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ACQUISITION AND GROWTH IN A PIONEERING
CLUSTER OF HIGH TECH FIRMS

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WHO OWNS THE CAMBRIDGE PHENOMENON?

Acquisition and growth in a pioneering cluster of high tech firms

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Acquisition is a means by which founders and investors can realise the value of their enterprises and as such is part of the life cycle of many technology enterprises. Acquisition of local firms attracts external capital to the area and results in post-acquisition spin-off by former employees, but it takes another business generation for any spin-off firms to grow to the size of their parent. The innovative potential of young firms that are subsumed within a corporate entity may not be realised. This paper quantifies the available data on patterns of acquisition and their impact in the Cambridge technology cluster. Among all acquired firms over the period 1988-2008, 80% were approaching mid-size (50 employees). Firms with good prospects/ a growth record, spin-off firms and firms funded by venture capital were particularly likely to be acquired, particularly as opportunities for IPO diminished in the economic downturn.

Introduction

As technology based sectors mature, consolidation sets in, with waves of merger and acquisition increasing concentration levels. These global developments have an impact on localities with a high concentration of firms that are targets for acquisition. However, evidence on the dynamics and implications of acquisition for a locality such as Cambridge is limited.¹ Several recent high-profile acquisitions in the cluster have drawn attention to the incidence of acquisition of innovative young firms. We present new longitudinal evidence to investigate these issues, drawing on evidence from the Cambridge area.

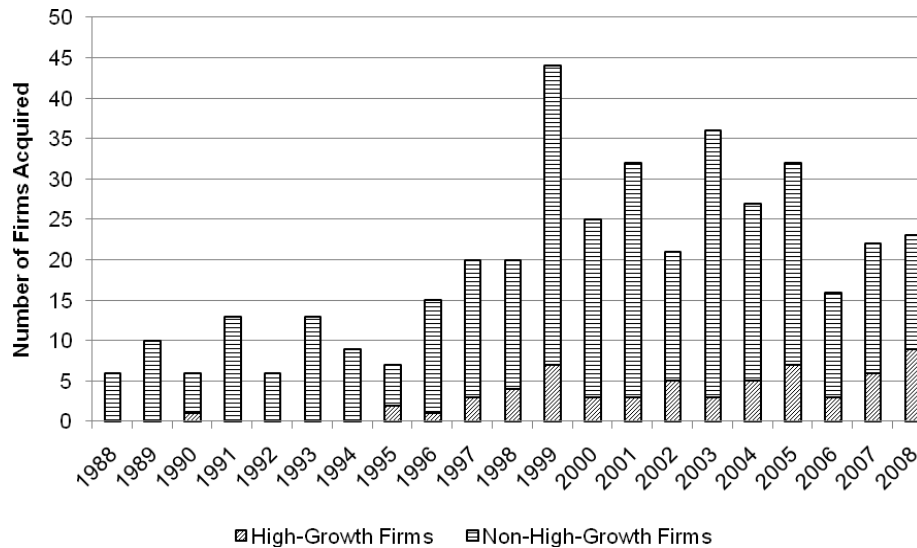
Cambridge Firms as Acquisition Targets

Cambridge firms have attracted both national and international acquirers in search of innovative technologies. Analysis of these developments in this paper is based on a database of high tech firms developed at the University of Cambridge over more than twenty years, in collaboration with the Research Group of the Cambridgeshire County Council².

Though acquisition of Cambridge technology firms is a trend of long duration, by the late 1990s the incidence of acquisition was nearly double rates in the 1980s (figure 1). About half of acquirers (46%) were foreign, 34% from the US. The markets for acquisition reflected business cycles. Thus acquisition increased almost seven-fold during the technology boom of the late 1990s before declining during the early 2000s.

¹ In the case of Cambridge, for instance, the last systematic assessment of acquisition and international ownership in the cluster was 1993 (Shah and Garnsey).

² Other papers based on this resource are available on:
http://www.ifm.eng.cam.ac.uk/ctm/publications/w_papers/



Source: IfM Cam tech database, Companies House

Figure 1 – Number of Acquisitions per Year

High-growth firms (those firms growing employment at 20% or more per year for 3 or more years) were frequent acquisitions targets (Mohr and Garnsey, 2011). These are generally viewed as the most promising firms in the cluster. Overall, some 42% of all high-growth firms were acquired over the period studied, compared with an incidence of 14% among all firms in the cluster. Only 5% of all firms resorted to acquisitions as a means of growth (cf. Pasanen, 2007); this share was greater for high-growth firms, among which 50% of firms had acquired another firm.

Acquisition is a means by which founders and investors can realise the value of their enterprises. Venture capitalists are intermediaries answerable to their own investors, and under pressure to show returns on investments in ventures. One route for realizing returns is through an Initial Public Offering on the stock market. As discussed below, markets have not recently been favourable to early stage companies, leaving acquisition as the other route to realising the investee firms' value. Firms supported

by venture capital (VC), and especially fast-growth firms, were particularly frequently acquired. Among all firms in the cluster that had received venture capital, 48% were acquired. The incidence of acquisition was greater still for firms in receipt of venture capital with a record of rapid growth, among whom 75% were acquired. Variance analysis reveals that firms receiving venture capital investment were almost six times as likely to be acquired as firms without venture capital investment³.

The limited information available suggests that venture capital investors benefited from their involvement with high-growth firms that were acquired. Investment and return information was available for 17 high-growth firms that had received venture capital investment and were subsequently acquired by other firms. On average, these acquisitions occurred at sales prices nine times above the total investment into these firms.

Overall, acquisition remained important for founders and investors in realising the value of their enterprises. It was possible to identify acquisition terms for 72 cases. For valuations that were disclosed the total exceeded £6 billion. It was not possible to identify beneficiaries of the deals, nor how returns were distributed. In 2011, Autonomy was acquired for more than the total of all previous acquisitions of firms that were official university spin-off s.

Size at time of acquisition

It is possible to identify the size category of acquired firms to better understand at what point in a company's development sale to an outside party occurs. Table 1 and

³ Specifically, a logit regression analysis with venture capital receipt as the independent variable and the incidence of a firm being acquired as the dependent variable (employing binary variables for both variables) yields an odds ratio of 5.9335 at $p < 0.01$ (coefficient: 1.7806, standard error: 0.1383). Further analysis did not point to issues of multicollinearity.

Table 2 provide such an analysis for all firms in the cluster, as well as first-generation spin-off companies, which often benefit from pre-incubated technologies. Table 1 shows that over 80% of firms were acquired prior to reaching mid-size (50 employees). A similar pattern emerges for first-generation spin-off firms from the University of Cambridge (Table 2).

Size Category	Number of Firms	Percentage
1-9	119	33.6%
10-49	166	46.9%
50-249	66	18.6%
250-999	3	0.9%
1000+	-	-
Total	354	100%

Source: IfM Cam tech database

Table 1 – Firm Size Distribution of Acquired Cambridge Firms at time of Acquisition

Companies with University origins are often sought after because of the promise of their technologies and intellectual property. Half of official university spin-off s in the 10 - 49 employee size group were acquired, and a quarter of the smallest size group were acquired (Table 2).

Size Category	Number of Firms	Percentage
1-9	23	26.4%
10-49	43	49.5%
50-249	20	23.0%
250-999	1	1.1%
1000+	-	-
Total	87	100%

Source: IfM Cam tech database

Table 2 Firm Size Distribution of Acquired Cambridge Spin-Off Firms at time of Acquisition

Impact of Acquisition

There are few longitudinal studies available of acquisition and it is seldom possible to follow the same firm's growth from independence through to its status as a unit in the acquiring company. Performance data for the acquired unit is usually conflated with that of the acquiring firm. This makes it difficult to analyse the impact of acquisition and accounts in part for the scarcity of evidence on this subject. However in this study, data on pre- and post-acquisition performance for Cambridge technology companies that became acquired units was assembled for the six sectors that accounted for most acquisitions. An important caveat in interpreting this evidence is lack of a control group of comparable firms not acquired. An exact match would in any case be difficult as each firm is unique in many respects. Nevertheless, it is of interest that improvements in profitability were frequently associated with restructuring that led to reduction in assets and employees. Overall, acquisitions were associated with job losses in the acquired units. Table 3 compares other performance indicators before and after acquisition – both for the entire period before and after the acquisition (left two columns of table 3) and, more specifically, three years before and after the acquisition (right two columns of table 3). Over a three year period before and after takeover (right side of table 3), there was a sizeable improvement in profitability and cash position for firms reporting data but a reduction in jobs. Among high growth firms, the rate of expansion of jobs halved after acquisition. Growth in assets did not continue over the long term. The firms for which data were available may have been following strategies more favourable to the cluster than those that do not report the impact of the acquisition.

Dimension	All Firms			High-Growth Firms		
	<i>N</i>	<i>Av. Growth 3 years prior to acquisition</i>	<i>Av. Growth 3 years after acquisition</i>	<i>N</i>	<i>Av. Growth 3 years prior to acquisition</i>	<i>Av. Growth 3 years after acquisition</i>
Turnover	13	68%	154%	8	101%	153%
Op. Profit	18	29%	46%	10	9%	124%
Net Assets	34	17%	13%	11	44%	33%
Cash	19	80%	153%	6	83%	182%
Employment	147	13%	1%	35	19%	9%

Table 3 – Reported 3 Year Pre- and Post-Acquisition Growth of Acquired Companies

The acquired firms had been experiencing rapid growth of sales, which diminished after takeover. Profitability and sales per employee increased but profits were liable to repatriation by foreign corporations.

Further evidence is needed on the extent to which release of assets and job reductions stimulates entrepreneurial activity, with experienced employees leaving to join local start-ups and entrepreneurs founding post-acquisition spin-off companies. Spinoffs founded post-acquisition are vulnerable to economic volatility but benefit from the previous experience of founders.

Though we lack detailed evidence on post acquisition spin-offs, many serial entrepreneurs fund a new enterprise on the basis of returns from selling a previous business. Thus serial enterprise data provide indirect evidence of developments that tend to occur in the aftermath of acquisition, though not with any precision. We identified 27 serial entrepreneurs who had started three or more companies over the period studied; some but not all their companies were acquired. As Figure 2 shows, employment in firms established by serial entrepreneurs expanded rapidly from the mid-1990s onwards, with a dip and recovery after the technology crash.

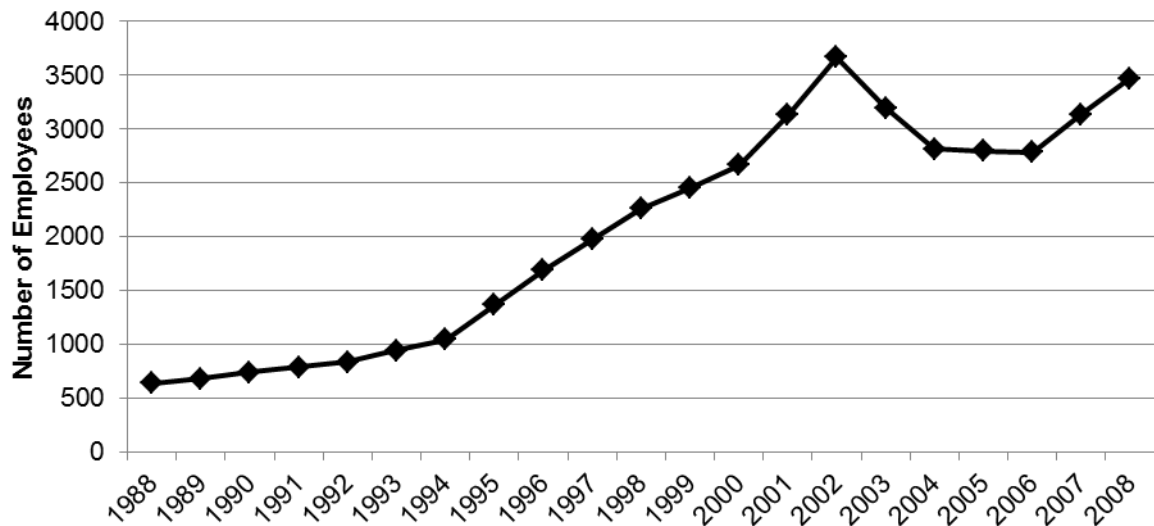
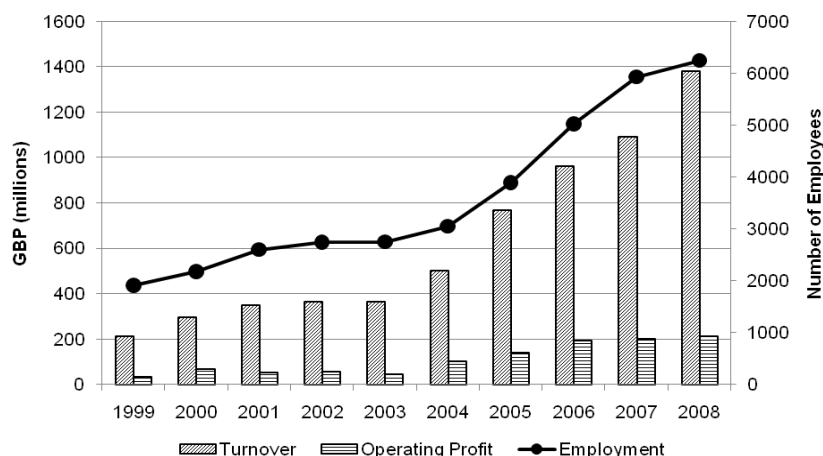


Figure 2 – Employment in Firms Founded by Serial Entrepreneurs

Independent Growth

The importance of independent growth for the cluster is shown by the impact of just four companies that have grown to be international leaders in their sector (figure 3). These firms grew to over 1000 employees and became leading firms in their industries. All four of these firms were formed as corporate spin-offs out of another local company. They are Domino (ink jet printing), ARM (chip design), Autonomy (search engines) and Cambridge Silicon Radio (semiconductors). These firms, as shown together in figure 3, grew rapidly from 2003 to 2008, after a period of stability following the technology crash, reaching a combined turnover of £1.4b and providing over 6000 jobs in the area by 2008, almost 15% of all jobs. They demonstrate how rapid growth can set off growth reinforcement effects. However individually, each firm went through periods of setback as shown elsewhere (e.g. Garnsey et al., 2006). Firms’ ability to redress setbacks is no less important than rapid growth.



Source: IfM Cam tech database, Companies House

Figure 3 – Cumulative Impact of ARM, Autonomy, CSR and Domino

Autonomy was acquired by Hewlett Packard in 2011 for £7b. At this stage it had 2700 employees worldwide. It was thus much larger than most acquired firms in the area at the time of acquisition. Autonomy was an exceptional firm with well-protected, vintage technology, but its experience reminds us that a longer period of independent growth can increase the returns achieved by founders and early investors. In contrast, early sales of the nine official Cambridge University spin-off firms for which valuations of the acquisition deal could be estimated, was around £1.9b in 2009. The beneficiaries were not reported and the university’s stake in official spin-offs tends to be diluted as successive rounds of funding increase the number of investors. The sale value of university spin-offs can be viewed in the context of revenues to the university from licensing, viewed in the Lambert Report (2003) as an alternative strategy to promoting spin-offs. These revenues amounted to about £6 million in 2010 (figure 4).

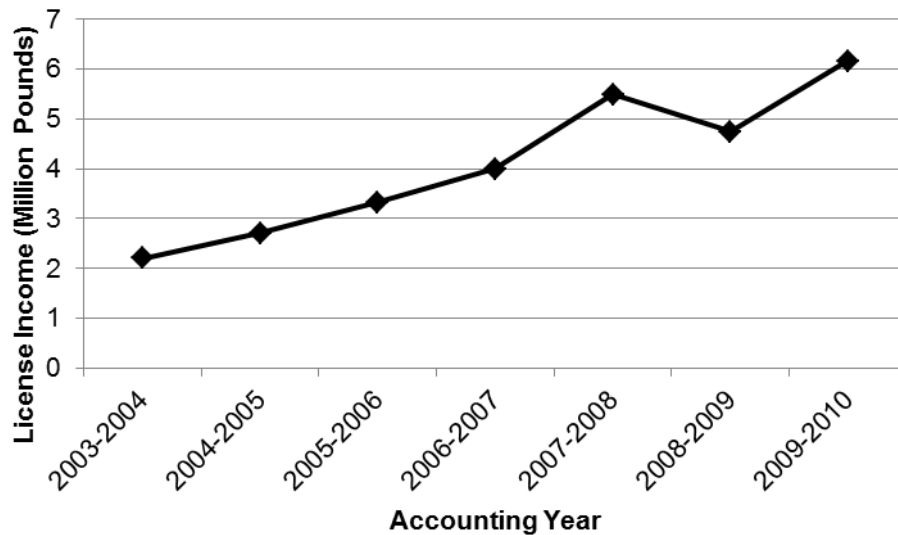


Figure 4 – Cambridge Enterprise Licensing Income 2003-2010

IPO as an Alternative to Acquisition

For many technology companies, especially those funded by venture capitalists, one option to gain access to the funds required for independent growth is listing company shares on the stock market through an initial public offering. Several policy measures, such as the establishment of the AIM Market or the relaxation of LSE listing rules for science-based companies, were aimed at facilitating this move. However, as Figure 5 reveals, the number of Cambridge tech enterprises pursuing public listings instead of acquisition by a third party is relatively limited and concentrated in periods of economic upswing, a pattern also found elsewhere.

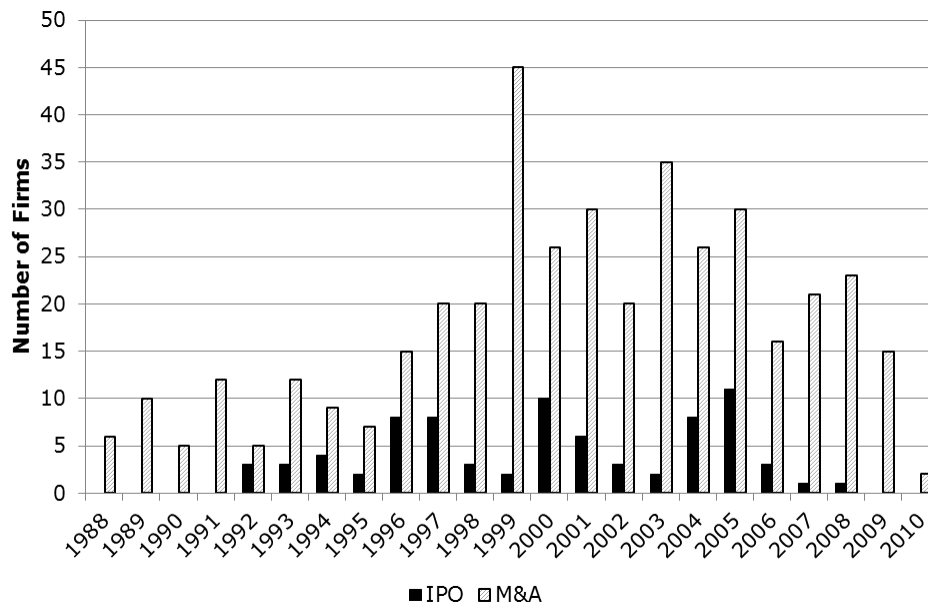


Figure 5a – IPO and Acquisition of Cambridge Tech Firms 1988-2008

Source: IfM Cam tech database

Who Buys Cambridge University Spin-out Firms?⁴

There are both official and unofficial spin outs from Cambridge, the latter being known as University start ups - firms founded by staff and students of the University of Cambridge that have no official connection with the university. It is difficult to obtain an exhaustive list of such companies; these data were built up over several years of inquiry. Spin-out firms are those in which the university has an official connection through intellectual property rights and/or an equity stake.

It proved possible to obtain evidence on disclosed terms and conditions from 55 deals out of the 103 acquisitions recorded of both spin outs and start ups. For 55 of these deals it was possible to discover price paid; the following analysis is as based on the available information.

⁴ The section on nationality of acquirers is based on *Acquisition of University of Cambridge Spin out and Start up firms*, Note by Christina Zhang and Elizabeth Garnsey, June 2008

Fig. 5b shows the distribution of deal size by buyer's nationality. UK acquirers were active in deals under \$100m whereas Japanese firm were active in deals under \$500m. American buyers, with a presence in all size categories, were interested in deals between \$10m and \$100m. The top 6 deals over \$500m were by US buyers.

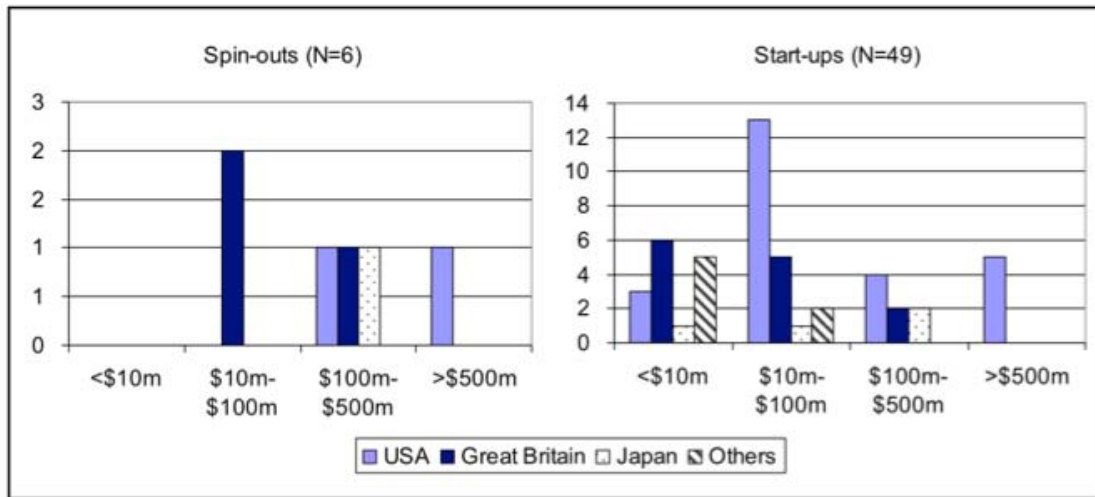


Fig. 5b Price Distribution by Buyer's Nationality in Takeovers of CU Spin-outs and Start-ups by Year 1993 – 2008 (55 deals with disclosed value) **Left axis of spin out chart is mis-numbered**

USA buyers made the largest number of takeovers at the highest average deal size. Japanese firms have participated in a relatively small number of takeovers at a high average price.

Cambridge Firms Acquiring Other Firms

Some firms grew fast enough to acquire other firms. High-growth firms accounted for over a third (37%) of all acquisitions by Cambridge companies; 24% of high-growth firms acquired another firm, which compares with 4% for non-high-growth firms and

5% for the cluster overall.⁵ The acquired firms were themselves international, however, involving little by way of local mergers. The effect of business cycles could be observed, as acquisition activity increased during the boom periods of the late 1990s and mid 2000s.

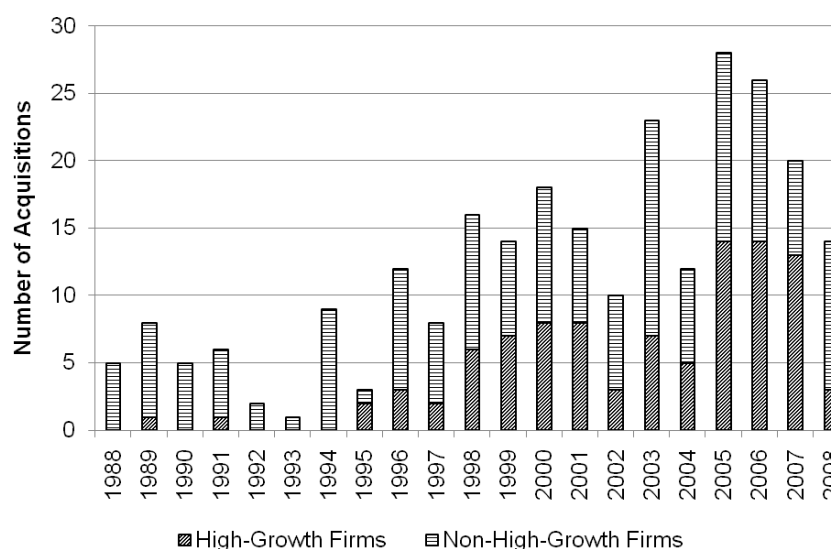


Figure 6 – Number of Acquisitions by Cambridge High-Growth and Non-High-Growth Firms, 1988-2008

As is to be expected, larger Cambridge firms were disproportionately active as acquirers, while smaller firms were involved in few acquisitions. Table 4 disaggregates acquisition transactions by employment size category of the acquirer and target at the time of the transaction⁶. While firms with more than 250 employees at the time of acquisition account for only 2% of the overall population and 16% of the group of acquiring firms, firms with over 250 employees account for nearly one third of all acquisition undertaken by Cambridge high-technology firms. This finding

⁵ Controlling for firms with HQs outside Cambridge, these figures were 28%, 4% and 6% respectively.

⁶ In total size information for 215 acquisition targets (72% of all acquisitions) could be established. Missing size information for targets usually related to international acquisitions during the early years of the study period.

is in line with the findings by Delmar and Davidsson (1998) and the notion that the costs involved in acquisition tend to make this mode of growth prohibitively expensive for smaller firms. Cambridge high-technology firms tended to acquire firms with fewer than fifty employees. The prominence of this target category even among larger buyers may suggest that acquisitions by larger Cambridge high-technology firms were mostly transactions to access complementary technologies or market-oriented capabilities.

The geographic location of firms acquired is an indicator of the global networks in which Cambridge firms operate. Figures 7 and 8 summarise this information for the cluster overall and for high-growth firms, respectively. Acquisition targets are concentrated in a few countries, with firms in the United States and the United Kingdom accounting for almost 80% of firms bought in both cases. Firms growing rapidly are more internationally oriented than cluster firms as a whole ($p < 0.05$). For the cluster overall, nearly 50% of all firms acquired by Cambridge high-technology companies were located in the United Kingdom. In contrast, two-thirds of all firms acquired by Cambridge *high-growth* firms were located outside the United Kingdom.

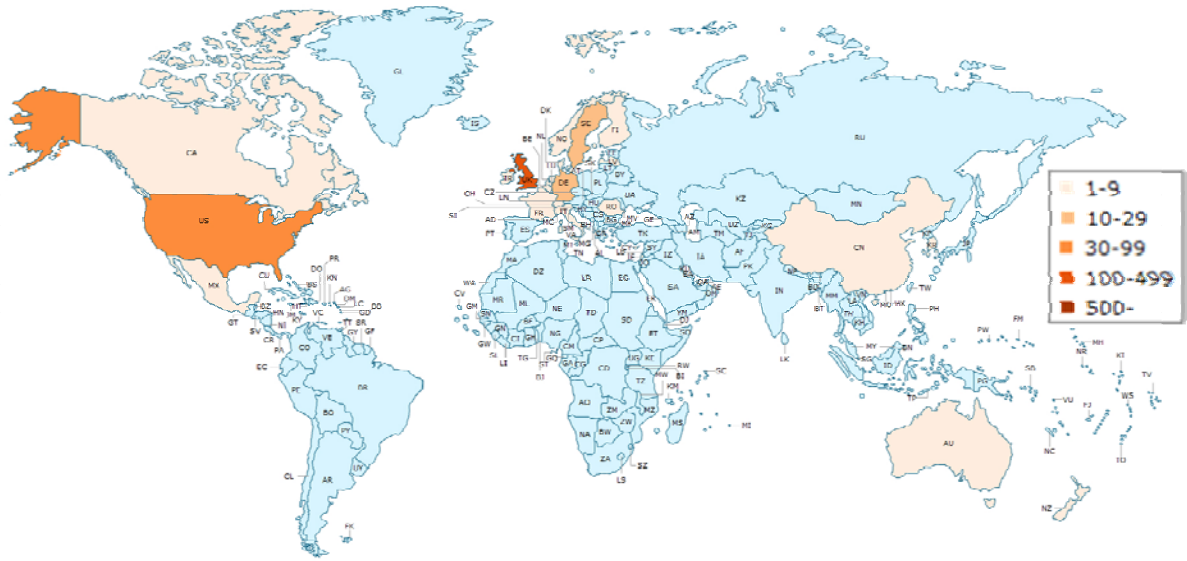


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Figure 7 – Location of Acquisition Targets of All Cambridge Technology Firms

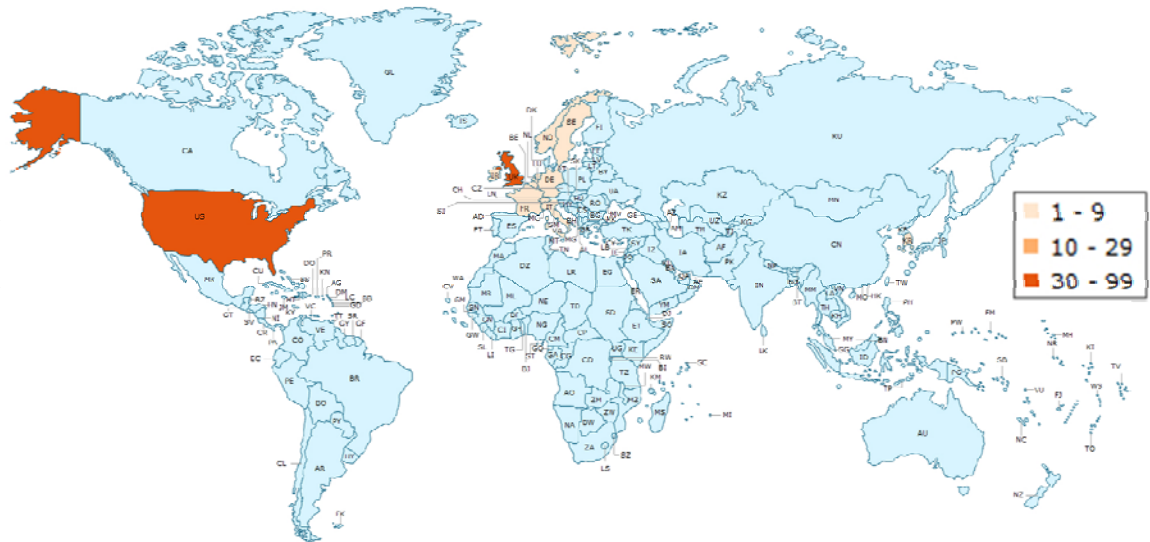


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Figure 8 – Location of Acquisition Targets of Cambridge High-Growth Firms

Conclusion

It is often noted that Cambridge high tech firms remain small for the most part. In recent years average size has risen, but fewer independent firms have been reaching

mid size (50 employees). One reason for this may be the high level of acquisition of those firms that have achieved rapid growth and market expansion in their early years. These tend to be the very firms that have greater potential for independent growth. Case studies reveal that acquiring firms often have difficulty sustaining the innovative potential of the entrepreneurial unit. In the case of science based firms, knowledge creation has been funded by tax payers in the science base and the acquisition of these firms by foreign buyers means that returns are likely to be repatriated elsewhere.

But the unknown factor is what would have happened had these firms not been acquired. Some might have continued to grow on an independent basis but others would not have prospered and ailing firms might have failed. The founders who sell their companies face a choice between certain wealth and a future for their innovation, on the one hand, and highly uncertain prospects for independent growth on the other hand. It is not surprising that so many of them choose to sell, especially when the fiscal situation is favourable to such sales. The cluster may ultimately benefit from the inflow of capital. But in the short term there has been limited sharing of benefits with the wider community resulting from acquisitions of promising firms in the Cambridge cluster.

There are however further outcomes for the local economy from acquisition. Post-acquisition spin-outs occur as employees leave the merged firm to set up new companies, whether pushed by dissatisfaction or pulled by opportunity. Departure of employees to post-acquisition spin-outs may pose a competitive threat and loss of valuable learning by the acquirer (Chaudhuri and Tabrizi, 1999; Klepper, 2007). Serial enterprise is related to such developments, as former employees leave to set up

other companies, contributing to the multiplication of new firms in the area (Garnsey and Heffernan 2005). Skilled employees are scarce resources in high-technology industries (Clodt et al., 2006).

Related technologies are often the outcome of post acquisition spin-off , as the firms develop “new species” of techno-activity rather than operating in direct competition with each other and the parent company. A single post-acquisition spin-out can give rise to a whole sector of new activity as firms’ progeny diffuse innovations through serial enterprise, creating value at the cluster level (Mason and Harrison, 2005). The impact of M&A activity requires further investigation along these lines. We have sought to provide initial steps towards such an understanding.

References

- Chaudhuri, S. and Tabrizi, B. (1999), Capturing the Real Value in High Tech Acquisitions, *Harvard Business Review*, 77(5),123-130.
- Cloodt, M., Hagedoorn, J. and Kranenburg, H.V. (2006), Mergers and acquisitions: Their effect on the innovative performance of companies in high-tech industries, *Research Policy*, 35, 642-6534.
- Delmar, F. and Davidsson, P. (1998), A taxonomy of high growth firms, In Reynolds, P.D., Bygrave, W.D., Carter, M., Manigart, S., Mason, C.M., Mayer, G.D. and Shaver, K.G. (eds.), *Frontiers of Entrepreneurship Research*, Center for Entrepreneurial Studies, Babson College, 399-413.
- Garnsey, E., Stam, E. and Heffernan, P. (2006), New Firm Growth: Exploring Processes and Paths, *Industry and Innovation*, 13(1), 1-20.
- Klepper,S. (2007), Disagreements, Spinoffs, and the Evolution of Detroit as the Capital of the U.S. Automobile Industry, *Management Science*, 53(4), 616-631.
- Lambert Review of Business-University Collaboration, HM Treasury, December 2003
- Mason, C.M. and Harrison, R.T. (2006), After the exit: Acquisitions, entrepreneurial recycling and regional economic development, *Regional Studies*, 40(1), 55-73.
- Pasanen, M. (2007), SME Growtyh Strategies: Organic or Non-Organic, *Journal of Enterprising Culture*, 15(4), 317-338.
- Shah, S. and Garnsey, E. (1993), The Acquisition of High Technology Firms: Evidence from Cambridge, Judge Institute of Management Studies Working Paper 1993/1994-3.

Appendix

The following data were obtained from firms for which data were available for performance before and after the acquisition of a Cambridge tech based company over the period 1990-2006.

Sector	Firms Acquired	Data Available	Av. Pre-Acquisition Growth of Firms	Av. Post-Acquisition Growth of acquired units
Biotech	37	7	74%	7%
Instruments	27	6	1%	-2%
Telecom	35	8	63%	-16%
IT	129	26	51%	10%

Impact of Acquisitions on Growth of Acquired Cambridge Tech Firms/ Units 1990 - 2006

Sector	Employment gains after acquisition	Employment losses after acquisition of units π	Overall employment impact on acquired units
Biotech	253	514	- 261
Instruments	101	406	- 305
Telecom	513	1202	- 689
IT	241	131	- 110

Impact of Acquisitions on Employment in Acquired Cambridge Tech Firms/Units 1990 - 2006

High-Tech Acquisition in the Cambridge Area: A comparison of the IT, Telecomms and Biopharm sectors, by Mohr V and Garnsey E., Working Paper 2010.