



Arts Data Profile: Rural Arts, Design, and Innovation

Research Brief #3: Innovation and Design Use by Small Manufacturers

In May 2017, the National Endowment for the Arts published *Industrial Design: A Competitive Edge for U.S. Manufacturing Success in the Global Economy*. Drawing from an extensive body of literature, as well as interviews with field experts, the Industrial Design report asserts the importance of this artistic discipline for manufacturers, particularly for small businesses that produce parts and components for larger businesses.

Small manufacturers represent an increasing share of the supply chain, and they account for much of the sector's job growth. Of the nearly 1.2 million new manufacturing jobs reported in 2014, about 75 percent were created by small manufacturers.¹

This Research Brief uses data from a U.S. Department of Agriculture survey of businesses—specifically from the Economic Research Service' (ERS) Rural Establishment Innovation

Survey (REIS)—to investigate the relationship between design use and innovation by small manufacturers. Complementing the conclusions of *Industrial Design*, this analysis shows that manufacturing innovation rises sharply with the use of design.

Among all small U.S. manufacturers, 35.9 percent are classified as “substantive innovators,” according to a methodology devised by ERS. Among small manufacturers that are “design-integrated” (i.e., establishments that substantially use and invest in design), the share that is highly innovative is much higher—83.7 percent.

Definitions

Establishment: As defined by the U.S. Bureau of Economic Analysis, an establishment is an economic business unit at a single geographic location, where business is conducted or where services are performed. An establishment is not necessarily identical to an enterprise or company, which may consist of one or more establishments.

Small manufacturers: In this analysis, “small manufacturers” are defined as those establishments with fewer than 500 employees.²

Substantive innovator: The REIS includes an array of questions pertaining to innovation. Examples include whether the establishment has protected intellectual property, whether it monitors customer satisfaction, and whether it reports abandoned or incomplete innovation projects—a strong indicator of whether an establishment recognizes the value of initial failures in the trial-and-error process of innovation.

Based on responses to this array of questions, a latent class analysis (LCA) conducted by ERS yielded three innovation classifications: (1) non-innovator; (2) nominal innovator; and (3) substantive innovator.

While non-innovators fail to meet a threshold of having rudiments of a continuous improvement system, nominal innovators meet this basic threshold. Substantive innovators, on the other hand, meet not only the first threshold, but also a second threshold of displaying behaviors consistent with far-ranging innovation.

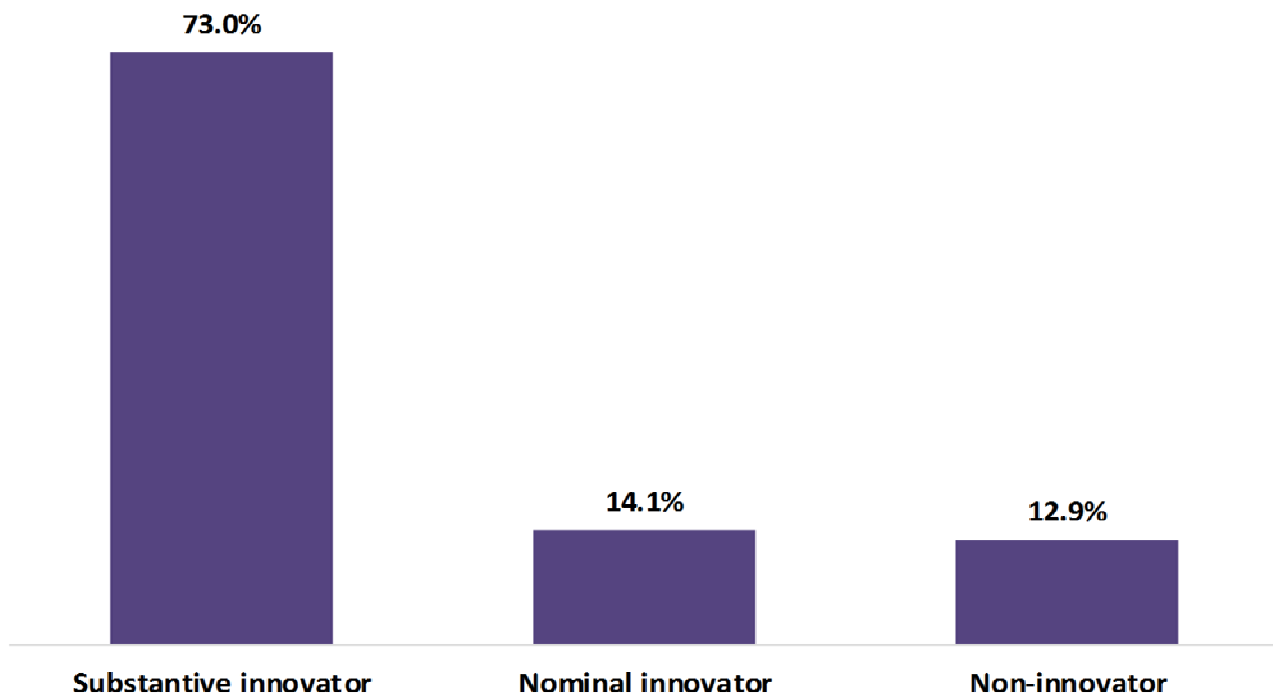
Design-integrated: Latent class analysis was also used to classify establishments into three categories of design use: (1) no systematic use of design; (2) “design last finish”; and (3) design-integrated.

On the design ladder, the phrase “no use of systematic design” refers to establishments that did not indicate using in-house or contracted design services; they also did not apply for patents or register trademarks or pursue other intellectual property protections.

“Design last finish” refers to establishments that reported use of in-house or contract design services, but which used few, if any, intellectual property protections.³

The highest rung on the design ladder is “design-integrated,” which refers to establishments that use in-house or contracted design services and that use several types of intellectual property protection. Such firms also reported they are likely to borrow funds for intangible investments such as branding or design.

Percent of small manufacturers that had abandoned or incomplete innovation activities in the past three years, by innovation classification: 2014



Data source: Rural Establishment Innovation Survey, Economic Research Service, U.S. Department of Agriculture

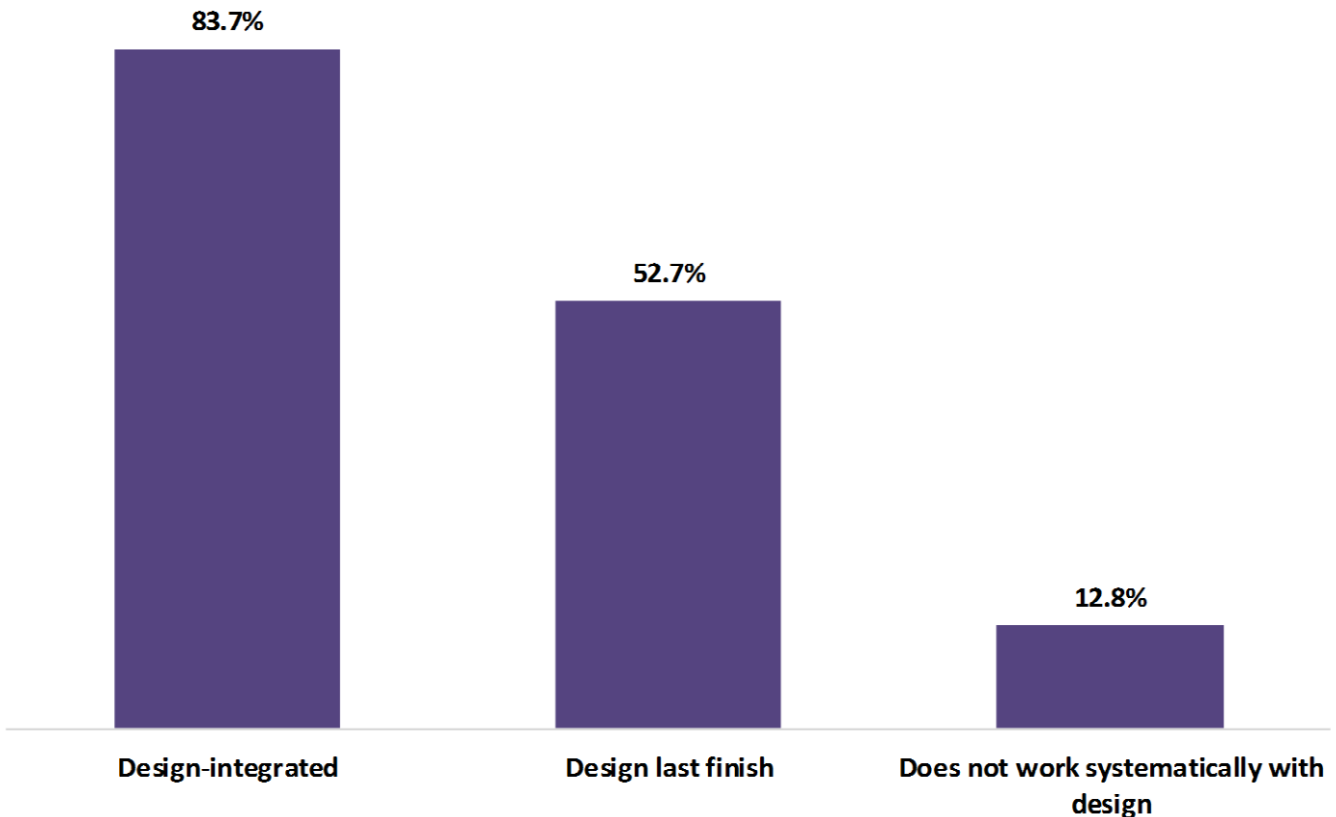
Innovation Rises with Design Use

Of the REIS population representing 180,000 small manufacturers, nearly 36 percent are classified as substantive innovators. The share changes dramatically, however, once design use is taken into account.

For example, among small manufacturers that were classified as using no systematic design, 12.8 percent are substantive innovators; among design-last-finish establishments, the share rises to 52.7 percent.

Among small manufacturers classified as design-integrated, a large majority—83.7 percent—are highly innovative.

Percent of small manufacturers that are substantive innovators, by use of design: 2014



Note: Differences are statistically significant at 95 percent confidence.

Data source: Rural Establishment Innovation Survey (REIS), Economic Research Service, U.S. Department of Agriculture

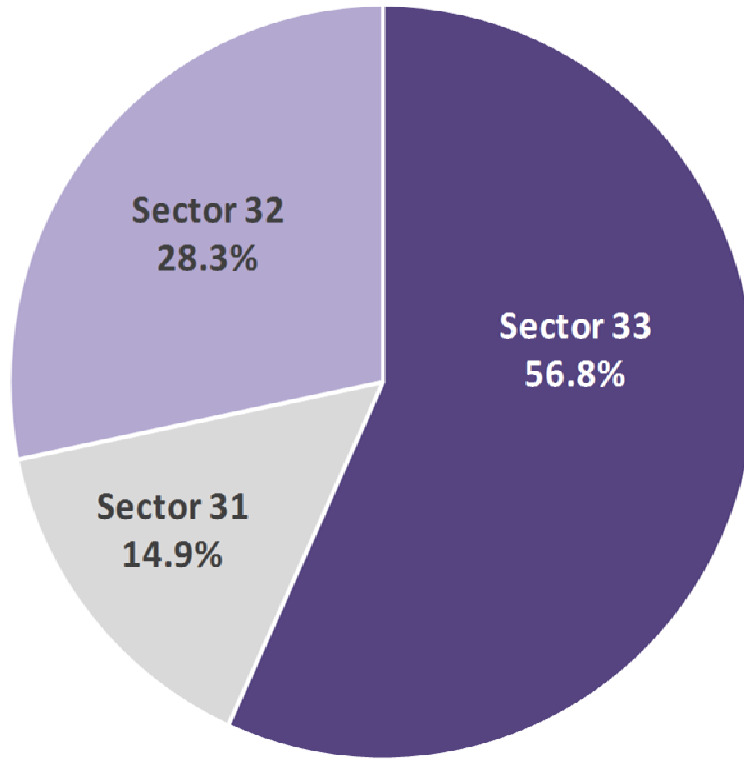
Design Use by Specific Manufacturing Sector

The manufacturing sector comprises three subdivisions corresponding to NAICS codes 31, 32, and 33.⁴ Sector 31 includes apparel and textile manufacturing, as well as the manufacture of food items and beverages.

Sector 32 refers to establishments that manufacture plastic and rubber products, chemicals and petroleum, and wood and paper products.

Sector 33, which accounts for more than half of all small manufacturing establishments, comprises metal product and machinery manufacturing; computer, electrical equipment, and appliance manufacturing; transportation equipment (including motor vehicles) manufacturing, as well as additional industries such as those making furniture, sporting goods, and jewelry.

Percent of small manufacturers by sector: 2014



Note: Small manufacturers employ fewer than 500 workers.
Data source: Rural Establishment Innovation Survey (REIS), Economic Research Service, U.S. Department of Agriculture

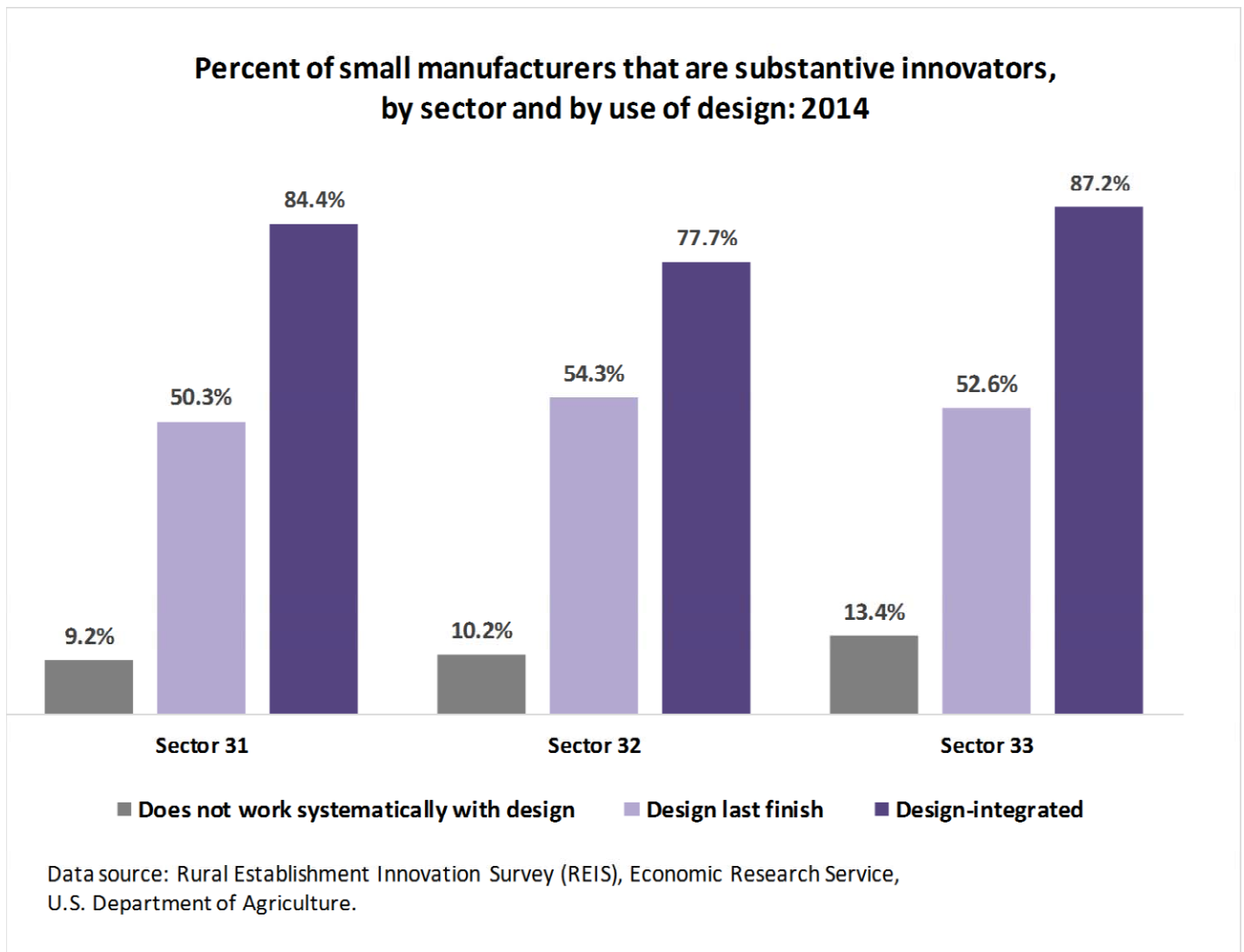
Examples of manufacturing industries by sector

Manufacturing sector	Example industries
Sector 31	Chocolate manufacturing; breweries; wineries; textile mills; footwear manufacturing; handbag and purse manufacturing.
Sector 32	Sawmills; paper manufacturing; printing; petroleum and coal products manufacturing; pharmaceutical manufacturing; plastics manufacturing.
Sector 33	Steel manufacturing; motor vehicle manufacturing; computer manufacturing; furniture and custom architectural woodwork manufacturing; jewelry and silverware manufacturing.

Source: U.S. Census Bureau, North American Industrial Classification System (NAICS)

Rural Establishment Innovation Survey results show that in all three manufacturing sectors, the share of small manufacturers classified as substantive innovators rises with design use.⁵ But the rise is steeper in sectors 31 and 33. For example, 35.5 percent of all small Sector-33 manufacturers are classified as substantive innovators. However, that share rises to nearly 53 percent when we look only at establishments classified as “design last finish” on the design ladder.

Notably, the share of small manufacturers in Sector 33 classified as substantive innovators exceeds 87 percent for establishments that are “design-integrated.”



Design Use and Operations in More than One Location

The REIS data suggest that small manufacturers producing goods in more than one location are, on average, more innovative than small manufacturers producing goods in just one location.

Of manufacturers producing goods in multiple sites, 55 percent are classified as substantive innovators. For manufacturers producing goods at just one site, the share is 30 percent.

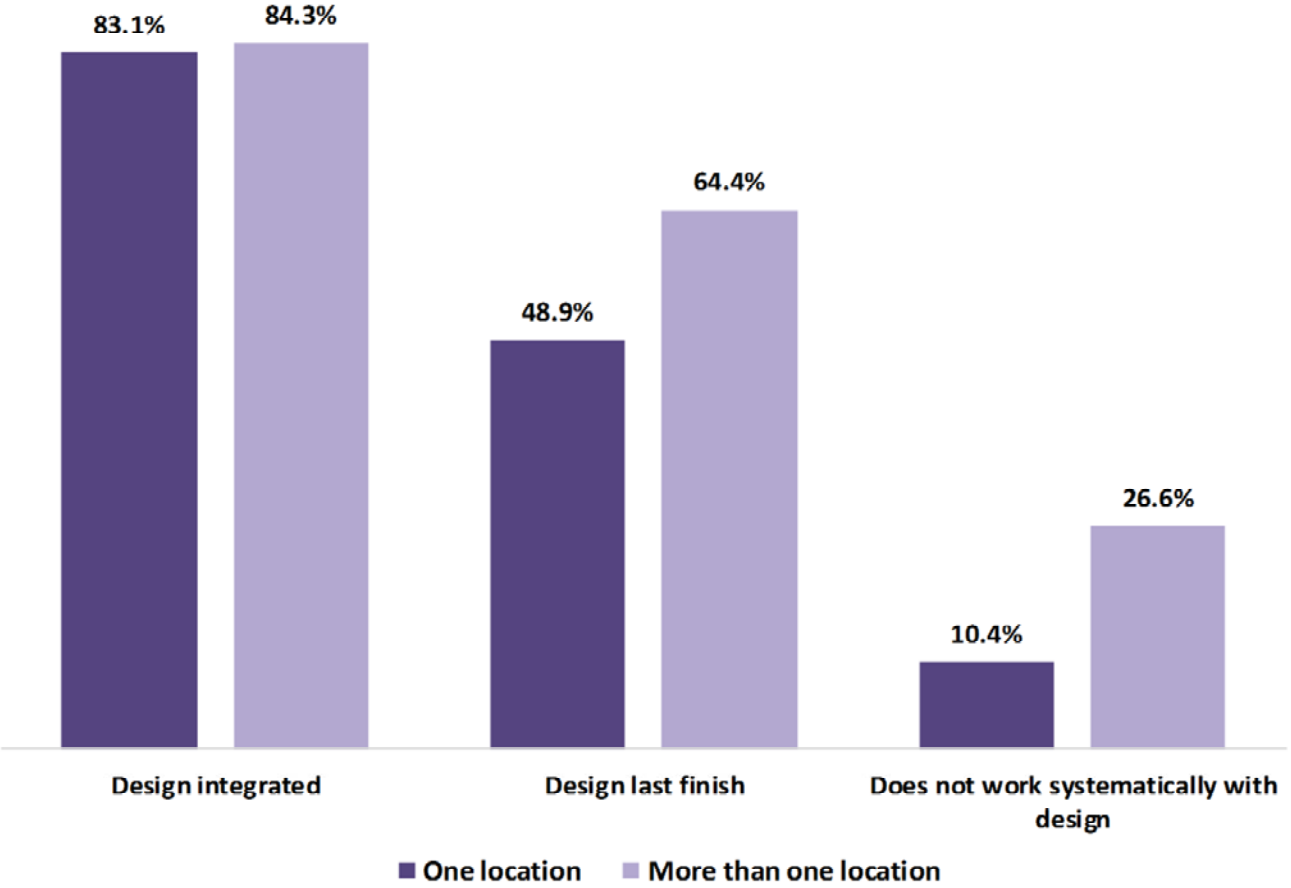
However, there is an important qualification to this finding: Design use equalizes innovation among small manufacturers when it comes to the number of locations used.

Among establishments that do not work systematically with design, the innovation gap between small manufacturers that produce goods in one location versus those that produce goods in multiple locations is 16 percentage points. The gap favors establishments with multiple production sites. (See the chart below.)

Similarly, among businesses classified as “design last finish,” the innovation gap (between single-site versus multi-site manufacturers) remains large—at 15.5 percentage points.

Nevertheless, for small manufacturers that are “design-integrated,” there is virtually no gap in innovation between establishments that produce goods at a single site and establishments that produce goods at multiple sites. Evidently, small manufacturers producing goods in just one location can be as innovative as their relatively larger counterparts (operating multiple production sites), if the single-location manufacturers substantially use and invest in design.⁶

Percent of small manufacturers that are substantive innovators by number of operating locations and by use of design: 2014



Data source: Rural Innovation Establishment Survey (REIS), Economic Research Service, U.S. Department of Agriculture

Endnotes

¹The U.S. Census Bureau’s Business Dynamics Statistics report a total of 1,169,870 jobs created in manufacturing in 2014. Of those, 886,256 (75.8 percent) were created by manufacturing establishments employing fewer than 500 workers. See also, Top 20 Facts About Manufacturing, National Association of Manufacturers.

²The definition of small manufacturers used in this analysis is similar to that used by the U.S. Census Bureau’s Statistics of U.S. Businesses. However, in Statistics of U.S. Businesses, small manufacturers are “enterprises” with fewer than 500 employees. An enterprise may consist of more than one establishment under common ownership or control.

³For more information on the design ladder, see Galindo-Rueda, F. and V. Millot, Measuring Design and its Role in Innovation. OECD Science, Technology and Industry Working Papers, 2015.

⁴NAICS is the North American Industrial Classification System.

⁵For Sector 32 manufacturers, the share classified as substantive innovators rises from 54.3 percent of establishments that are “design last finish” to 77.7 percent of establishments categorized as “design-integrated.” That difference, however, is not statistically significant, even at 80 percent confidence. Likely contributing to this statistical outcome is the small REIS sample size of design-integrated establishments in Sector 32—just 51 establishments.

⁶As an indicator of establishment size, the average number of workers employed by small manufacturers operating in just one location is 30. Among those functioning in more than one location, the mean employed is 110 per plant.