U.S. Manufacturing Jobs:

Where Companies Are Hiring

CREC CENTER FOR REGIONAL ECONOMIC COMPETITIVENESS

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Contents

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Key Findings

This assessment of web-based job advertisements finds that manufacturers were seeking to hire for 669,000 web-advertised job postings during the first six months of 2011. Only a small number of these postings were for production activities. *Labor Insight*, a web tool developed by Burning Glass International, Inc. that aggregates data about web-advertised job openings, demonstrates that manufacturers sought workers for a variety of opportunities:

- Nine percent of web-advertised job openings in manufacturing during the first six months of 2011 were production-related. These openings accounted for just over 60,000 of the manufacturing sector's nearly 669,000 job openings advertised online between January and June 2011.
- Manufacturing job openings were concentrated in major metropolitan areas along the Atlantic seaboard, among Midwestern states, and in Texas and California.
- Almost one in four manufacturing job openings was in just three industries—computer and peripheral equipment manufacturing, aerospace product and parts manufacturing, and pharmaceutical and medicine manufacturing.
- During the first half of 2011, manufacturing openings were concentrated in sales and management positions, engineering positions, and production occupations requiring significant prior work experience.
- Over half of the openings within manufacturing required more than a high school diploma, and one out of every four production-related jobs required educational attainment beyond a high school diploma.
- Only seven percent of available manufacturing jobs identified a specific certification requirement. Where certifications were required for manufacturing jobs, many related to lean manufacturing.

Introduction

Manufacturing plays a vital role in the U.S. economy's health and vitality. Presently and historically, the manufacturing sector has proven to be a significant source of jobs that pay family-sustaining wages for skilled and semi-skilled workers. Manufacturers also make significant contributions to U.S. gross domestic product, exports, and worldwide competitive advantage. Over the past several decades, however, manufacturing has undergone a dramatic transformation. Successful manufacturers in today's economy are those that effectively integrate technology into their production processes, adapt new production models, and tap global sources of inputs.

A consequence of this transformation is significant change in manufacturers' demand for labor. To achieve increased output, manufacturers have increased worker productivity while reducing the size of their production workforce in the process. Moreover, many available production jobs require workers with greater levels of skill and knowledge. As a result, manufacturing firms continue to pay above average wages, but finding the right workers has become more challenging. In light of these changes, it is vital that we clearly understand the manufacturing sector's demand for workers.

While traditional public data sources provide a historical view of past trends, policy makers have not received this information quickly enough to fully understand and appreciate the immediate consequences of change: employment data are typically six months to two years old before they are published. Furthermore, information about the occupational mix of these industries tends to be at least 18 months to three years old by the time it is published. More current information that is capable of revealing the immediate and near-term future hiring plans of manufacturers is therefore necessary for the development of effective, timely policy decisions. Real-time labor market information (LMI) provides this much needed perspective on U.S. manufacturing.

The purpose of this paper is to examine the characteristics of the manufacturing sector through the lens of real-time LMI in order to develop a framework for a repeatable, regular study of manufacturing using this data source. This paper uses real-time LMI from Burning Glass International, Inc.'s *Labor Insight*[1] to

[1] Real-time LMI is developed by extracting information from publicly available, web-posted job notices. Once aggregated and organized, these data can provide information about what industries are hiring, where jobs are available, and the kinds of education, skills, and certifications these jobs require. A more detailed description of real-time LMI and Burning Glass's *Labor Insight* can be found in Appendix I.

examine hiring trends from January 1, 2011 to June 30, 2011 within the U.S. manufacturing sector. Before beginning this analysis, a brief background on this paper's framework is provided for context.

Understanding Manufacturing Talent Needs in Real-time

What do web-based job advertisements reveal about how the U.S. manufacturing sector's demand for labor is changing?

This analysis examines three fundamental questions important to policymakers and jobseekers:

- Where are the advanced manufacturing jobs?
- Who is hiring?
- What preparation do workers seeking jobs in today's manufacturing sector need?

These questions are examined through two lenses: total manufacturing job openings and the production occupations that comprise a subset of all manufacturing job openings.[2] Openings in production occupations are important to assess because they often define conceptions of American manufacturing. Iconic images of manufacturing like *Rosie the Riveter* or robotics assemblers in a modern context strongly influence how the public perceives manufacturing.

However, manufacturing in the twenty-first century is far more than assembly and production. It also involves a broad spectrum of other functions such as research and development, engineering, sales and management, warehousing and storage, and shipping, just to touch on a few of modern manufacturing's key product life cycle components. As a result, the complete cycle of manufacturing (Figure 1) includes many activities not directly tied to production—these activities are related to and support activities at the "core" of manufacturing, such as fabrication, logistics, assembly, and packaging.

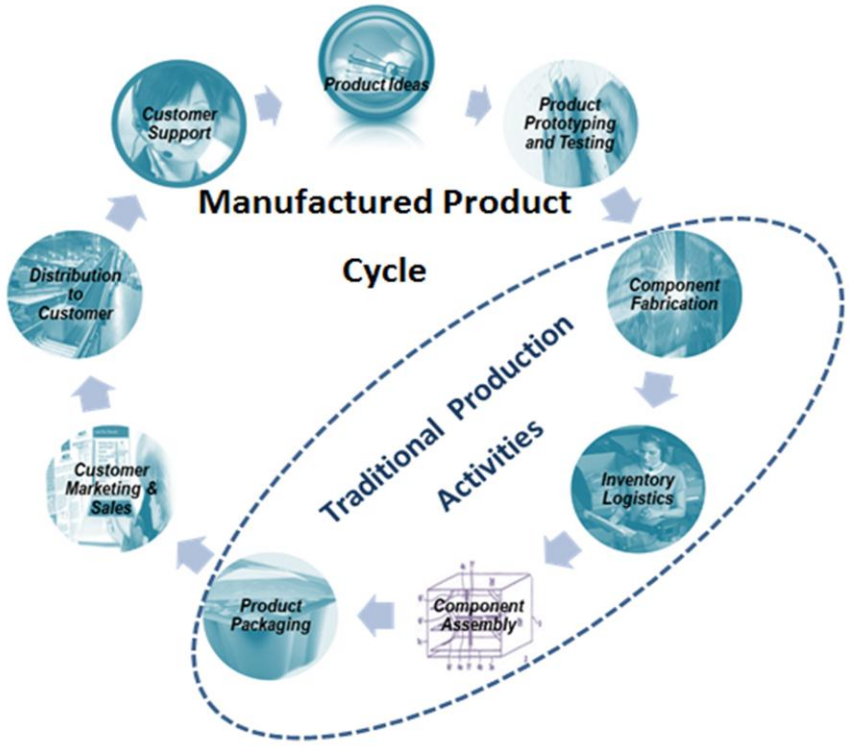
[2] It is important to note the difference between industries and occupations. Industry names describe what companies make (e.g., firms in the auto industry produce cars), and occupational titles describe what workers do (e.g., welders weld). This is a significant distinction because, as will be seen later, many of the jobs currently in demand in the manufacturing sector are white collar jobs that are not directly involved in production.

"Non-production" activities are critically important in adding value to the products that manufacturers produce by:

1. Creating competitive advantage through innovation, shorter delivery times, or unique customer service for a product;
2. Adding value to manufactured goods through software components and communication connectivity; and
3. Enabling mass customization of products for unique market segments through increased understanding of customer groups and on-demand production responses.

To describe manufacturing only in production terms is to miss many important high-wage, growing components of the manufacturing product enterprise cycle as it exists today. In this analysis, production job openings are examined as a subset of all manufacturing job openings in order to enable a better analysis of the traditional components of the manufacturing enterprise cycle and treat them as distinct from the non-production activities that are increasingly important to U.S. manufacturers.[3]

Figure 1: Manufacturing Product Cycle

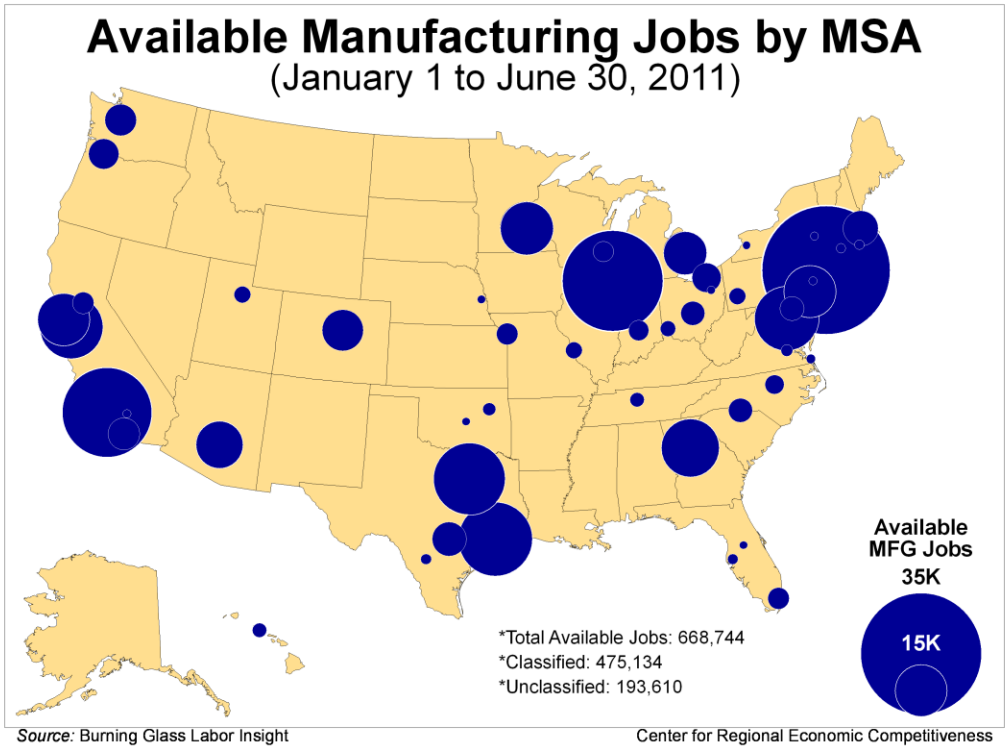


[3] Because this analysis relies on real-time LMI, several important caveats should be noted. See "Appendix I: About the Data" for more information.

The Geography of Manufacturing: Where the Jobs Are

Analyzed through the lens of real-time LMI, the location of job openings demonstrates the importance of metropolitan areas to the strength of U.S. manufacturing. During the first six months of 2011, there were 668,744 openings for manufacturing sector positions, almost 80 percent of which were found in the top 100 Metropolitan Statistical Areas (MSAs) for openings. As illustrated in Figure 2, many of these jobs were concentrated in 50 MSAs, and the greatest number of openings was found along the Atlantic seaboard, among Midwestern states, and in Texas and California. Clearly, manufacturing can be found in both high cost and low cost areas with a large share of jobs in major population centers.

Figure 2: Geography of Manufacturing Job Opportunities, 2011



The metropolitan areas with the largest number of manufacturing openings are identified in Figure 3. Many of these metro areas are among the most populated as well. However, while these areas account for 24 percent of the total U.S. population (according to Census 2010), 32 percent of all manufacturing openings in the first six months of 2011 were found in these locations. Among these 10 MSAs, the Silicon Valley region (San Jose-Sunnyvale-Santa Clara, CA) had the greatest number of manufacturing openings per capita.

Figure 3: Geographic Distribution of Openings

All Manufacturing Openings		
MSA	Openings	% of Total Openings
New York-Northern New Jersey-Long Island, NY-NJ-PA	37,112	5.5%
Chicago-Naperville-Joliet, IL-IN-WI	27,614	4.1%
Los Angeles-Long Beach-Santa Ana, CA	25,187	3.8%
Houston-Sugar Land-Baytown, TX	21,353	3.2%
Dallas-Fort Worth-Arlington, TX	20,210	3.0%
Washington-Arlington-Alexandria, DC-VA-MD-WV	18,347	2.7%
San Jose-Sunnyvale-Santa Clara, CA	18,094	2.7%
Atlanta-Sandy Springs-Marietta, GA	16,825	2.5%
Minneapolis-St. Paul-Bloomington, MN-WI	15,263	2.3%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	15,134	2.3%

Figure 4 shows the top MSAs for production openings. These areas accounted for nearly 30 percent of all production openings during the first half of 2011. While production openings tend to mirror total manufacturing openings overall, several metropolitan areas emerge as relatively strong production centers for hiring despite the fact that they are not among the top areas for overall manufacturing openings. For instance, both Cleveland and Phoenix were top locations for production openings during the period, but they were not top locations for total manufacturing openings. Conversely, the

Figure 4: Geographic Distribution of Production Openings

Production Openings		
MSA	Openings	% of Total Openings
Los Angeles-Long Beach-Santa Ana, CA	2,294	4.2%
Chicago-Naperville-Joliet, IL-IN-WI	2,112	3.9%
New York-Northern New Jersey-Long Island, NY-NJ-PA	2,039	3.7%
Minneapolis-St. Paul-Bloomington, MN-WI	1,597	2.9%
Houston-Sugar Land-Baytown, TX	1,479	2.7%
Cleveland-Elyria-Mentor, OH	1,362	2.5%
Atlanta-Sandy Springs-Marietta, GA	1,209	2.2%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1,091	2.0%
Dallas-Fort Worth-Arlington, TX	1,083	2.0%
Phoenix-Mesa-Glendale, AZ	1,040	1.9%

Washington, DC and San Jose areas were top locations for total manufacturing openings (Figure 3) but not production openings.

Taken together, the importance of white collar jobs to manufacturing in major metropolitan areas becomes apparent. Within the top ten metropolitan areas for openings, production openings average about 7 percent of total openings. (Minneapolis is one exception: more than 10 percent of its total openings were in production occupations.) The prevalence of these openings demonstrates the extensive opportunities in the manufacturing sector that are not production related. Non-production jobs accounted for more than 91 percent of all manufacturing job openings during the first half of 2011. These positions support production through a vast manufacturing infrastructure of business process, engineering, and sales-related hiring.

Non-production jobs accounted for more than 91 percent of all manufacturing job openings during the first half of 2011.

The Manufacturing Mix: Job Openings by Industry[4]

Most available manufacturing jobs during the period were found in 10 industries (Figure 3). Companies hiring in these industries had close to 295,000 openings, or more than 44 percent of all job openings

Figure 3: Total Manufacturing Openings

All Manufacturing Openings		
Industry	Openings	% of Total Openings
Computer & Peripheral Equipment	64,557	9.7%
Aerospace Product & Parts	50,870	7.6%
Pharmaceutical & Medicine	46,227	6.9%
Navigational, Measuring, Electromedical, & Control Instruments	23,807	3.6%
Beverage	22,783	3.4%
Communications Equipment	21,172	3.2%
Semiconductor & Other Electronic Component	20,149	3.0%
Medical Equipment & Supplies	17,651	2.6%
Motor Vehicle Parts	16,147	2.4%
Commercial & Service Industry Machinery	11,472	1.7%

[4] The following analysis of openings by industry is at the 4-digit North American Industry Classification System (NAICS) level.

One in four manufacturing job openings was in just three industries:

- ***Computer and peripheral equipment manufacturing***
- ***Aerospace product and parts manufacturing***
- ***Pharmaceutical and medicine manufacturing***

during the period.[5] Many of the industries listed here are generally considered high-technology industries (beverage manufacturing is one exception). Moreover, almost one in four manufacturing job openings was in just three industries—computer and peripheral equipment manufacturing, aerospace product and parts manufacturing, and pharmaceutical and medicine manufacturing.

Production openings by industry (Figure 4) tend to mirror the top industries hiring in manufacturing overall with several notable differences. For instance, machine shops, turned product, and screw, nut, and bolt manufacturing—which feeds into many other manufacturing industries—had the third largest number of production job openings. Similarly, industries related to agricultural and food manufacturing—such as bakeries and tortilla manufacturing, beverage manufacturing, and agriculture machinery manufacturing—were top industries for all manufacturing and production hiring.

Figure 4: Total Manufacturing Openings

Production Openings		
Industry	Openings	% of Total Openings
Pharmaceutical & Medicine	2,253	4.1%
Aerospace Product & Parts	1,859	3.4%
Machine Shops; Turned Product; and Screw, Nut, & Bolt	1,764	3.2%
Bakeries & Tortilla	1,707	3.1%
Beverage	1,487	2.7%
Printing & Related Support	1,287	2.3%
Motor Vehicle Parts	1,135	2.1%
Medical Equipment & Supplies	1,121	2.0%
Navigational, Measuring, Electromedical, & Control Instruments	1,097	2.0%
Agriculture, Construction, & Mining Machinery	985	1.8%

[5] Approximately 29 percent of all manufacturing openings were unclassified by 4-digit NAICS industry.

The Skills Manufacturers Need

Openings by Occupation

The distribution of openings by occupation demonstrates the types of positions that were open (and their associated quality) within the manufacturing sector during the first half of 2011. The openings displayed in Figure 5 account for about 31 percent of total manufacturing openings and 73 percent of production openings, respectively. Within manufacturing overall, the largest number of openings was in

Figure 5: Occupation Distribution

All Manufacturing Openings		
Occupation	Openings	% of Total Openings
Sales Representatives, Wholesale & Manufacturing, Except Technical & Scientific Products	50,811	7.6%
Mechanical Engineers	44,453	6.6%
General & Operations Managers	20,057	3.0%
Computer Software Engineers, Applications	19,217	2.9%
Retail Salespersons	17,034	2.5%
Maintenance & Repair Workers, General	12,597	1.9%
Computer Systems Analysts	10,788	1.6%
Industrial Production Managers	10,718	1.6%
Manufacturing Engineers	10,432	1.6%
Computer Software Engineers, Systems Software	10,372	1.6%

Production Openings		
Occupation	Openings	% of Total Openings
First-Line Supervisors/Managers of Production & Operating Workers	8,864	16.2%
Inspectors, Testers, Sorters, Samplers, & Weighers	7,035	12.8%
Production Workers, All Other	6,946	12.7%
Computer-Controlled Machine Tool Operators, Metal & Plastic	6,057	11.0%
Assemblers & Fabricators, All Other	3,853	7.0%
Machinists	3,179	5.8%
Welders, Cutters, & Welder Fitters	1,078	2.0%
Cutting, Punching, & Press Machine Setters, Operators, & Tenders, Metal & Plastic	970	1.8%
Separating, Filtering, Clarifying, Precipitating, & Still Machine Setters, Operators, & Tenders	904	1.6%
Bakers	897	1.6%

four general areas: sales, management, IT and computing, and engineering. As products become more complex, manufacturers need a sales force capable of keeping up with these changes and selling in a wider set of markets. Skilled managers and supervisors are needed to successfully implement new production processes. IT and computing experts are also needed to maintain corporate information technology infrastructure. Among engineering openings, the most in-demand occupations were mechanical and manufacturing engineers.

While hiring within the manufacturing sector was spread across a number of different occupations, production-related openings were more concentrated in a smaller set of occupations. Over half were in just four occupations—first-line supervisors, inspectors and testers, general production workers (all other), and computer numerical control (CNC) machine operators. Hiring in these occupations reflects a need for workers that can effectively implement modern production techniques and technologies.

Openings by Job Title

Job titles vary widely from occupation to occupation, and sometimes the same title can mean very different things in different industries. However, it is helpful to examine in-demand job titles because, even across industries, titles often require similar skills. Figure 8 lists the top in-demand job titles for the January to June 2011 period. Job titles with the most openings correspond closely to in-demand occupations, although there is some variation.

The majority of top titles for all manufacturing openings were in sales-related positions. The rest were mainly in engineering positions, with the notable exception of interns. These findings are mostly

Figure 6: Top Titles

All Manufacturing Openings		
Title	Openings	% of Total Openings
Sales Representative	16,936	2.5%
Software Engineer	8,695	1.3%
Manufacturing Engineer	8,667	1.3%
Account Executive	8,021	1.2%
Intern	7,025	1.1%
Account Manager	6,783	1.0%
Merchandiser	6,282	0.9%
Systems Engineer	5,867	0.9%
Process Engineer	4,640	0.7%
Quality Engineer	4,405	0.7%

Production Openings		
Title	Openings	% of Total Openings
Production Supervisor	4,314	7.9%
Machinist	2,469	4.5%
CNC Machinist	1,786	3.3%
Plant Manager	1,398	2.6%
Machine Operator	1,189	2.2%
Manufacturing Supervisor	977	1.8%
Production Worker	893	1.6%
Welder	770	1.4%
CNC Programmer	726	1.3%
Assembler	665	1.2%

consistent with openings by occupation. The prominence of intern as a title may reflect the increasing need for work experience that is integrated into academic training prior to full-time permanent hiring. It could also reflect a hesitancy to hire permanent employees in an uncertain economic climate. Finally, the prevalence of intern as a common job title might also be a function of the time period used in this analysis: the January to June timeframe closely corresponds with the summer intern hiring cycle, especially for white-collar occupations.

Among production opening titles, a notable characteristic for this period was the prevalence of management-related titles. Production supervisor, plant manager, and manufacturing supervisor (a combined 12 percent of production openings) all require some level of prior production-related experience. Demand for these titles may reflect a need for replacements for older, more experienced workers that are leaving the full-time workforce.

Openings by Company

Manufacturing companies perform a wide variety of business processes beyond production. An examination of the top firms with job openings provides insight into the types of companies that are hiring. Across all manufacturing during the first half of 2011 (Figure 7), the top companies that were hiring demonstrate the importance of the information technology and aerospace and defense industries to the U.S. manufacturing sector and the economy overall. With the exception of PepsiCo and Coca-Cola, these companies were in the information technology or aerospace/defense industries. Combined, these top 10 companies represented 13.1 percent of total manufacturing openings. This list

Figure 7: Top Companies

All Manufacturing Openings		
Company	Openings	% of Total Openings
IBM	18,257	2.7%
Lockheed Martin Corp.	13,699	2.0%
Northrop Grumman	9,354	1.4%
PepsiCo Inc.	9,203	1.4%
Hewlett-Packard	7,133	1.1%
Dell	6,824	1.0%
Siemens	6,656	1.0%
L3 Communications Holding Inc.	6,080	0.9%
Crossmark Printing Inc.	5,435	0.8%
Coca-Cola Enterprises Inc.	5,267	0.8%

Production Openings		
Company	Openings	% of Total Openings
OnSite Company Inc.	1,172	2.1%
Coca-Cola Enterprises Inc.	461	0.8%
Lockheed Martin Corp.	351	0.6%
Johnson Controls Inc.	331	0.6%
PepsiCo Inc.	323	0.6%
Eaton Corp.	321	0.6%
Siemens	317	0.6%
Honeywell	310	0.6%
IBM	287	0.5%
eProduction Solutions	278	0.5%

demonstrates the important role that large companies play in the manufacturing employment base: these ten companies represented more than one in ten U.S. manufacturing job openings during the first half of 2011.

Companies hiring in production occupations during the first half of 2011 (Figure 7) paint a similar picture, further demonstrating the extent to which information technology and aerospace and defense industries drove hiring in the sector in early 2011. One notable difference among the top companies hiring for production occupations is eProduction Solutions, an oil and natural gas production company.

It is also worth noting that some manufacturing companies make extensive use of temporary employment and staffing agencies. For instance, the largest hiring agent for production openings, OnSite Company, is an affiliate of Aerotek Staffing Agency, which targets its recruitment and personnel services at companies with jobs that requiring a high degree of technical skills. Companies like OnSite allow manufacturers to hire workers on a short-term or temporary basis or to identify and tap specific skill pools for permanent workers. Working with companies like OnSite gives firms the benefits of controlling their variable costs and allows them to test employees before hiring them in more costly and permanent full-time positions. Unfortunately, positions advertised through a staffing agency prevent an assessment of precisely where or with what companies these openings are associated.

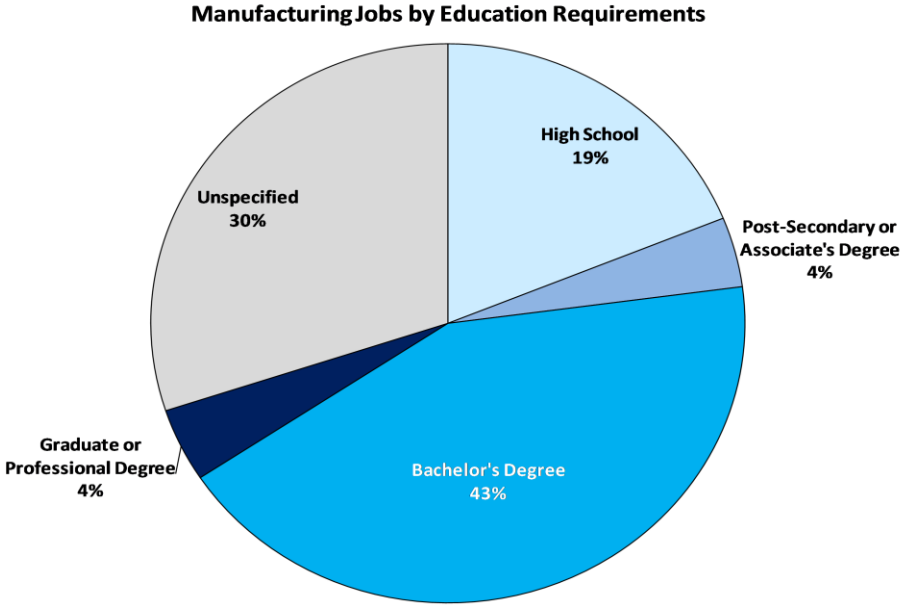
Over half of the openings in manufacturing required more than a high school diploma, and companies demanded educational attainment beyond high school for one out of every four production-related jobs.

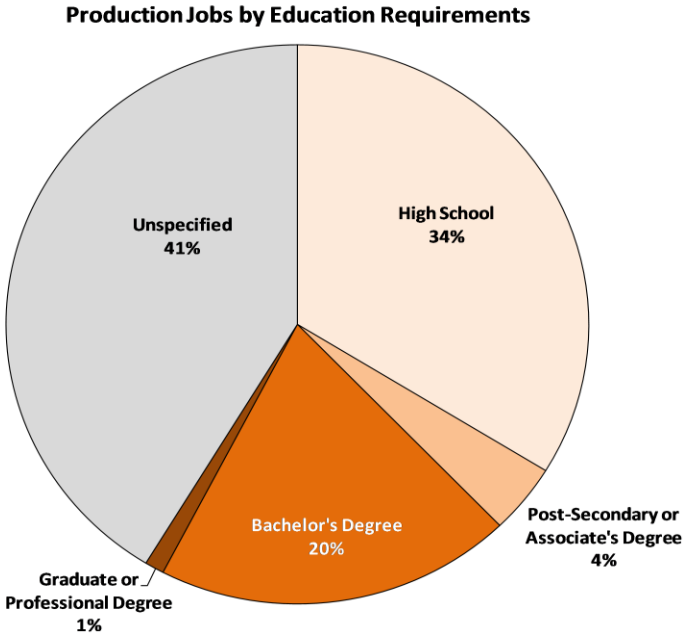
Openings by Education Requirement

The distribution of education requirements in job postings, as shown in Figure 8, provides some indication of the types of workers needed by manufacturers. Higher education requirements indicate the need for an advanced skill set that cannot be acquired through on-the-job training and must be obtained in a formal classroom setting in order to perform the tasks associated with a position.[6]

[6] The portion of openings unclassified by educational requirement is significant. While some portion of these openings likely have educational requirements that are simply unlisted in the job posting, a large portion likely represent openings that require less than a high school diploma. This is a particular challenge of assessing openings by educational requirement using real-time LMI. When possible, Burning Glass makes reasonable assumptions about education requirements based on occupation and job

Figure 8: Overall Distribution of Education Requirements





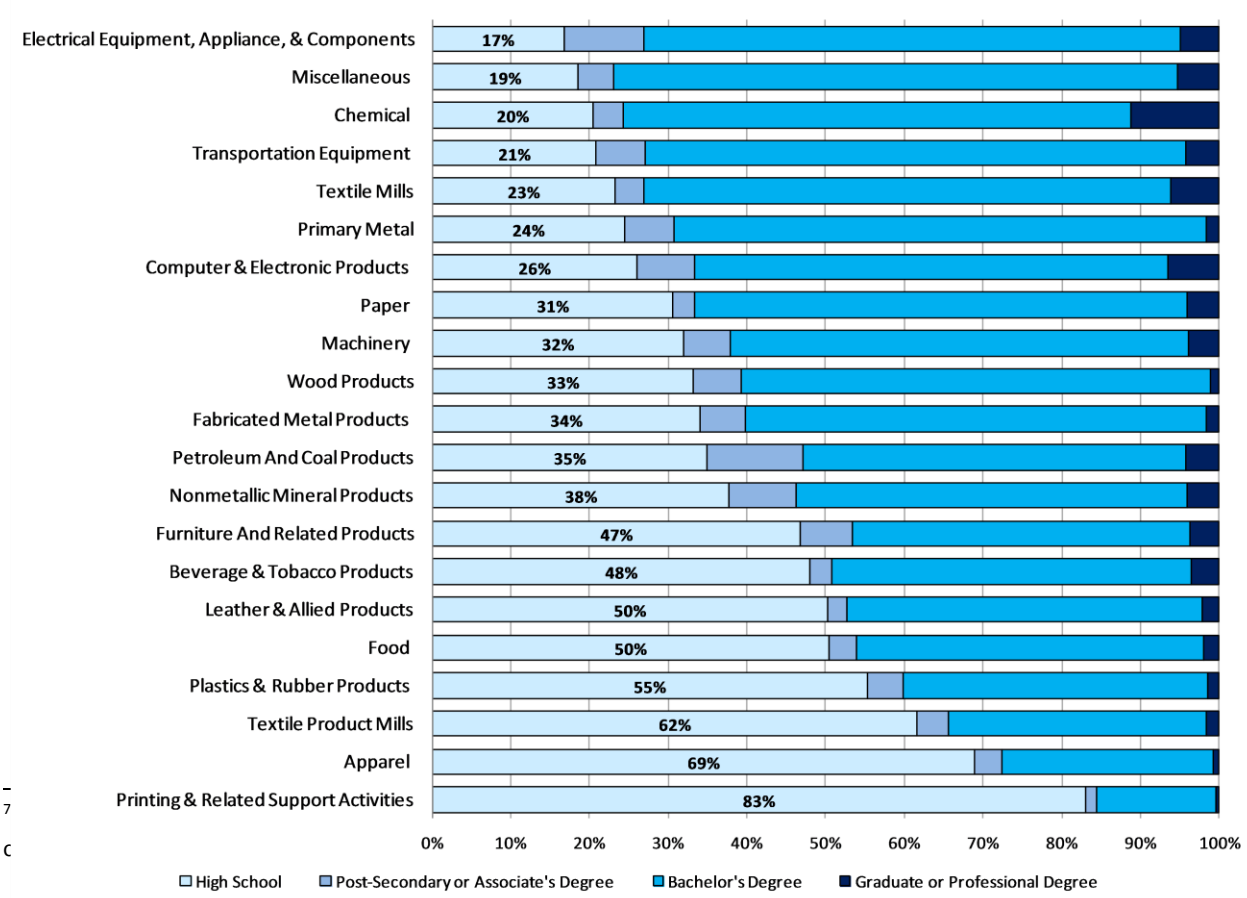
Overall, the education requirements of openings demonstrate that the in-demand jobs in manufacturing are not for workers with limited skills and education. Over half of manufacturing openings during the period required more than a high school diploma, and companies demanded educational attainment

title; however, positions that have requirements less than a high school diploma are particularly difficult to parse and effectively label.

beyond high school for one out of every four production-related jobs. The explanation for this trend can be found in some of the findings described earlier, including the prevalence of white-collar openings among overall manufacturing openings; the prevalence of managerial titles among openings, including production openings; and the industry mix of information technology, medical device, and aerospace/defense companies hiring during the period.

Figure 11 shows the education requirements for job openings[7] in several key industries. Electrical equipment, appliance, and component manufacturing; miscellaneous manufacturing (which is dominated by medical device manufacturing openings); and chemical manufacturing had the highest percentages of classified openings requiring more than a high school diploma. Chemical manufacturing also had the largest percentage of openings requiring a graduate or professional degree (more than 11 percent). Among those industries looking for workers with some kind of post-secondary education or an associate's degree, the greatest proportions were in petroleum and coal products manufacturing (more than 12 percent) and electrical equipment, appliance, and components manufacturing (more than 10 percent).

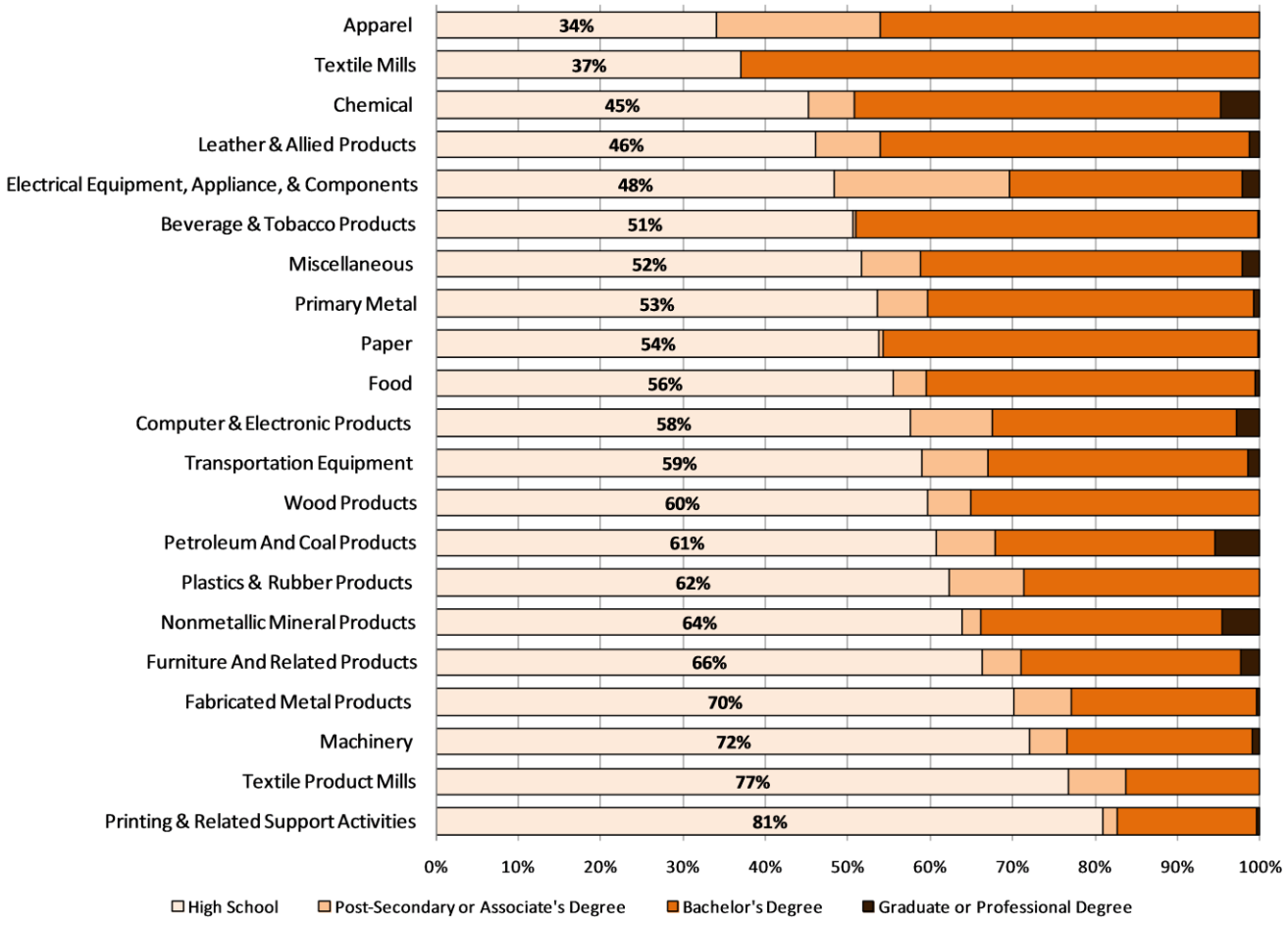
Figure 9: Total Classified Manufacturing Job Openings by Industry



These data are particularly revealing when considering production-related occupations. Analysis using more traditional data sources, such as the U.S. Bureau of Labor Statistics' (BLS) classification of minimum educational requirements by occupation, does not provide this level of detail. In the BLS classification system, the minimum education requirement for almost all production-related occupations is nothing more than varying degrees of on-the-job training.[8] As shown in Figure 10, one out of every four production-related jobs required something more than a high school degree.

Most of the industries below (16 of the 21 industries)[9] required only a high school degree for more than half of their production-related openings. Apparel manufacturing, textile mills,[10] and chemical manufacturing had the largest proportion of classified production openings that required more than a

Figure 10: Classified Production Job Openings by Industry



[8] For a more detailed description of the BLS minimum education classification, see: http://www.bls.gov/emp/ep_education_tech.htm.
[9] An industry, in this case, refers to a 3-digit NAICS industry.
[10] Textile mills' education requirements may be skewed: there were only 86 openings with classified education requirements during the period.

high school diploma (between 55 and 66 percent). Apparel manufacturing is somewhat surprising, but this industry had 535 production-related openings, comparable to the other industries during the first half of 2011, and a relatively large percentage of openings required post-secondary education or an associate's degree (20 percent). Other industries with above average percentages of openings requiring post-secondary education or an associate's degree included electrical equipment, appliance, and component manufacturing (21 percent) and computer and electronic product manufacturing (10 percent).

Openings by Skill Areas and Certifications

The skills (Figure 11) and certifications (Figure 12) associated with openings can help to demonstrate the background that companies expect successful job applicants to have when they apply for openings. In this way, these data can help to provide insights into training investment decisions. They can also inform workers about the kinds of skills necessary to secure a manufacturing job or to advance in their current careers.

As noted earlier, sales occupations were some of the most commonly advertised manufacturing occupations. Therefore, it is not surprising that sales and marketing skills were the most in-demand skills during the period. Over 38 percent of the manufacturing jobs advertised between January and June 2011 sought these skills. Other in-demand skills included business support skills, such as scheduling and purchasing; knowledge of customer relationship management software like Oracle; and basic technical skills, such as inspection, technical support, and mathematics.

Among production jobs, many basic STEM (Science, Technology, Engineering, and Math) skills were

Figure 11: Skills Distribution

All Manufacturing Openings		
Skill	Openings	% of Total Openings
Sales	188,579	28.2%
Marketing	67,586	10.1%
Inspection	31,002	4.6%
Scheduling	27,037	4.0%
Oracle	26,897	4.0%
Product Development	25,058	3.7%
Mentoring	24,622	3.7%
Technical Support	24,175	3.6%
Mathematics	23,701	3.5%
Purchasing	22,648	3.4%

Production Openings		
Skill	Openings	% of Total Openings
Inspection	9,311	17.0%
Machining	6,882	12.6%
Computer Numerical Control	6,121	11.2%
Sales	5,752	10.5%
Mathematics	4,339	7.9%
Packaging	3,526	6.4%
Machine Operation	3,522	6.4%
Machine Tools	2,769	5.1%
Lathes	2,694	4.9%
Micrometers	2,491	4.5%

prominent. These ranged from skills needed to operate specific types of equipment (for example, CNCs, lathes, and micrometers) to more general skills, such as mathematics and inspection. Skills such as machining were also important for in-demand production jobs.

Openings requiring certifications represent the spectrum of manufacturing sector-recognized standards and special private certification programs that are unique to individual industries. The prevalence of Six Sigma, Black Belt, and Green Belt certifications among all manufacturing openings and production openings speaks to the importance of lean manufacturing principles and their application in advanced manufacturing industries. Overall, about seven percent of all manufacturing openings specifically

Figure 12: Certification Distribution

All Manufacturing Openings		
Certification	Openings	% of Total Openings
Project Management Certification	5,395	0.8%
Six Sigma	4,036	0.6%
Commercial Driver's License	3,825	0.6%
American Production & Inventory Control Society Certification	2,314	0.3%
Forklift Operator Certification	2,165	0.3%
Black Belt	2,147	0.3%
Green Belt	2,108	0.3%
Certified Public Accountant	2,065	0.3%
Certified Quality Engineer	1,398	0.2%
Microsoft Certified Systems Engineer	1,385	0.2%

Production Openings		
Certification	Openings	% of Total Openings
Forklift Operator Certification	491	0.9%
Six Sigma	245	0.4%
Black Belt	237	0.4%
Green Belt	147	0.3%
Welding Certification	140	0.3%
American Society for Quality Certification	124	0.2%
Commercial Driver's License	79	0.1%
Soldering Certification	76	0.1%
Certified Quality Engineer	70	0.1%
Project Management Certification	52	0.1%

required some type of certification, suggesting that certifications are important but not yet widely required across the manufacturing sector. The trends in certification requirements will be important to monitor in the future.

About seven percent of all manufacturing openings required some type of specific certification.

Conclusion

Real-time LMI offers many important insights into the current manufacturing labor market. For instance, it shows that metro areas are important centers for manufacturing employment and that an overwhelming number of manufacturing jobs advertised online (91 percent) are not directly related to production activities. Moreover, many of the available jobs are in a relatively small number of manufacturing industries and companies. For instance, one in four manufacturing job openings is in just three industries—computer and peripheral equipment manufacturing, aerospace product and parts manufacturing, and pharmaceutical and medicine manufacturing. In addition, online recruiting activity was relatively concentrated—approximately one in eight manufacturing jobs available during the first half of 2011 was advertised by one of only 10 large companies.

The data analyzed here also shows that manufacturing has few good-paying job opportunities for people with limited skills and education. The opposite is, in fact, true: more than half of the available jobs required workers with education beyond high school. For available production jobs, one-quarter required education beyond high school. Overall, manufacturers are seeking workers to fill positions related to sales, management, and engineering, and among production-related openings, jobs are available for workers with STEM skills and lean manufacturing certifications.

While these data highlight important trends, several caveats need to be considered. For instance, the relatively low proportion of production job openings may be partially explained by the declining share of jobs in production occupations that have been lost due to the adoption of new labor-saving technologies. It may also partly be explained by outsourcing of recruitment or different employment recruiting practices for these occupations. In other words, the reason for this distinction is still very

much unclear. Furthermore, it is likely that a smaller proportion of available production jobs are advertised online, so this analysis may understate hiring activity among production jobs.

Finally, this analysis represents one real-time LMI lens through which to examine manufacturing. Many additional views are possible. In addition to the direct workforce applications of the data, such as assisting jobseekers or analyzing skill and certification demands, drilldowns by individual industries or geographies into any of the dimensions discussed within this paper are possible. This type of analysis might be used to answer questions for policy makers at the regional and state levels. As these data develop and strengthen over time, other types of analysis will become possible. However, this first snapshot of manufacturing through hiring activity provides an important starting point for monitoring the evolving state of the manufacturing sector.

Appendix I: About the Data

About Real-time LMI

"Real-time" labor market information (LMI) provides a new lens for examining the complexities of advanced manufacturing. Data analysts generate real-time LMI by extracting information from publicly available, web-posted job notices. By using continuously improving text-scraping and artificial intelligence technologies to manipulate the content of those web postings, real-time LMI can gather, organize, categorize, and help analysts make sense of vast quantities of data in a very short period of time. Real-time LMI data includes the entire array of unstructured background information that employers provide to potential jobseekers through their current employment advertisements. These advertisements tell workers that employers plan to hire in the near future to meet business needs, and they also describe the knowledge, skills, and abilities that a firm will require to succeed in the near-term future.

Organized and aggregated, this information is a powerful tool that can help policymakers understand companies' short-term hiring plans and the factors influencing those plans. Current computing and data management technologies allow for quick data mining and processing, transforming raw job posting data into information that can be used for analysis. In contrast to traditional data sources, which can take months or years to produce, this information can be produced within a few weeks. Real-time LMI makes it possible for analysts to assess short-term company growth plans as firms are making decisions, rather than months or years after decisions have been made as with traditional public survey data.

However, real-time LMI is not produced by public data agencies, so it does not have the same quality standards as Federal statistical sources. Furthermore, because it is still experimental and likely biased in ways that are not clear, Federal data agencies have been slow to adopt the technology. Private data providers, however, are experimenting extensively with real-time LMI. Through research, they have found that real-time LMI reflects the employee-recruiting plans (rather than actual hires) of companies. Furthermore, the data focuses narrowly on the hiring outlook of only those companies that advertise job opportunities on the web (rather than all employers). Despite these limitations, as businesses become increasingly comfortable with using the Internet as a worker recruitment tool and as analysts better understand the inherent biases of the data, real-time LMI can help to revolutionize the way data are collected and analyzed, including the speed at which insightful information is available to understand economic turning points and the characteristics of emerging trends.

About This Analysis

This analysis relies on Burning Glass International, Inc.'s data and analysis tool, *Labor Insight*. Burning Glass's advanced spidering technology currently extracts information from 16,000 online job boards, newspapers, and employer sites on a daily basis and de-duplicates postings for the same job on multiple sites. However, as noted above, this data source does not capture openings that are filled through other networks, such as friends and family referrals, union-certified member lists, or signs posted in a factory doorway or shop window.

Web spidering technology continues to be refined—it is not a perfect science. Burning Glass is continuously refining its parsing methodology, and job opening counts change regularly as refinement occurs. However, many job openings remain unclassified with regard to specific characteristics, including but not limited to occupation, skill, and certification information. In some cases, the percentages are significant due to inadequate information in the job postings. Where feasible, this paper notes unspecified/unclassified job opening numbers as a means of providing context for the conclusions drawn from the available data, but the implications of this missing data are not fully understood.

Any analysis using real-time data necessitates the specification of a time period, and data are not always directly comparable form time frame to time frame due to the imperfections in capturing it, many of which are unique to each period. Access dates are also an important consideration as improved web spidering and data parsing techniques frequently result in revised counts. This analysis relies on a six month time frame from January 1, 2011 through June 30, 2011. All data was accessed in early to mid-October 2011. Time series comparisons should be made with considerable caution due to changing consumer behaviors regarding internet usage for the employee search process; changing electronic data sources, such as the emergence of new job boards and the closure of others; and changes in how data are categorized. Reliable historical comparisons continue to be a particular issue with real-time data.

In short, like any other data source, real-time LMI has some limitations that need to be noted to effectively qualify the insights that result from a thorough analysis. That being said, the data provides a completely unique way to examine available information about jobs that companies are actively advertising, what firms are requesting in terms of qualifications and skills, and which jobs are perceived as difficult to fill. This information can be invaluable to policy makers and jobseekers as they assess their capability to fill available openings, particularly as analysts gain experience with real-time LMI and better learn to interpret the data.

CREC CENTER FOR REGIONAL ECONOMIC COMPETITIVENESS

About CREC

The Center for Regional Economic Competitiveness (CREC) was established in 2000 as a not-for-profit 501(c)3 organization to provide research, training, and technical assistance to regions seeking to use fact-based analysis to design and implement innovative job creation strategies in a knowledge-driven economy. Through its technical assistance and research efforts, CREC helps leaders and organizations to understand the economic forces impacting their regions and their individual roles and responsibilities in promoting economic prosperity. CREC also assists these community stakeholders in formulating transformational strategies to build sustainable regional growth.

To accomplish its work, CREC staff:

- Conduct economic research and analysis for individual localities and regions
- Conduct training sessions for development practitioners and researchers to teach effective ways to gather and analyze data
- Assist decision makers in creating economic and workforce development strategies tailored for their region's needs and opportunities
- Identify assets upon which regions can build effective strategies
- Prioritize issues that affect strategy implementation

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