

Fabricated Metal Manufacturing in the Chicago Metropolitan Region

August 13, 2014

Excerpted and adapted from March 29, 2013 Project Report
for the MacArthur Foundation. Further background available on request.

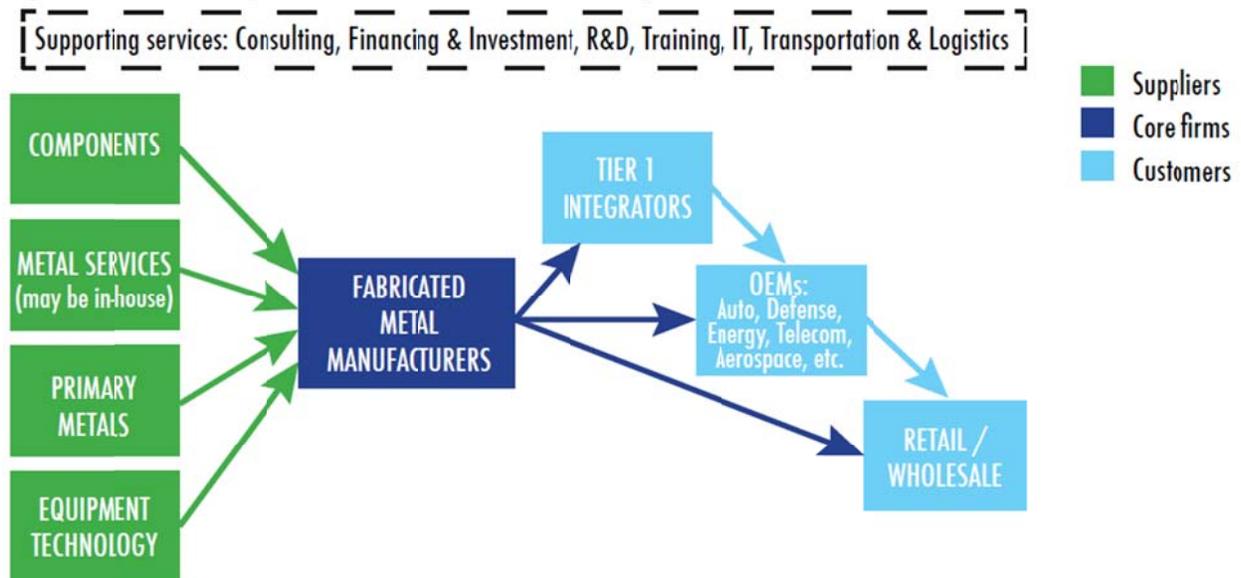


As the largest manufacturing sector in the region, and one with strong links to many other types of manufacturing, Fabricated Metal serves as a logical focal point for understanding the opportunities of manufacturing in the Chicago region and its neighborhoods. The trends and challenges facing Fabricated Metal manufacturers also parallel those confronting other manufacturers. As such, interventions devised to grow Fabricated Metal will likely support many other parts of manufacturing.

What is the Cluster?

Fabricated Metal manufacturing intersects with many other types of manufacturing, using outputs from other manufacturers and making end and intermediate products for multiple markets. Fabricated Metal products run the gamut from small automotive components, such as fuel injectors, to large panels used in thermal shields for nuclear reactor vessels. As shown in the following conceptual map, and described in more detail below, several different types of firms participate in the Fabricated Metal cluster.

Figure 2. Cluster Map: Fabricated Metal Manufacturing



Core

Fabricated Metal Manufacturers: The Fabricated Metal cluster has, at its core, the small and medium-sized companies that transform metal into intermediate (or occasionally end) products and join separate parts together, using one or multiple techniques (such as bending, cutting, welding, forging, forming, stamping, machining, etc.).¹

¹ These firms are represented by all of NAICS code 332 *except* 3328, which is covered under “Metal Services.” Interestingly, in the Chicago region, the core firms have a higher share of office and headquarters related functions than the national average.

Suppliers

Metal Services: A key input to the core of the cluster, sometimes performed in house and sometimes outsourced to another, usually local, firm is metal *services*. This primarily refers to coating, engraving, heat-treating, plating, finishing, annealing, etc.²

Primary Metals: Another important input is primary metals, often steel. This can be sourced from around the world, and many firms have several sources in order to meet demand in a timely manner (about 10-20% in the Midwest). Some firms require especially high-quality steel which may limit them to fewer suppliers/locations (many of which are located within the Midwest).³

Components: Other inputs that firms may use in their products include fasteners, hardware, electrical components, fabric, plastic, etc.⁴

Equipment manufacturers: This cluster also buys equipment with which to make its products, primarily from metalworking machinery manufacturers.⁵

Customers

Tier 1 integrators: Tier 1 integrators may be fabricated metal, machinery or other types of manufacturing firms; what distinguishes them from the cluster core is their slightly higher place on the supply chain. Tier 1 integrators combine fabricated metal outputs with other components to create an intermediary product for OEMs. For example, a Tier 1 auto-supplier might buy fenders created by a metal stamping firm (subset of fabricated metal), and then combine it with other products to create an entire automobile body to sell to Ford or Chrysler.

OEMs (Original Equipment Manufacturers): OEMs produce end products for consumer or commercial end users. These customers of the Fabricated Metal core run the gamut from auto to defense, telecom to energy and more. To reach the OEMs, firms may first supply Tier 1 integrators or sell directly to OEMs (often through distributor networks).

Retailers or wholesalers: Retailers and wholesalers help distribute Fabricated Metal products designed for end use (e.g., hand tools, saws, locks and keys), as well as final products that contain Fabricated Metal parts.

Support Institutions: Local trade associations, community colleges, research institutes, banks and consultants all support Fabricated Metal manufacturers. These groups provide services ranging from workforce training to technical assistance to industry news to financing.

² Represented primarily by NAICS code 3328.

³ Represented primarily by NAICS code 331.

⁴ This portion of the cluster includes parts of NAICS 335, 326 and 313, among others.

⁵ Represented by NAICS code 3335.

Regional Opportunity: Cluster Strength and Growth Potential

On all measures, Fabricated Metal meets the criteria for a promising regional cluster. As the largest manufacturing subcluster with 56,000 employees and over 2,000 firms in just the core fabricated metal firms, Fabricated Metal anchors the region’s manufacturing base.⁶ Fabricated Metal employment and gross product concentrate in the region at levels 30% and 24% higher, respectively, than their national presence. Fabricated Metal firms are spread throughout the Chicagoland area, creating opportunities that are truly regional (see Figure 3).

Figure 3. Fabricated Metal Employment across the Chicago

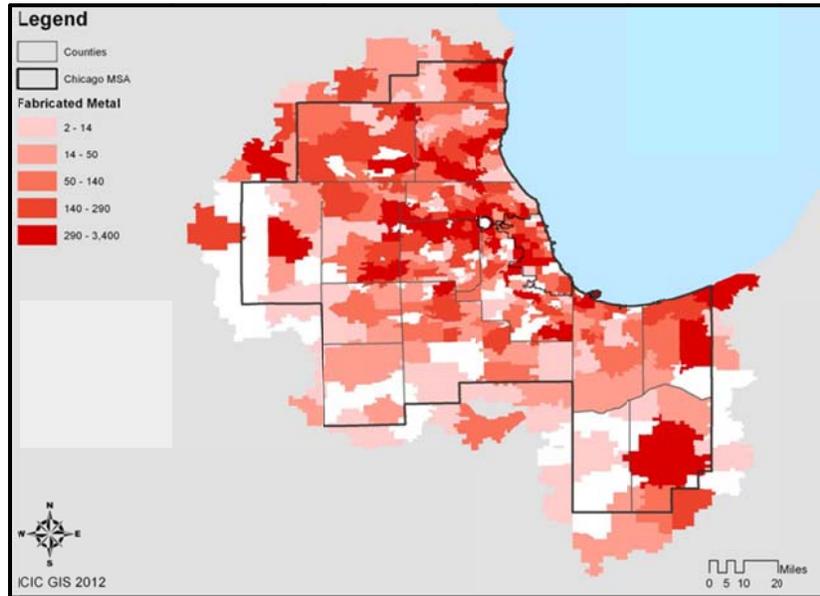
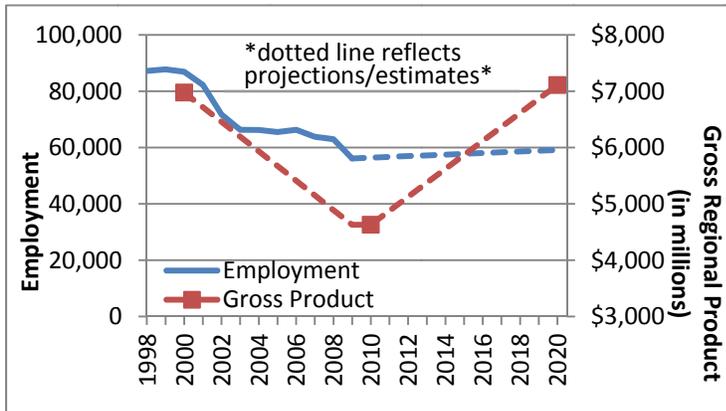


Figure 4. Core Fabricated Metal Employment and Gross Regional Product



Fabricated Metal ranks 7th among exported products in Illinois, with the value of all products totaling \$3 billion, a 212% increase from 2000.⁷ In contrast with its increase in exports, Fabricated Metal’s employment and gross product declined in the first decade of this century, part of a nationwide drop in nearly all types of manufacturing. However, employment growth since 2010 has already surpassed 10% locally and nationally, and experts predict this growth will continue.⁸

Local firms share this optimism about the future of Fabricated Metal manufacturing; having made it through a tough decade, most firms interviewed experienced positive revenue growth over the last few years, and expect to see a continued upward trajectory.

⁶ See Appendix C for data sources and methodology, for this and all other metrics not otherwise sourced.

⁷ Illinois’s 212% growth rate for Fabricated Metal exports exceeds the overall growth rate in Illinois (116%) and the Fabricated Metal growth rate for the nation (93%). Illinois’s Fabricated Metal exports account for 6.7% of all Fabricated Metal exports, higher than Illinois’ share of all exports (4.4%).

⁸ See, among others, Howard Wial, “Locating Chicago Manufacturing: The Geography of Production in Metropolitan Chicago,” Center for Urban Economic Development at UIC, February 2013.

Reshoring and New Global Markets are Driving Positive Growth and Challenges in the Cluster

Much of the expected growth in Fabricated Metal owes to the “reshoring” phenomenon – the return to the United States of manufacturing companies that over the last few decades moved production to lower-wage countries like China. The cost structure of manufacturing overseas for delivery to North American markets no longer offers sufficient advantage, due to rising wages, stronger currencies and uncertain transportation costs.⁹ Concerns surrounding quality control, intellectual property and time to market further tip the scales in favor of domestic manufacturing. Getting in front of this reshoring trend, Chicagoland Fabricated Metal firms are courting overseas customers that seek access to the U.S. marketplace.

In addition to reshoring production to serve North American markets, Chicago-area firms are finding ways to exploit rapid economic growth in China and Southeast Asia, often by partnering with peer manufacturing firms overseas that can make their products to meet Chinese customer specifications. Some firms are working with Chinese distributors to market their products, while maintaining all of their production in Chicago/the U.S. Still others are opening their own small sales offices abroad, utilizing sales staff employed by the Chicago-area firm.

Though enthusiastic about their growth prospects, firms also face challenges as a result of the rapid reshoring. Many firms lack the adequate space, technology and personnel to expand their capacity and meet increased demand. Local ordinances and inadequate infrastructure make expansion difficult. This presents a challenge for the region, as lack of space is frequently the impetus for a move – and firms looking to move are likely to at least consider locations outside the region.¹⁰

Furthermore, uncertainty arising from both the political environment (including Illinois’s fiscal situation, health care costs and workers’ compensation) and much shorter customer lead-times (down to 1-3 weeks now, compared with 6-8 weeks prior to the recession, as OEMs and other customers prefer to make frequent small purchases rather than store large inventories) hinders firms’ abilities to plan for hiring/staffing shifts, decide on appropriate levels of inventory or forecast long-term sales trends. Combined with constant changes in technology, this uncertainty causes reluctance among firms to invest in new equipment, R&D, workforce or other business improvements.¹¹ This results in a tension for firms, who recognize the need to stay on top of trends and continuously upgrade to the latest technology – in the words of one Chicago-area manufacturer, “dormancy is death” – but may struggle to do so given limited resources.

⁹ According to a study by Hackett Group, production in China was 31% cheaper than in advanced nations in 2005, but by 2013, that gap will be down to 16% (<http://www.thehackettgroup.com/about/research-alerts-press-releases/2012/05242012-reshoring-some-chinese-manufacturing-jobs.jsp>). Moreover, a Boston Consulting Group report estimates that, by 2015, U.S.-based manufacturing will only cost 7% more than in China, and between 8 and 23% less than in the United Kingdom, Germany, France, Japan, and Italy (<http://www.bcg.com/media/pressreleasedetails.aspx?id=tcm:12-116389>).

¹⁰ As one interviewee noted, “If people need to change facilities for any reason, they’re likely to move away.”

¹¹ According to one interviewee, “Businesses are holding onto a lot of cash due to uncertainty. But there’s willingness and readiness to invest and expand once the economy recovers.”

Metal Services Could Be a Weak Link in the Cluster

Metal services firms employ approximately 6,700 people in the region, and are more concentrated locally than nationally, with a location quotient¹² of 1.7. As such, metal services play a critical role in Chicago's Fabricated Metal cluster, with core firms relying on these services for value-added processes to their products, such as coating, engraving, heat treating, plating, finishing and annealing. Core Fabricated Metal firms typically outsource to standalone metal services firms for these processes, but firms are increasingly acquiring or expanding the capacity to perform some services in-house. This can be attributed in part to firms' desires to diversify, but also to a concern among core manufacturers about lower quality and productivity among regional metal services firms, compared to other parts of the U.S. and especially countries like Germany.¹³ Though not yet severely impacting the cluster, the higher costs associated with lower metal services productivity could ultimately make the Chicago region a less competitive place for Fabricated Metal firms to locate.

Technology Upgrades are Critical to Success

Technology is critical to the value proposition of the cluster, for core Fabricated Metal firms as well as metal services and other suppliers. Customers seek a product that is delivered on time every time, defect-free and competitively priced. To achieve these requirements, firms are making investments in cutting-edge automated, robotic, laser or other specialized equipment to support new products and improve existing ones. Some firms in the cluster obtain new competencies by actively acquiring other firms as part of their business strategy.

New technologies for core processes include highly automated (with advanced programmable controls) grinding, milling, and turning machines, hydro-gaging equipment, stamping presses, 3D-printers, and fiber-optic (vs. CO₂) and CNC laser cutting and bending machines. Once an investment is made to upgrade core process technology, the entire process chain can be impacted and other areas may also need upgrades. For example, introducing a technology that makes parts more quickly will likely also require new conveyors and robotic "pickers" to keep up with the increased speed.

The new machines typically require fewer operators, but these operators need to have a different set of skills than the previous workforce, including understanding how to do applied engineering and programming, maintenance, etc. Fabricated Metal firms in the region are having difficulty finding the right workers to program and run the new technologies. Workforce challenges are likely to increase as skilled workers retire and demand increases.¹⁴

¹² Location quotient, or LQ, is an indicator of industry concentration. It is a ratio expressing industry *i*'s share of total regional employment compared to industry *i*'s share of total national employment. An LQ of 1.0 indicates that the region's concentration in the industry mirrors the nation's. An LQ of greater than 1.2 is considered a significant concentration. See also Appendix B.

¹³ According to firm interviews, Chicagoland metal services companies use less advanced automation technologies than firms in Germany, making goods more expensive (before shipping and other local advantages are taken into account). Domestic productivity analysis (Brookings Institution analysis of Moody's Analytics data, 2010) confirms the same may be true comparing the Chicago area with national firms – Chicago's metal services companies are approximately 5% less productive than metal services companies nationally.

¹⁴ Boston Consulting Group, "Why a Skills Gap Is Unlikely to Constrain a U.S. Manufacturing Resurgence," November 7, 2012, https://www.bcgperspectives.com/content/commentary/globalization_management_two_speed_economy_skills_gap_unlikely_constrain_manufacturing_resurgence/

Barriers and Opportunities for Small Businesses

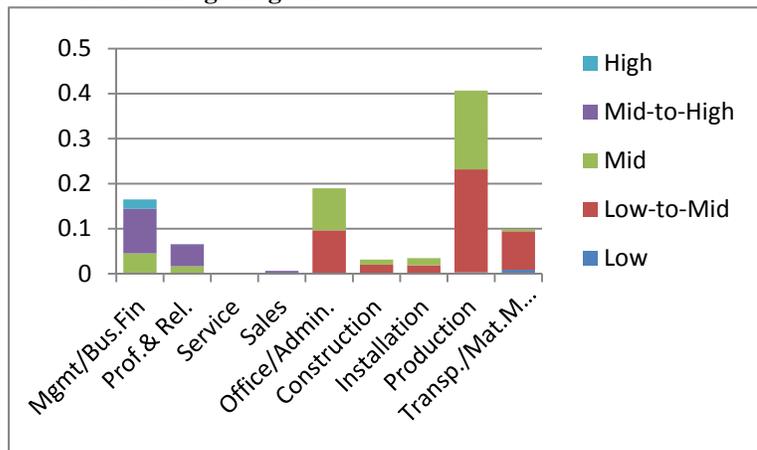
Fabricated Metal is not known for attracting new startups. Firms in Fabricated Metal are considerably older than the average firm – only 13% of Fabricated Metal establishments that existed in 2010 had formed within the previous five years, compared with 42% in the overall economy; meanwhile 56% of Fabricated Metal firms have been in business for 20 or more years, compared with only 21% in all industries. On the other hand, over 50% of fabricated metal firms have fewer than 10 employees (and 32% have fewer than five), suggesting lower barriers for new, small firms to enter the market. From 2000 to 2010, the number and proportion of very small fabricated metal firms in the region grew, while larger firms declined in number and relative portion of the cluster. Furthermore, while many new technologies could be prohibitively expensive, 3D-printers cost as little as \$500,¹⁵ making it easier for neighborhood entrepreneurs to enter the cluster.

Employment opportunities for a range of skill levels

Jobs within Fabricated Metal offer opportunities for advancement as well as living wages.

Within the two largest occupational categories, production and office/administrative occupations, jobs are split between low-to-mid skill and middle-skill occupations (see Figure 5). This makes it more likely that an employee could enter into a position that required fewer skills and, through experience and on-the-job training, ultimately move up the ladder to a better paying, more skill-intensive job. The potential for upward mobility is especially important given the increase in the proportion of jobs requiring a middle skillset, in both production and office/admin occupations.¹⁶

Figure 5. Fabricated Metal Occupational Distribution by Skill Level for Chicago Region



Furthermore, Fabricated Metal manufacturing jobs tend to provide at least a living wage,¹⁷ although that depends in part on the specific occupation. Average regional wages in Fabricated Metal range from \$23,000 for service workers to \$90,000 for officials and managers. Lower skilled laborers earn an average of \$33,000 annually, while higher-skilled craft workers earn

¹⁵ Ricardo Bilton, “Portabee: A \$500 3D printer you can finally afford,” VentureBeat, November 23rd, 2012, <http://venturebeat.com/2012/11/23/portabee-3d-printer/>

¹⁶ Since 2000, the proportion of regional production jobs requiring a middle skillset has increased 5%, from 38% to 43%, and the proportion of middle-skilled office/administrative jobs has increased 2%, from 47% to 49% (RW Ventures and ICIC analysis of PUMS occupational data, 2000 and 2010 and O*Net job zones). These figures account only for the change in the mix of jobs, not for the change in skills required for the same job. As such, the increase in required skills is likely undercounted here.

¹⁷ Based on MIT’s Living Wage Calculator (<http://livingwage.mit.edu>), a “living wage” in Cook County, IL ranges from a before tax annual income of \$21,790 for a single adult to \$65,341 for one adult with three children. The \$46,000 average regional wage for Fabricated Metal manufacturing across occupations meets living wage criteria for all but single parents with 2 or more children.

\$45,000. The average regional wage across occupations is \$46,000, a \$5,000 or 11.5% wage premium compared to national wages.¹⁸

Conclusion

Fabricated Metal is an important cluster regionally, given its size and its relationship with many other manufacturing clusters. A focus on Fabricated Metal through targeted initiatives could capitalize on emerging trends and growth opportunities, while mitigating challenges facing the cluster, thereby amplifying its impact on the economy. For example, potential interventions include: enhancing productivity and innovation through process/technology improvements; supporting firms' capacity for market diversification; increasing firms' potential for strategic business planning; facilitating in-place expansions or minimally disruptive moves; and increasing access to talent. These are described in more detail below.

Technology Improvements

To become more innovative and productive, Fabricated Metal firms need access to cutting-edge technologies and more efficient processes. While the strongest and most successful firms typically learn about and purchase the latest tools on their own, others, particularly smaller firms and metal services companies, require assistance. These firms primarily need help with process innovation, as many firms have successfully used the same fundamental process for years and lack the know-how to find or develop the perfect machine to fit their requirements and increase their output. Once a firm identifies the equipment it wishes to purchase, paying for the machinery may cause additional difficulties, discussed under "Strategic Business Planning."

Customers tend to dictate the products that Fabricated Metal firms create, making product innovation in the strict sense of the word a lesser concern for many Fabricated Metal manufacturers.

Well-established organizations like IMEC, as well as emerging initiatives under PEGJ, UI Labs, the Digital Manufacturing and Design Innovation Institute, and others, have or plan to develop capacities related to helping firms increase their productivity through technology, presenting an opportunity for collaboration.

Market Diversification

Many Fabricated Metal products can be used by multiple end-use industries with minimal alteration, creating an opportunity for firms to diversify into new, high-growth markets. Firms would benefit from help recognizing new market opportunities and then building relationships with potential customers in those industries.

Strategic Business Planning

As discussed earlier in this chapter, uncertainty about the state of the economy combined with frequent changes in the "latest" technology make Fabricated Metal firms hesitant to make large investments in new equipment. Business planning assistance could help firms understand the costs and benefits of investment more completely and better plan for the future. Firms may also

¹⁸ See Appendix C for data sources and methodology. Howard Wial, in "Locating Chicago Manufacturing: The Geography of Production in Metropolitan Chicago," found that Fabricated Metal workers earned nearly \$57,000 annually in Chicago, lower than other manufacturing sectors but on par with the average regional wage for all industries.

need assistance accessing new sources of capital or figuring out how to use their existing finances to pay for new equipment.

Another critical opening for intervention is succession planning. In some small firms, all upper management is approaching retirement, and no obvious replacements exist internally. While some owners are content to close shop and sell, others would like to see the company outlive them, but do not know how to begin developing a viable solution.

Expansion Facilitation

One major threat to the Chicago region's Fabricated Metal cluster, described in the Regional Opportunity section, is the difficulty firms encounter when they need to expand or make changes to their facility. A potential avenue to address this need might involve bringing together manufacturers looking to expand, along with municipal representatives, neighborhood leaders and others, to seek a mutually beneficial solution. Ultimately, the primary goal would be for the manufacturer to stay in their current location and build out as necessary, complying with important regulations but working with municipal representatives to find ways around onerous or prohibitive statutes. When onsite expansion was not feasible, the group could seek new locations that would cause minimal disruptions to the company's workforce, suppliers and customers. An expansion assistance program would deepen the relationship and trust between the Chicago region's manufacturers and its governments, and would likely inform government in ways that would improve long-term industrial policy.

Access to Talent

Fabricated Metal manufacturers face a challenge in attracting qualified workers. Many existing organizations, such as City and suburban community colleges and trade associations, increasingly recognize the need to develop additional manufacturing talent. In response, they are offering targeted training programs. It is important to ensure that neighborhood residents are able to participate in the best training programs and subsequently acquire gainful employment.

In addition, small Fabricated Metal firms that may not have the ability or the need to make additional full-time hires may benefit from the ability to access skilled engineers for occasional work like programming and troubleshooting complex machines. A shared engineer-for-hire program could enable multiple firms to access the talent they need when they need it.