



# SMALL BUSINESS RESEARCH SUMMARY

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## Small Firms and Technology: Acquisitions, Inventor Movement, and Technology Transfer

by CHI Research Inc., Haddon Heights, NJ 08035  
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Small firms are integral to the innovation process even when they are not responsible for the final or breakthrough technology. Small firms may play a role in large firms' technical breakthroughs in several ways. Large firm innovators may acquire small firms (and their patents), hire small firm inventors, or build on prior small firm patents. This study seeks to determine the extent to which large firms rely on small firms and their achievements in developing new technologies.

### Overall Findings

Small firms are a vital element of new technology in many industries. Their importance is not immediately apparent when all industries are considered, because small firms tend to be excluded from such key capital intensive industries as automotive, aerospace, and oil research. In newer high technology industries, such as biotechnology, medical electronics, medical equipment, and telecommunications, large firms frequently rely on small firms' discoveries and inventions.

### Highlights

- Between 2000 and 2002, there was an increase in the number of actively innovating firms (those with more than 15 patents in the previous five years). The researchers updated an existing database of innovative firms and found that 104 companies

were dropped from the database, while 318 were added.

- The influence of small firms in technology is increasing. Small firms represented 40 percent of the highly innovative firms in 2002, as opposed to 33 percent in the 2000.

- In their patents, large firms in the biotechnology, medical electronics, semiconductor, and telecommunications industries have a higher-than-expected number of citations of small firm patents. When all industries are considered, reliance on small firm inventions is less obvious. This is the result of the virtual absence of small firms in certain key industries, among them aerospace, oil and gas mining, and motor vehicles and parts.

- Between the mid-1990s and the early 2000s, large firms' share of elite inventors (those with at least 10 patents in a two-year period) fell from 72 percent to 69 percent. The share of elite inventors employed by small firms rose from 12 percent to 16 percent during the same period.

- Large firms and small firms had a similar percentage of their elite inventors remain in their employ (74 percent and 79 percent, respectively). Only 49 percent of inventors working in the public sector remained with their employers. Elite inventors tended to move within their firm-size category, moving from one large firm to another or from one small firm to another.

- Of the 24 companies that acquired small firms, six firms gained 50 percent or more of their technology strength through acquisitions (as measured by patents and citations in other patents).

- Contrary to expectations, large firms obtained limited technology through the acquisition of small firms. Only three of the 41 firms that were acquired were small.

- Small firms have a greater technological impact in industries that tend to consist of many young, small innovative firms. Industries that fit these characteristics include biotechnology, computers and peripherals, medical electronics, medical equipment, semiconductors and electronics, and telecommunications industries. More than half of the small firms in these industries only obtained their first patents after 1990.

## Scope and Methodology

Using raw, publicly available patent data, the authors created a database to determine the extent to which newer patents rely on prior patents and to track inventor movement and firm acquisitions. The authors also verified some of the missing fields in the patent data, such as firm size.

To determine how much patents rely on previous patents, the researchers created a database of innovative companies (those with 15 or more patents during each of two time periods). The database contained 1,270 companies for the time periods 1996-2000 and 1998-2002. To determine whether firms had been acquired, the researchers analyzed technologically innovative companies (firms with 45 or more patents) and compared their status in 1998 and 1994. For inventor movement, the researchers focused on the elite inventors (with at least 10 patents in the period 1993-95 or 2000-02 and at least one patent in each time frame) and assigned them, where possible, to firm size categories. These elite inventors represented 1.5 percent of unique inventors but accounted for 27 percent of patents.

## Ordering Information

The full text of this report and summaries of other studies performed under contract to the U.S. Small Business Administration's Office of Advocacy are available on the Internet at [www.sba.gov/advo/research](http://www.sba.gov/advo/research). Printed copies are available for purchase from:

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