developed by the founder, a Cambridge University postdoc and the researchers with whom he worked, then gradually expanded the range of products it handled. It was a startup dependent on strong local ties. Bango's core technology consisted of the skills built up by its founders through the experience of founding two earlier locally based startups.

On the capital procurement front, both firms secured capital only from domestic sources. Bango was started with funds from the buy out of the two founders' previous startup, supplemented by an investment by a local VC. As one of the founders explained, they tried to procure capital globally but found it difficult (even from the USA, where they had hoped to attract investors). Abcam was started with capital procured from its founder chairman, who was also an angel investor. The firm received no funding from VCs. Since buying and selling antibodies required only a small amount of additional research expense to achieve solid earnings, the company did not need to seek large amounts of external funding.

On the HR front, these two firms differ somewhat. The members of Abcam's management team almost all hold either doctorates or master's

degrees in biochemistry or pathology from Cambridge University. They have been recruited via alumni associations or local networks. In this case, recruitment is very local. In contrast, Bango's CEO was able to use his personal connections built while living in the USA to recruit two Americans as vice-presidents for sales and administration. That would have been very difficult to do without the CEO's overseas experience and personal networks, because it had not received investments from overseas VCs, who would have been able to tap their global networks for introductions to capable individuals.

Thus, in both these cases, the degree of globalization in procurement of core technologies and capital was low, if not completely local. On the HR front, globalization of recruitment would also have been low had there not been special circumstances in one of the two cases.

5. Limitation and Further Research

This essay proposes a tentative classification of high-tech startup globalization strategies and considers several propositions relating to resource procurement and targeted markets. Confining the case studies to firms based near Cambridge in the UK controls for differences due to geographical, social, economic, or political conditions; but with only four cases, this research is only a preliminary effort. As a next step, it will necessary to examine more startups from the Cambridge region that fit the proposed classification, to see how the propositions hold up. Also, in the preliminary study reported here, two of the four firms were academic startups in the life sciences domain, so that direct comparisons were possible. It is now necessary not only to expand the sample but to ensure the presence of multiple cases in the same business domains.

Future research will further expand the sample to include cases from Europe, the USA, and Japan. Analysis of an expanded, multinational sample will

be particularly important when comparing startups that pursue technological innovation, to examine whether they target the global market from the start (Proposition 1) and procure resources globally (Proposition 2).

Notes

- 1) Definitions of high-tech startups are taken from David J. Ben Daniel, the Don and Margi Berens Professor of Entrepreneurship at Cornell University, and the US Department of Commerce. According to the Department of Commerce, high-tech firms are those which spend twice as much as other firms on R&D (Shanklin, W.L. & Ryans, J.K.Jr, 1984). John Nesheim quotes Ben Daniel's description of Apple during its startup phase, where he describes Apple as a small firm that had latent within it the power to create an economic foundation for future growth, generate employment, propagate technological change, and create a distinctive corporate culture that would influence management everywhere (Nesheim, 1997).
- 2) For more information on the four case studies, see Tajiri and Tsuyuki (2010) and Tsuyuki (2009). Information used here was taken from the four firms' websites. The founders of Abcam and Bango were interviewed in September, 2010.

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