volume 7 | issue 3

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innovations

TECHNOLOGY | GOVERNANCE | GLOBALIZATION

Making in America

ENTREPRENEURIAL SOLUTIONS TO GLOBAL CHALLENGES

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Technology | Governance | Globalization

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Organization of the Journal

Each issue of *Innovations* consists of four sections:

1. Lead essay. An authoritative figure addresses an issue relating to innovation, emphasizing interactions between technology and governance in a global context.

2. Case narratives. Case narratives of innovations are authored either by, or in collaboration with, the innovators themselves. Each includes discussion of motivations, challenges, strategies, outcomes, and unintended consequences.

3. Analysis. Accessible, policy-relevant research articles emphasize links between practice and policy—alternately, micro and macro scales of analysis. The development of meaningful indicators of the impact of innovations is an area of editorial emphasis.

4. Perspectives on policy. Analyses of innovations by large-scale public actors—national governments and transnational organizations—address both success and failure of policy, informed by both empirical evidence and the experience of policy innovators. The development of improved modes of governance to facilitate and support innovations is an area of editorial focus.

Adam Friedman and Joan Byron

High-Tech, High-Touch, and Manufacturing's Triple Bottom Line

After decades of neglect, the manufacturing sector is now getting welcome attention as a critical element in the revival of our national economy. But research and policy development on U.S. manufacturing have tended to focus on technology-intensive subsectors and processes, including, most recently, "advanced manufacturing." As defined in a recent $26 million federal funding announcement, advanced manufacturing is "a family of activities that (a) depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or (b) make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences (for example, nanotechnology, chemistry, and biology)."

Thus defined, "advanced manufacturing" takes advantage of our nation's depth of engineering talent and offers the U.S. a competitive edge against countries whose advantages have been based in part on low labor costs.

But for policymakers at the federal, state, and local levels, a U.S. manufacturing renaissance should not only be about technological leadership and market share; it should be just as much about leveraging the potential of an increasingly diverse workforce, revitalizing cities and inner suburbs, and maintaining a high quality of life while reducing the environmental impacts of production and consumption. A narrow technological focus will miss opportunities based on other competitive advantages, such as sophisticated design, market insight, and the ability to respond to quick shifts in demand. Moreover, a narrow definition will not

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Joan Byron now leads the Pratt Center's policy development and advocacy work; her prior projects include the Center's Transportation Equity initiative, and support of local coalitions working for the reclamation of the Bronx River and the removal of the Sheridan Expressway.

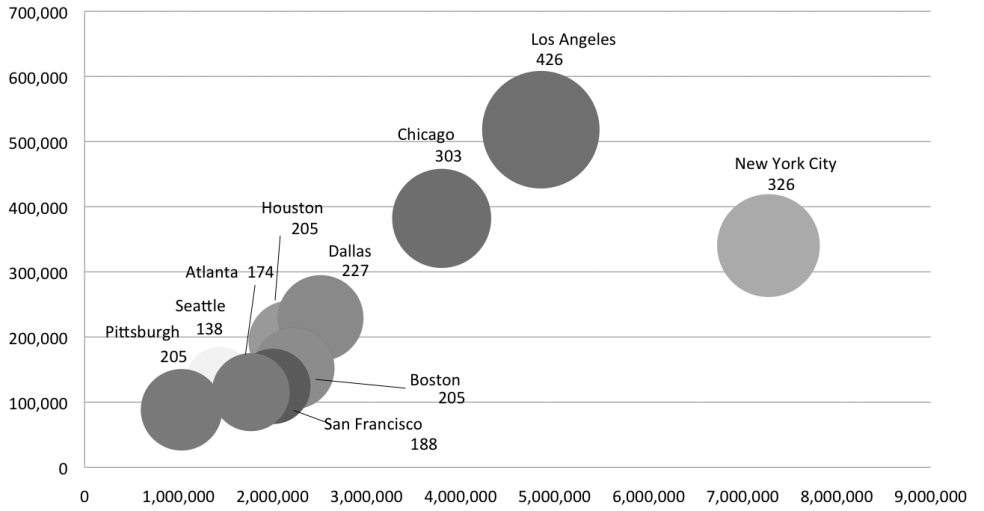

Figure 1. Subsectors in Large Cities:
Area of Bubble Represents Numbers of Unique 6 Digit NAICS Subsectors

Source: US Census 2010

produce the broad-based benefits that we need so desperately to address the growth in income disparity that characterizes our service-driven economy.

Relatively little research has taken a triple bottom line approach to "new manufacturing" or considered the impact it has not only on our economy but also on our society and our environment. From this perspective, it may be useful to identify "high-value/high-performance" (HV/HP) subsectors, intentionally including makers of both "high-tech" and "high-touch" products, and to compare recent trends in their activity to each other and to the manufacturing sector as a whole. The high-touch grouping illustrates how performance and value can be created from attributes other than advanced technology.

The high-value/high-performance rubric takes in everything from technologically advanced producer goods to high-end consumer products made by traditional processes. Though companies within these emerging subsectors may be disparate in the products they make, the processes they employ, and the markets they serve, they have five important characteristics in common:

- High value added, which enables high wages (though the actual opportunities created for different types of workers is likely to vary among sectors and by place)
- High value added incorporating a low environmental impact—low-bulk, low-waste, low-transportation impacts—as well as the use of green products and processes
- High level of innovation, meaning:

3113: Sugar and Confectionery: Sugar, Chocolate from cacao beans, Chocolate from purchased product, Non-chocolate confection
3119: Other Food: Snack food, Nuts, Coffee and tea, Flavoring, Seasoning, Dressing
3231: Printing and Related Activities: Commercial lithographic, flexographic, and screen printing, Quick printing, Digital printing, Books printing, Tradebinding, Prepress services
3345: Navigational, Measuring, Electromedial, and Control Instruments: Electromedial and electrotherapeutic apparatus, Automatic environmental controls, Search, detection, navigation, guidance, and aeronautical instruments, Totalizing fluid meter and counting devices, Analytical laboratory instruments, Irradiation apparatus, Watch, clock, and parts
3346: Magnetic and Optical Media: Software reproducing, Compact disc and tape reproducing, Magnetic and optical media production
3351: Electric Lighting Equipment: Electric lamp bulbs and parts, Lighting fixtures (residential, commercial, and industrial), Other lighting equipment
3371: Household and Institutional Furniture: Wood kitchen cabinets and countertops, Upholstered household furniture, Unupholstered wood household furniture, Metal household furniture, Wood cabinets
3391: Medical Equipment and Supplies: Surgical and medical instruments, Surgical and medical appliances and supplies, Dental equipment and supplies, Ophthalmic goods, Dental laboratories

Table 1. Selected High-Value/High-Performance Manufacturing Subsectors

  - A short cycle time for design > prototyping > production
  - A large proportion of new products
  - A high degree of customization and response to insights from clients and markets
- High employment multipliers
- High level of interaction with other firms and/or clusters

HIGH-VALUE/HIGH-PERFORMANCE MANUFACTURING: A SNAPSHOT

As part of our mission, the Pratt Center for Community Development is exploring the ways that new manufacturing can make the economies of New York and other U.S. cities not only more competitive but more inclusive and sustainable.

For this project, we selected five large and five mid-sized Metropolitan Statistical Areas (MSAs), looking for regional and demographic diversity. We also considered manufacturing diversity, based on the number of unique six-digit North American Industry Classification System (NAICS) codes with a substantial presence in each MSA. We aimed for geographic variety by including MSAs on the coasts, and in the Midwest and South. We then identified eight manufacturing subsectors (at the four-digit NAICS code level) that we define as high-value/high-performance; these are listed in table 1. Of these, we selected four that produce high-touch consumer goods, including high-end, design-intensive, high-value

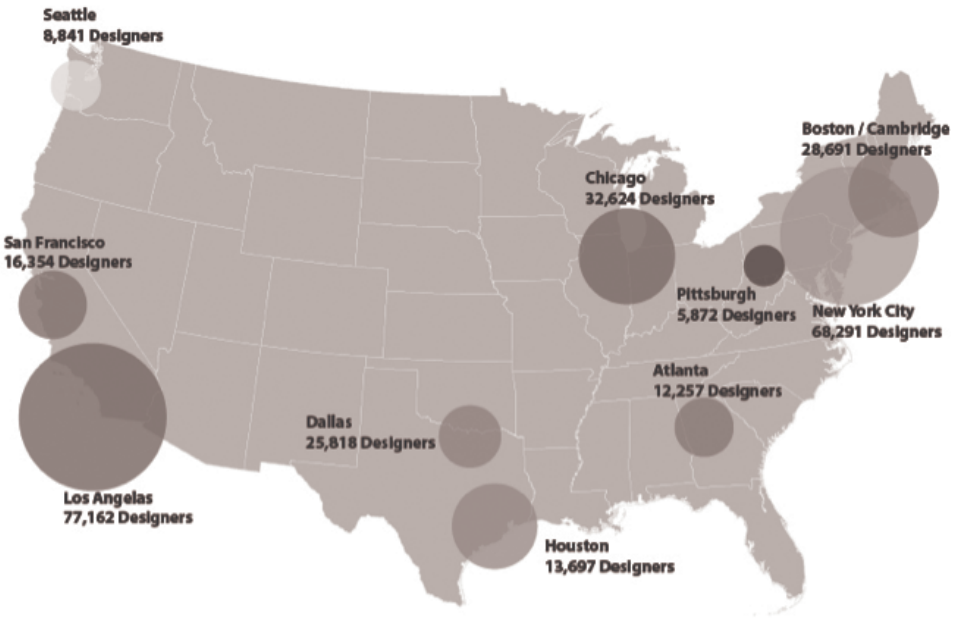

Figure 2. Professional Designers by City

Prepared by Pratt Center for Community Development, July 2012.
Source: US Census, American Community Survey, 2009

products; the other four produce technology-intensive products, mainly (though not exclusively) producer goods. Both the "touch" and "tech" subgroups include but are not limited to sub-sectors we would describe as high-value/high-performance (HV/HP).

It is worth noting that the lines between high-tech and high-touch production are far from clear and are likely to blur even more as production methods integrate once-disparate disciplines and methods. For example, Crye Precision, a maker of advanced body armor for military and law enforcement personnel, relies on sophisticated design and state-of-the-art materials—and on sewing by skilled seamstresses that the company recruits from neighborhoods close to its Brooklyn Navy Yard factory.

Our goal was to examine recent trends in employment and small firm activity in the HV/HP subsectors, and to compare trends among subsectors, across cities, and against U.S. manufacturing as a whole. We are intentionally creating a snapshot, not a comprehensive analysis; rather than providing answers, we aim to raise further questions and frame directions for future research. Our hypothesis is that the overall contraction of U.S. manufacturing (and perhaps also its modest rebound in 2010-2012) masks a much more complicated reality, with quite disparate trends in different cities and sectors.

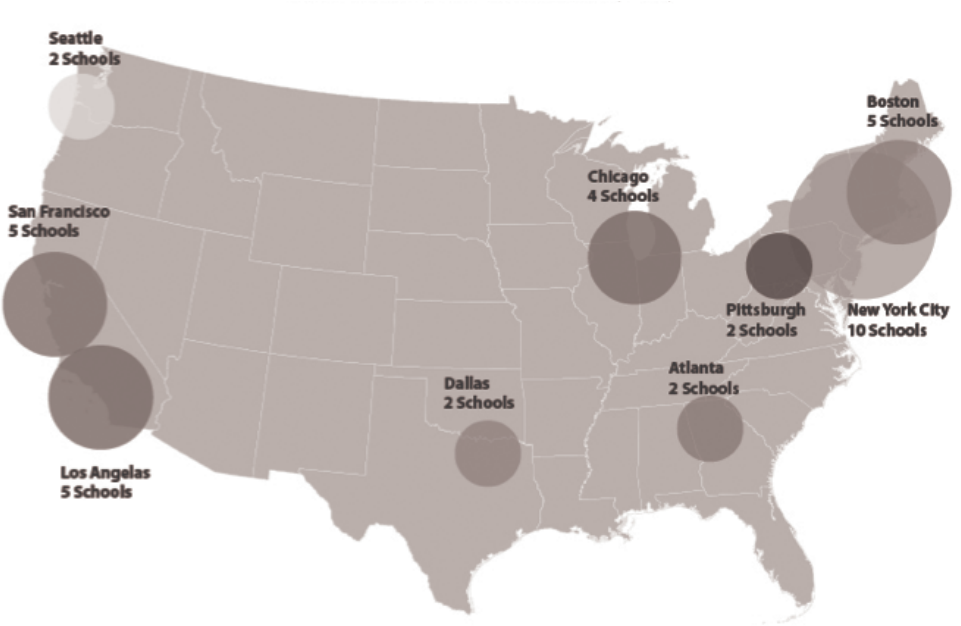

Figure 3. Accredited Design Schools by City

Prepared by Pratt Center for Community Development, July 2012
Source: National Associate of Schools of Art & Design

We also were interested in factors that may correlate with the emergence and growth of small firms in HV/HP subsectors. This also was not a comprehensive analysis of all possible factors but a snapshot of demographic and economic conditions we believe are likely to be conducive to innovation and to the development of new industries and products. The factors are sectoral diversity, growth in numbers of small firms by subsector, concentrations of design and engineering talent, and the location of university programs in design and engineering.

A further hypothesis is that policies designed to support individual sectors may not be sufficient to encourage innovation and the emergence of new high-potential industries. Programs that attempt to focus too narrowly on "the next big thing" may in fact be targeting "the last big thing." We suggest that places that are already sectorally diverse, and that are hubs of design and/or engineering talent, are the most likely to spawn the next generation of new industry sectors. We think that the right question is not simply about which industry sectors government policies should bet on; we also should be asking what policies (federal, state, and local) will best support the emergence and growth of high-performance manufacturing regardless of sector.

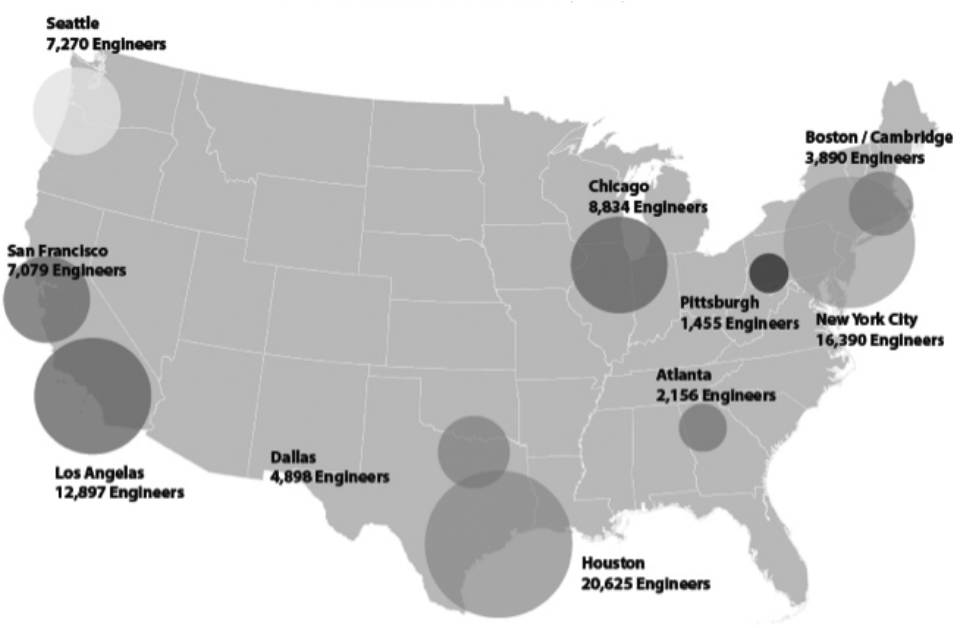

Figure 4. Professional Engineers by City

Prepared by Pratt Center for Community Development, July 2012
Source: US Census, American Community Survey, 2009

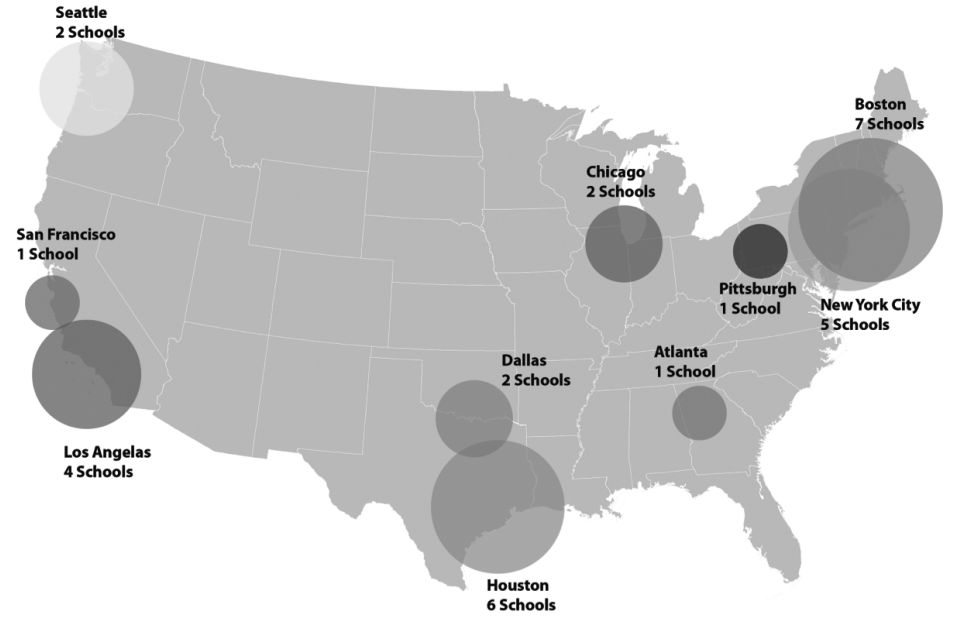

Figure 5. Accredited Engineering Schools by City

Prepared by Pratt Center for Community Development, July 2012.
Source: Accreditation Board for Engineering and Technology.

SECTORAL DIVERSITY

From Jane Jacobs to Ricardo Hausmann, observers of economic development have cited diversity and complexity as key drivers of innovation and growth. Entrepreneurs exchange ideas; capabilities cross-pollinate and generate new products. We compared the number of unique six-digit NAICS codes occurring in each of our large and mid-sized MSAs with each city's total workforce and total manufacturing workforce. Not surprisingly, the largest cities—Los Angeles and New York—had the largest number of manufacturing subsectors, but several mid-sized MSAs boast respectable numbers as well.

By this measure, cities like Boston, San Francisco, and Seattle punch well above their weight in the number of manufacturing subsectors that call them home (see figure 1 on page 120). What makes some cities sectorally prolific?

We mapped concentrations of engineers and designers, and also of universities with accredited design and engineering programs. The results are shown in figures 2, 3, 4, and 5. Some interesting relationships among these datasets can be noted. Boston's manufacturing workforce is 75 percent as large as Houston's and it has only about 20 percent as many engineers, but the two cities have equal levels of manufacturing diversity, as measured by the number of NAICS codes represented in table 1. Does Boston/Cambridge's world-class cluster of design and engineering schools support the proliferation of new industry subsectors? Does the dominance of the oil industry in Houston crowd out other, emerging sectors? Cities with large numbers of these professionals, and the university programs that train them, often house the research centers and incubator spaces that nurture not only individual startups but the networks that enable innovation. These same cities are also the locations of "maker spaces," industrial incubators, and other shared work environments that serve this network-building function.

SMALL FIRM TRENDS IN THE HIGH-VALUE/HIGH-PERFORMANCE SUBSECTORS

Finally, we looked at recent trends in selected subsectors that include HV/HP production, including technology-intensive and design-intensive producer and consumer goods. We made our selections as illustrations rather than as a comprehensive representation of small manufacturing; we chose subsectors that are likely to include a high proportion of firms that we would qualify as HV/HP, but at the four-digit level, the subsectors will inevitably include other kinds of firms as well.

We examined changes in the numbers of small (10-19 employees) and very small firms (<10 employees) in our ten MSAs between 2003 and 2010. This period is of particular interest because it reveals how different subsectors have been impacted by the recession and which have been best able to recover. Figures 6 and 7 show these trends for small and very small firms in New York. Figures 8 and 9 show them for small and very small firms in San Francisco.

We did not have access to firm-level data for this preliminary scan, so it is impossible to say whether (for example) some San Francisco firms that previously

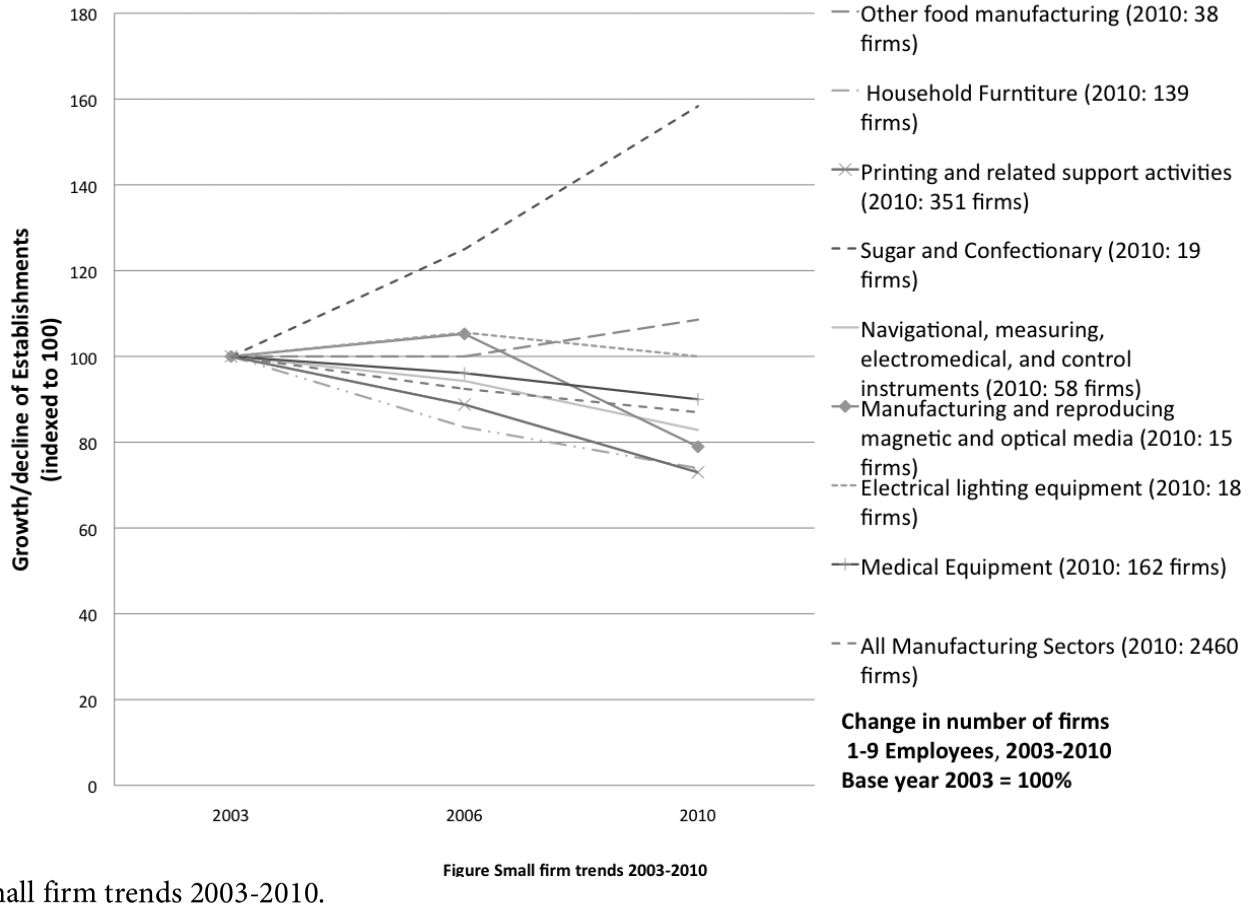

Figure 6. Small firm trends 2003-2010.

Change in number of firms with 1-9 employees, High-Tech / Producer and High-Touch / Consumer Firms compared to All Manufacturing, San Francisco MSA.

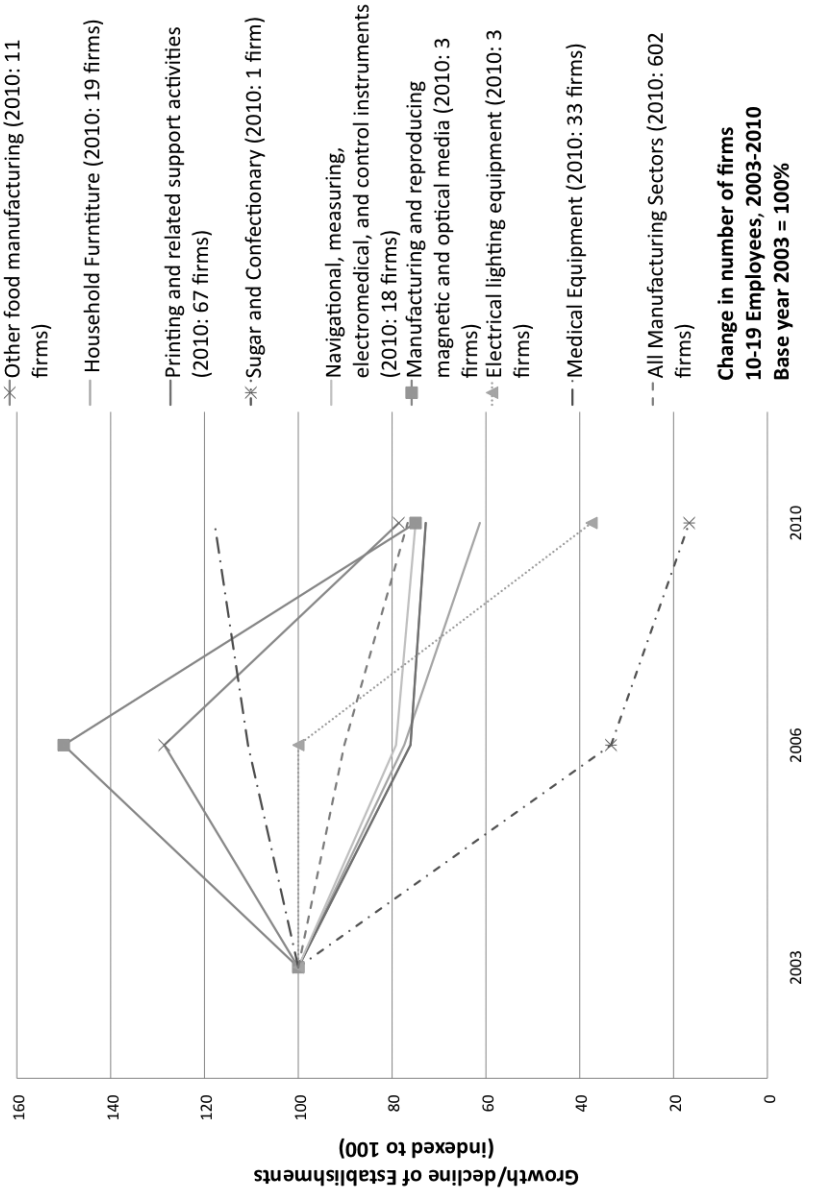

Figure 7. Small firm trends 2003-2010
Change in number of firms with 10-19 employees, High-Tech / Producer and High-Touch / Consumer Firms compared to All Manufacturing, San Francisco MSA

Source: U. S. Census 2010

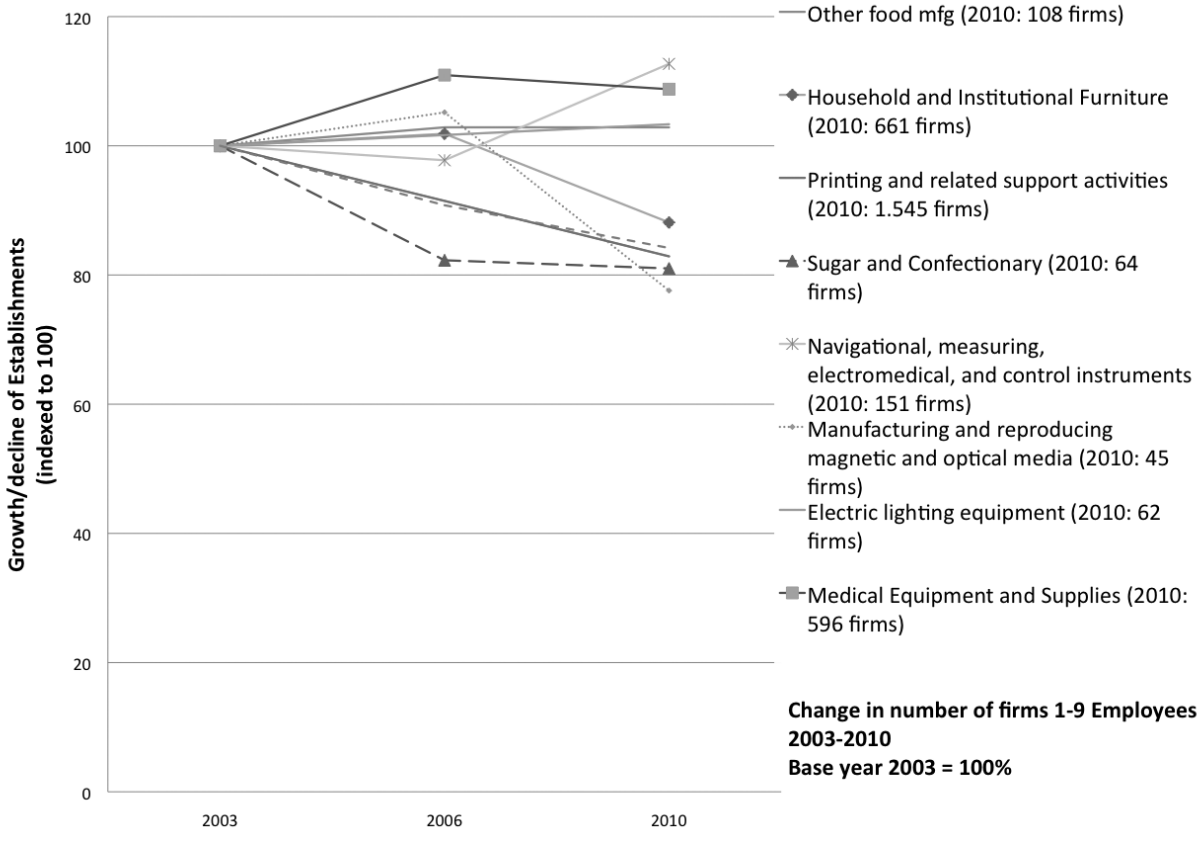

Figure 8. Small firm trends 2003 - 2010
hange in number of firms with 1-9 employees, High-Tech / Producer and High-Touch / Consumer Firms compared to All Manufacturing, New York MSA.

Source: U.S. Census 2010

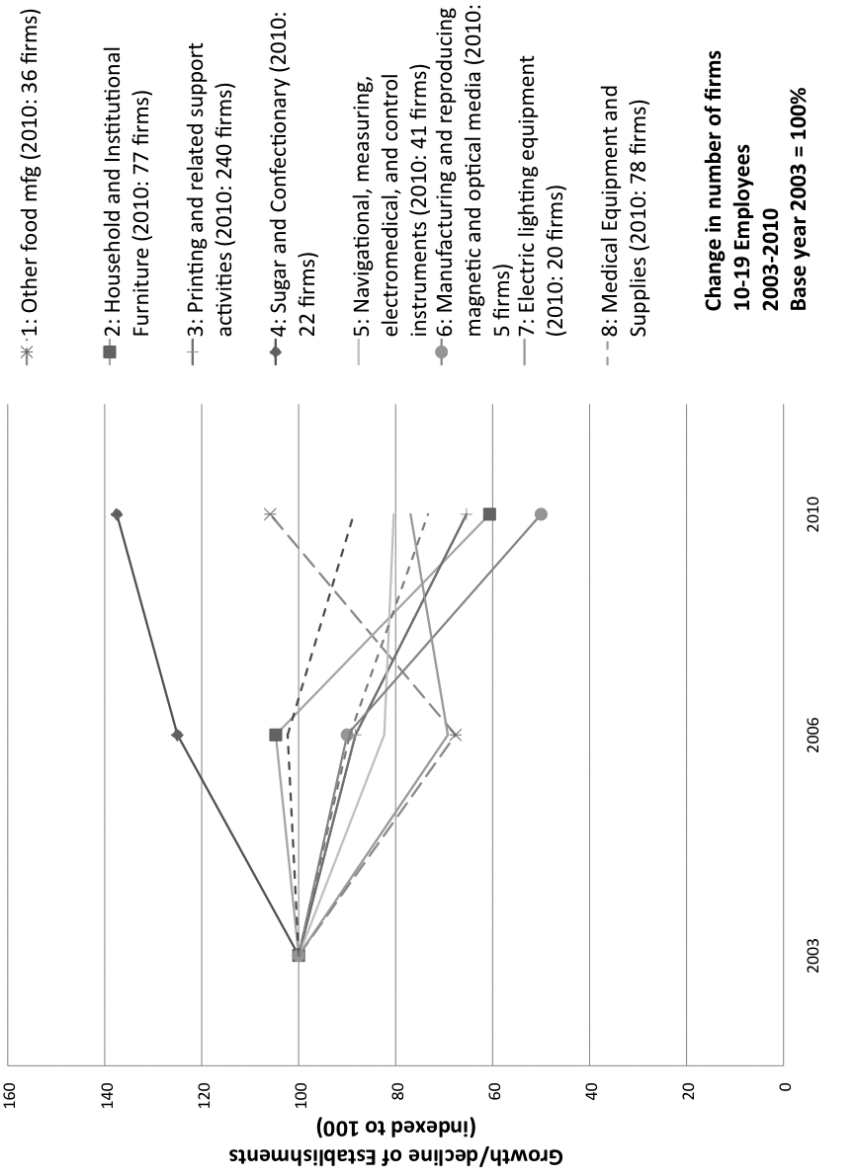

Figure 9. Small firm trends 2003 - 2010

Change in number of firms with 10-19 employees, High-Tech / Producer and High-Touch / Consumer Firms compared to All Manufacturing, New York MSA

Source: U.S. Census 2010

employed 10-19 workers shrank to the 1-9 employee level after 2006, partially masking the deaths of previously existing smaller firms. In New York, by contrast, four of the eight subsectors showed either actual growth or a slower rate of decline in 10-19-person firms after 2006 than before.

The divergence of patterns of growth and contraction, pre- and post-2006, was surprising even to us. We should note that in some cities the very small numbers of firms in some sectors mean that "trends" may not be reliably represented. Still, at least four patterns are worth noting:

- In most cities, the number of firms increased in a significant number of our selected sectors, at least up to 2006.
- Even after 2006, almost all of the selected cities saw growth in one or more sectors, despite the overall trend toward a decrease in the number of small manufacturing firms between 2006 and 2010.
- Over the entire period 2003–2010, there was generally more growth in the number of small firms making high-touch/consumer goods than in those making high-tech/producer goods—but we saw examples of growth in most of the tech/producer subsectors as well.
- Generally, though not in all cases, the high-touch/consumer sectors were more volatile than the tech/producer sectors. That is, sectors making consumer goods tended to grow more quickly (in 2003–2006) but also to contract more dramatically (in 2006–2010).

There is far too little data about small firm growth and contraction at the subsector level to warrant speculation about patterns, much less about causation. And because we have focused on changes in the number of small firms, not on employment or revenue, this snapshot reveals little about the economic impact of small firm activity.

However, despite these limitations, the analysis suggests that an overly narrow definition of "advanced manufacturing" will lead to missed opportunities in sectors that show promise in terms of business and job growth. Perhaps more disturbing is that these opportunities are in high-touch sectors that derive their value from factors other than advanced engineering and consequently may be more accessible to people with lower levels of educational attainment or other credentials. In addition, the preliminary data suggests that cities and metropolitan areas with more diversified manufacturing bases are likely to be more resilient in the face of economic shocks than those with fewer active sectors.

MORE QUESTIONS

Some obvious directions for additional research include the relationship between sectoral diversity and growth in high-performance manufacturing, as well as the locational factors contributing to both. Are places with high levels of sectoral diversity also the places where HV/HP manufacturing is growing? Are high-performance firms more prevalent in cities, in suburbs, or in the exurban fringe, and how does this vary among U.S. regions? Do denser urban environments promote

the clustering of firms in emerging high-performance sectors? Does the presence of designers, engineers, and university programs correlate with high performance? Has the emergence of maker spaces like TechShop been a factor in the growth of small, high-performance firms?

Another set of questions of interest to policymakers revolves around the economic implications of sectoral diversity and of high-performance manufacturing. Are the HV/HP sectors adding jobs at a higher rate than other manufacturing subsectors? What are the demographic profiles of employees in emerging high-performance sectors, particularly their levels of education? Do some subsectors offer better prospects—for both employment and advancement—to the most disenfranchised groups? That is, can high-performance manufacturing offer opportunities to workers who lack formal credentials? Answering this last question is urgent if we want manufacturing to reopen the pathways to the middle class that were cut off as the gates of large factories closed in the mid-20th century .

Understanding the sectoral and geographic characteristics of industries that are likely to be the most fertile ground for innovation, and that are likely to create opportunities for a broad spectrum of workers, is an important step toward formulating policies that will be supportive of manufacturing innovation and entrepreneurship that is also sustainable, both socially and environmentally.

Acknowledgments

The Pratt Center for Community Development, a department of Pratt Institute, has worked since the 1970s to support community-based organizations working for social, economic, and environmental justice in New York City. Current projects include initiatives to scale-up small building energy retrofits, strengthen urban manufacturing, and support locall led planning for sustainable development. Pratt Center fellows contributing research and analysis for this article were Derek Brunelle, Josh Eichen, Gwendolyn Galedary, and Bo Scarimo.

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1. U.S. Economic Development Administration, press release on the Advanced Manufacturing Jobs and Innovation Accelerator Challenge, May 29, 2012. Available at http://www.eda.gov/news/pressreleases/2012/05/29/advanced_manufacturing.htm.
2. The term "high touch" was coined in the early 1980s by John Naisbitt in his best-selling book, *Megatrends*. Naisbitt pointed out the fallacy of automating every business transaction without including human interaction at some point. We use it here to contrast the high-tech emphasis on engineering to create value with the value that is created by "the personal touch" of a designer, a craftsperson, or an insightful entrepreneur.
3. "The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy," U.S. Census Bureau, http://www.census.gov/eos/www/naics/. Establishments are classified at levels from two to six digits, with two-digit codes being the most general and inclusive, and six-digit codes the most specific. NAICS code definitions available from http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart_code=31&search=2012%20NAICS%20Search. To be counted, a subsector had to include a minimum of 5 establishments per city.

4 Source: U.S Census, 2010.

5 Source: U.S Census, 2010.

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