

Hiring Difficulties in Minnesota's Manufacturing Sector: Are there skills gaps in Manufacturing?

Alessia Leibert, February 22, 2013

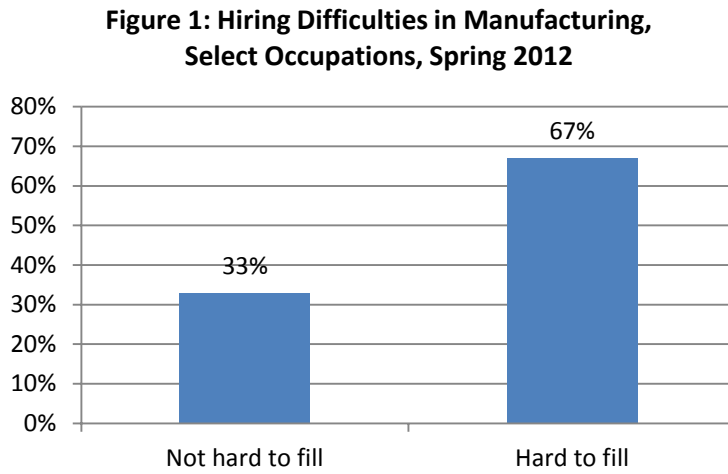
Manufacturing in Minnesota is facing unprecedented challenges and opportunities. After the job losses of the Great Recession, employers are under pressure to meet pent-up demand by adding staff. Competition among firms is very high for experienced workers as older ones are retiring. Several commentators have argued that more manufacturing jobs could be created if more people had the skills, and perhaps educational credentials, that employers are looking for. This article analyzes the level of "skills gaps"- or mismatches between the skill requirements of a job and the skills of the available workforce- in Minnesota.

To investigate the prevalence of hiring difficulties in manufacturing and determine how many are specifically attributable to skills mismatches, DEED's Labor Market Information Office rolled out a Hiring Difficulties Survey of employers. This article presents results for three groups of manufacturing occupations: at the high skill level, industrial engineers; at the intermediate skill level, industrial engineering technicians and machinists; at the low skills level, machine operators and setters.

Hiring Difficulties Survey Quick Facts

- 86 manufacturing establishments with 600 estimated vacancies (Minnesota Job Vacancy Survey, Second Quarter 2012) responded to the phone survey, representing a 77 percent response rate.
- Occupations surveyed: Industrial Engineers, industrial Engineering Technicians, Materials Engineers, Machinists, Numerical Tool & Process Control Programmers, Computer-Control Machine Tool Operators
- Survey questions for the measurement of hiring difficulties:
 - 1. Did you have/are you having difficulties filling this position?**
 - 2. If yes, are these statements true or not for this position? (Check all that apply.)**
 - a) There weren't enough applicants with the right type of education or training.
 - b) There weren't enough applicants with the right skills, knowledge, or experience.
 - c) The hiring difficulty was related to the wage being offered.
 - d) The hiring difficulty was related to the geographic location of the work.
 - e) The hiring difficulty was related to the hours or shifts of work.

Figure 1 shows that two thirds (67 percent) of manufacturing vacancies reported in Spring 2012 were hard to fill.



Most hiring difficulties did not prevent employers from successfully hiring. Sixty-four percent of positions reported as hard to fill were successfully filled by the time the interviews were conducted, about two to eight months after the job was posted.

WHAT EMPLOYERS SAID ABOUT HIRING DIFFICULTIES

Employers who reported hiring difficulties were asked to identify the reasons by choosing from two main areas:

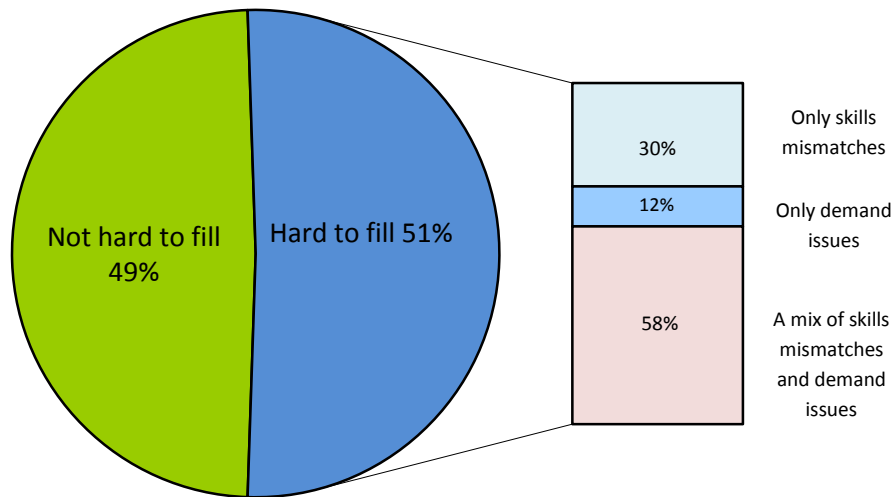
1. Hiring difficulties caused by a mismatch between job requirements and the *training, skills, and experience* of applicants (skills mismatches);
2. Hiring difficulties caused by problems that are unrelated to candidates' qualifications, such as *unattractive work hours, wages, geographic location, and others* (demand-side factors).

Results are presented by occupational group.

ENGINEERING: Moderate incidence of skills mismatches, few training gaps

Employers reported that fifty-one percent of engineering occupations (including industrial engineers, materials engineers, and industrial engineering technicians) were hard to fill. Of those hard to fill, 30 percent were caused exclusively by skills mismatches, 12 percent by demand-side factors, and the remaining 58 percent were caused by a combination of skills mismatches and unattractive demand (See figure 2).

**Figure 2: Factors perceived by employers as contributing to hiring difficulties
Engineering occupations, (N= 165)**



Employers' comments reveal that applicants lacked work experience in a similar role or industry, or a unique blend of skills typically acquired with experience. The following quotes illustrate this point:

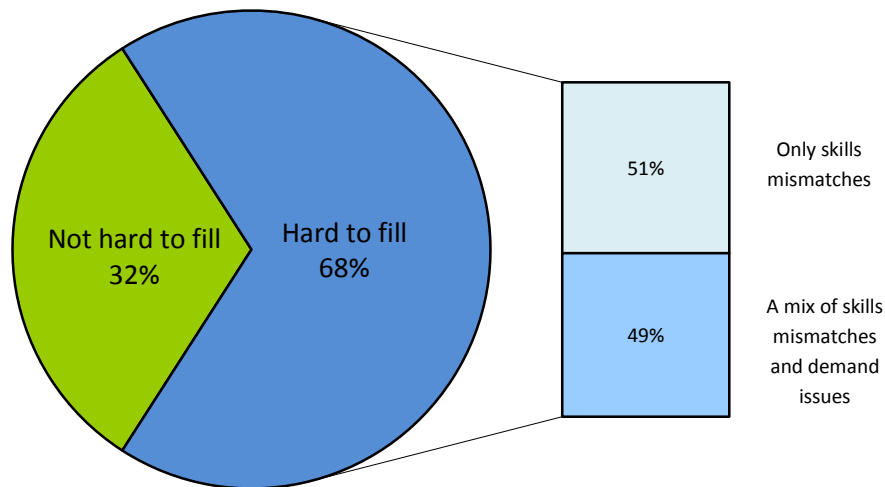
- *Hiring entry-level manufacturing engineers is pretty easy, but finding experienced workers is more challenging.”*
- *“Not as many people have the combination of a packaging engineering degree and three or more years of experience.”*
- *“We were seeking previous manufacturing leadership experience, along with computer skills and a desire to continue to grow. We did not see many applicants with that combination of skills.”*

Finding new graduates in engineering was not a problem for employers. Rather, difficulties recruiting experienced candidates often stemmed from uncompetitive wages or locations that are hard to commute to.

PRODUCTION: High incidence of skills mismatches, moderate training gaps

Hiring difficulties were much more prevalent in production occupations, which included Machinist, CNC Programmers, and Computer-Control Machine Tool Operators. Two out of three (68 percent) vacancies were reported as hard to fill, and skills mismatches alone affected one half of cases (see Figure 3).

**Figure 3: Factors perceived by employers as contributing to hiring difficulties
Production Occupations (N=475)**



When demand-side factors were cited as a problem, location¹ was the biggest barrier, followed by uncompetitive wage. The following quotes from respondents illustrate these points:

- *“There aren't many people with the required skills and education in this county, so location contributes to our hiring difficulties. There are some qualified people three counties away, but who knows if they are willing to relocate?”*
- *“Firms steal people from other firms, competing on wage.”*
- *“We've always offered good benefits here, but apparently people are more interested in the pay than in benefits. We might consider offering more money and less benefits.”*
- *“The job market for machinists is very competitive, there aren't that many out there compared to demand so you can be choosy on where you want to work, and the days/hours of work.”*
- *“It's hard to get someone with that level of experience to work on a weekend”.*

When pure skills mismatches were cited as a problem, three main issues emerged: inadequate hands-on training, inadequate applicants' experience, and overall low number of applicants for production openings. Below are some illustrative comments from respondents:

- *“There are trade schools (2-year program for machining), where the lowest level machinist come from. In our area there aren't enough qualified machinists because they are being pulled by*

¹ Location can be problematic either because rural areas are hard to commute to, or because semi-urban areas have a high concentration of manufacturers that compete for the same candidate pool.

other machine shops, so recently we started an apprenticeship program trying to recruit people with some sort of mechanical background and put them through a 6-8 weeks training. We'll continue running those programs until we get enough people. There is really no end in sight. "

- *"Applicants had training but no practical experience on our machines."*
- *"There are not enough applicants. Blue collar work, factory work is not what people want. They don't want to go to school to learn the trades."*

The first issue is described by some respondents as a lack of practical experience among individuals with a two year program in machining, CNC programming, or machine tool technology. Does this point to gaps in vocational training in Minnesota? Interestingly, no single respondent mentioned the lack of locally available training programs as a reason for the hiring difficulty, meaning that the education system already has the capacity to develop general occupational skills.

The second and most frequently reported problem is the lack of hands-on skills such as machinery fabrication and CNC programming, which are often groomed through years on the job. So, unless training is tailored around the individual needs of employers, lack of work-based experience could still be a barrier to getting a job even for candidates with good educational credentials.

Finally, the third problem is the declining number of people interested in a career in manufacturing. Employers lament that, at the high school level, students are being pushed to a four-year college program, leading to a shallow candidate pool for jobs requiring high school or a 2-year degree. A number of employers said that the few individuals who do apply lack technical abilities and employability skills². Although the problem might originate from an overall negative perception of blue collar work or fears of job insecurity in manufacturing, employers tend to view it as a talent gap.

Among the three areas of concern outlined above, lack of hands-on skills and experience effects more respondents and appears to be a direct cause of hiring difficulties. The next section discusses what level of training is most problematic for employers.

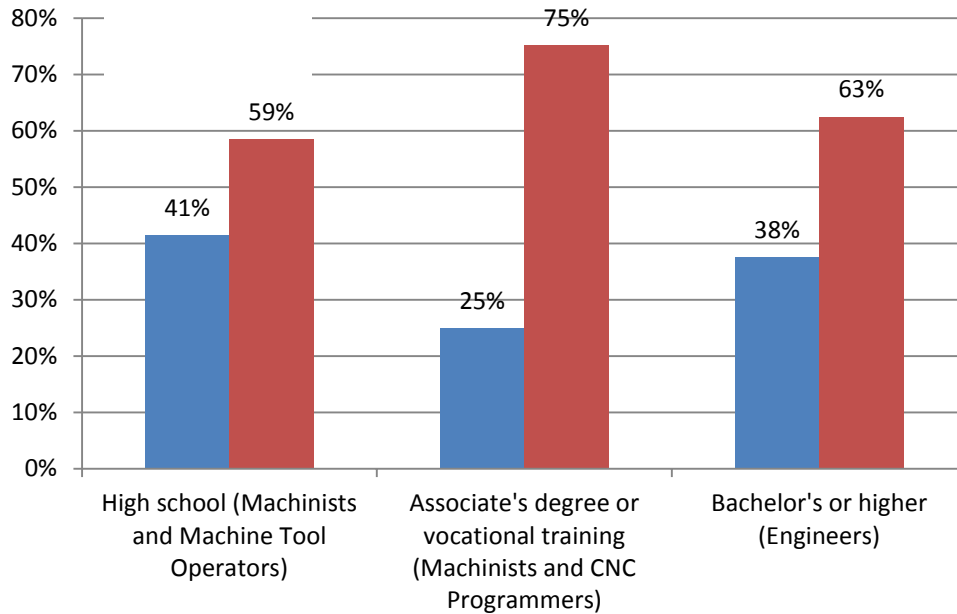
WHERE ARE THE TRAINING NEEDS?

As illustrated in Figure 4, hiring difficulties were most common among vacancies requiring some college or an associate degree (75 percent), followed by those requiring a bachelor's degree or higher (62 percent) and finally those requiring a minimum of a high school degree (58 percent). Recall from the previous section that employers had no trouble finding new graduates in engineering, and hiring difficulties at the bachelor's degree level were more commonly related to unattractive demand and lack of experience than to inadequate supply of trained individuals. Therefore, it is among Skilled Trades jobs where manufacturing employers experience the greatest difficulties meeting their demand for skills

² A few employers who posted vacancies for machine operators and setters reported difficulties finding candidates who show up on time, do not break the machines, and are not job hoppers. Some employers mention a lack of basic math skills and mechanical aptitude, but predominantly basic employability skills are missing.

from the available labor market. Could the delivery of additional technical training help employers find the talent they need? If yes, what form of training would be most effective?

Figure 4: Hiring Difficulties in Manufacturing by Education Level, Spring 2012



Detailed comments from respondents show a mixed picture. On the one hand, as discussed in the previous section, the overwhelming majority of employers attribute hiring difficulties across all education levels to a lack of hands-on skills typically developed through on-the-job training or years of work experience. Two-year programs are already available in Minnesota to teach critical skills such as machining, CNC programming, and machine tool technology, but employers are also looking for individuals with experience in an industrial setting that could substitute formal education³. On the other hand, some employers also expressed concern for low enrollments in these kinds of programs, and attribute the problem to a lack of exposure to vocational training in high school and to the negative image of blue collar work.

These findings suggest that skills gaps definitely exist, but they cannot be entirely filled with formal education. Hiring difficulties might occur even if the supply of formally qualified labor is abundant in the market. Expanding access to shop classes at high school and encouraging more enrollments in vocational training programs would of course be helpful, but won't be enough to solve the broader

³ This is the reason why many vacancies for Machinists were reported by employers as needing only a high school degree plus experience (see Figure 4).

problem of a lack of experience. Additional training in the form of apprenticeships, or occupation-specific coursework combined with paid internships, would probably benefit manufacturers the most.

Employers, in collaboration with local schools, likely have a role to play in developing the hands-on technical skills - the leading cause of hiring difficulties in manufacturing. Indeed, when asked what strategies they would use or are already using to respond to persistent hiring difficulties, employers suggested the following:

- Enhance internal training: Establish apprenticeship programs; train internally to bring new hires up to speed even if they do not have the two years of formal schooling.
- Collaborate with local technical colleges: Establish student internship programs in collaboration with local schools.
- Improve recruiting strategies and career information: Contact local colleges to see if they have a database of applicants. Reach out to high schools and technical colleges to try to get more kids interested in careers in manufacturing.

Finally, it is important to underscore that two-thirds of hiring difficulties in jobs requiring post-secondary training were perceived to be driven by a mix of skills mismatches and demand factors. This could reveal a causal relationship between certain job characteristics and recruitment problems in manufacturing. The next section explores demand-side factors and their ability to explain hiring difficulties.

UNDER WHAT CONDITIONS ARE HIRING DIFFICULTIES MORE LIKELY TO EMERGE?

What other factors contribute to hiring difficulties besides skills mismatches? Let's recall that several employers indicated location, wage, and competition among manufacturers as reasons for their hiring difficulties. In order to accurately measure the impact of these factors, we included them in a model that predicts the probability of a vacancy being hard to fill. Table 1 lists all factors associated with hiring difficulties.

Table 1: Comparison Hard-to-fill and Not-hard-to-fill Manufacturing Vacancies by Firm and Job Characteristics, Spring 2012 ⁴			
** strong factor			
* weak factor			
Factor	Categories	% Not hard to fill	% Hard to fill
Occupation**	Industrial Engineers and industrial engineering Technicians	37%	63%
	Machinists/ Numerical Tool & Process Control Programmers	17%	83%
	Computer-Controlled Machine Tool Operators, Metal and Plastic	63%	37%
Job Experience Requirements**	No experience required (ENTRY-LEVEL)	60%	40%
	Experience of less than three years	28%	72%
	More than three years of experience	24%	76%
Wage offers**	Median for Industrial Engineers	\$31	\$30
	Median for Machinists	\$14	\$12
Location of Firm**	Metro Area	45%	55%
	Greater Minnesota	20%	80%
Industry of Firm*	Machine shops	32%	68%
	Other manufacturing industries	35%	65%

⁴ The model was able to correctly predict the presence (or absence) of a hiring difficulty in 77 percent of survey data, with a Nagelkerke R Square of .358. The following variables were included in the model: Geography (Metro Versus Greater Minnesota), industry, occupation group (engineering, machinists, machine operators), experience level requirement, log of wage offered.

Consistent with the analysis presented earlier, the quantitative model reveals hiring difficulties as a function of a job's occupational classification and experience requirements. But we also find measurable evidence of demand-side effects on hiring difficulties: firm location, industry sector, and wage offers. Each factor is explained below.

Occupation: Hiring difficulties are highest among machinists and CNC machinists, and lowest among machine operators: The probability of a job being hard to fill is 8 times higher for machinists compared to machine operators, and 4 times higher for engineers and engineering technicians compared to machine operators. This result confirms that jobs requiring vocational training or an associate's degree in a technical field are those where employers struggle the most.

Entry-level versus experienced jobs: The probability of a job being hard to fill increases by a factor of 4 if the job requires a high experience level compared to no experience. In other words, hiring difficulties in manufacturing are a function of years of experience and the skills obtained through that experience.

Wage: The analysis finds evidence of hiring difficulties being systematically related to the wage offered. In particular, an increase of 1 percent in the mean wage of the sample, holding all other variables constant, causes the likelihood of a vacancy's being hard to fill to drop to less than one tenth (.077). As shown in Table 1, this difference is observed specifically for Machinists, where starting wage offers for hard-to-fill jobs were systematically lower than those for not hard to fill jobs regardless of region and other factors. Interestingly, results from Fall 2012 Job Vacancy Survey -collected six months after the data shown here- show a sharp increase in median wage offers for Machinists, indicating that employers are taking decisive action to make these jobs more attractive. If the upward pressure on wages continues and rises above the prevailing wage⁵, the job market for machinists would be consistent with a condition of shortage.

Location: The probability of a job being hard to fill increases by a factor of 5 if a vacancy is in Greater Minnesota regions compared to the Metro Area.

Industry: All manufacturing firms included in this survey appear to experience a similar level of hiring difficulties regardless of what they are producing. Manufacturers are all in the same boat when it comes to hiring within the same occupation. The analysis found only one exception: Vacancies in machine shops appear to have a higher likelihood of being hard to fill compared to other sectors in manufacturing. They are the most damaged by the erosion of vocational education in high school, and are experiencing the most dramatic workforce pipeline problem. Also, this industry had the highest concentration of vacancies that were "always advertised", possibly indicating high turnover. As the quintessence of blue collar, low-tech labor, machine shops represent the old image of manufacturing careers. The recruiting challenges faced by the manufacturing sector are in part related to the effort to replace the old stereotype with a new image of high-tech, high-skilled, stable and rewarding careers.

⁵Median wage offers for Machinists rose to \$21 an hour in Fall 2012. A wage of \$21 an hour corresponds to the median wage for Minnesota (also called "prevailing wage") as measured by the OES survey. Source: Occupational Employment Survey Minnesota, Third Quarter 2012

<http://www.positivelyminnesota.com/apps/lmi/projections/detail.asp?code=514041&geog=2701000000> .

In conclusion, we see that all manufacturers face similar challenges finding experienced candidates, but especially in machining occupations. We also find a systematic relationship between wage and hiring difficulties especially in machining occupations, indicating that demand conditions do play a role in hiring difficulties. We are also seeing, in the most recent job vacancy round, signs of upward pressure on wages for the hardest-to-fill occupations as employers see the need to make these professions more attractive.

CONCLUSIONS

Survey results offer a comprehensive picture of skills gaps as one of many factors driving hiring difficulties in manufacturing. The complexity of the issue does not lend itself to one-size-fits-all solutions and will require responses at various levels. The supply problem won't just be solved with increasing graduation rates in vocational training and engineering programs, but rather with a coordinated set of interventions at different levels of the workforce system. First of all, through the addition of machine-related courses at high school to expose students to careers in the skilled trades. Second, through increased collaboration between employers and technical colleges to offer internships and work-based learning opportunities. Lastly, through continued efforts on the part of employers to expand on-the-job training and make skilled trade careers more attractive. Career explorers must be convinced that manufacturing jobs are coming back and they can be relied upon as the backbone of a stronger middle class in Minnesota.