Colorado Helps Advanced Manufacturing Program

Automation in the Colorado Manufacturing Industry

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RUTGERS
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SMLR was originally established by an act of the New Jersey legislature in 1947 as the Institute of Management and Labor Relations. Like its counterparts that were created in other large industrial states at the same time, the Institute was chartered to promote new forms of labor–management cooperation following the industrial unrest that occurred at the end of World War II. It officially became a school at the flagship campus of Rutgers, the State University of New Jersey, in New Brunswick/Piscataway in 1994. For more information, visit smlr.rutgers.edu.

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INTRODUCTION

Today's manufacturing shops are increasingly becoming automated eliminating the more repetitive or physically demanding processes from human hands. To ascertain the role that automation may play in the near term in Colorado's manufacturing sector, the Colorado Helps Advanced Manufacturing Program (CHAMP) program engaged in a pilot study of the state's industry and workforce from the perspective of manufacturing employers. These findings are derived from EERC's interviews with employers involved with the CHAMP program (N=15) and a pilot survey with employers attending a regional meeting of Colorado manufacturers (N=10). All data were collected between May and August of 2017. Given the small number of survey respondents these results should be seen as exploratory, but they point to important trends that may affect demand for the manufacturing workforce and inform directions for future research.

CHAMP was a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant awarded by the U.S. Department of Labor. CHAMP, which ran from 2013-2017 involved a consortium of seven Colorado community colleges, a technical college, and a four-year university.[1] The Colorado Community College System (CCCS) provided technical assistance and management support for the consortium.

The primary objectives of the CHAMP project were to realign Colorado's higher education manufacturing certificate and degree programs with industry's current and anticipated needs and to increase the attainment of degrees and certifications in manufacturing.

In this brief, EERC found that employers are generally interested in increasing automation, and some have already implemented automation processes of varying scope and scale. However, multiple interview respondents noted that the process of automation was not as simple as it appeared, and implementation could be time and resource intensive. We discuss employers' views on the manufacturing workforce and motivations for automation, as well as some of their challenges and concerns related to automation.

AUTOMATION AND THE WORKFORCE

The fates of the manufacturing workforce and of automation are intertwined. Automation addresses tasks previously performed by workers, changing the nature of the work individuals perform. For this reason, automation is often described as a threat to the manufacturing workforce. It has the potential to ultimately decrease the number of jobs in manufacturing to a small number of specialists running computers and robotics replacing a larger number of workers carrying out manual tasks. Ironically, employers report that they are currently

[1] The consortium included Front Range Community College (FRCC), Aims Community College, Community College of Denver (CCD), Emily Griffith Technical College (EGTC), Lamar Community College (LCC), Pikes Peak Community College (PPCC), Pueblo Community College (PCC) and Red Rocks Community College/Warren Technical College (RRCC), and MSU Denver (MSU).

challenged to find enough skilled workers to fill their jobs, and that automation is a strategy to address these shortages.

Employers see manufacturing in Colorado as a stable if not growth industry. Survey respondents reported optimism about the future growth of their firms; 7 out of 10 expected to increase employment over the next 6-12 months, and 6 out of 8 responded that they expected the number of manufacturing positions in their organization to expand. The remaining two employers expected the number of employees remain the same. None of the surveyed employers expected a contraction of their employee positions.

At the same time, the employers were less optimistic about the availability of qualified individuals to fill open positions; 9 out of 10 employers indicating on their surveys that they had issues in finding qualified workers. The 9 employers who said "yes" to having difficulty in finding employees, were then presented with six common reasons for hiring challenges. They were asked to select all that applied, and to rank them in order of significance. Table 1 presents the employers' responses ranked in order of agreement.

Table 1. Employers' perceptions of challenges to finding qualified workers

	N of respondents
Lack of technical competencies (hard skills)	7
Lack of workplace competencies (soft skills)	4
Lack of experience	4
Lack of available applicants/no applicants	4
Inability to pass a drug test and/or background check	3
Looking for more pay than is offered	2
Total respondents	9

Skills and experience, specifically the lack thereof, were cited most often as a challenge to filling an open position. Technical competence was the biggest challenge.

Given that there may be difficulties in filling jobs, we asked the respondents about alternative strategies they may have considered to address gaps in their workforce. Again, EERC asked respondents to select all that applied from a list of 6 strategies. Automation was the most popular strategy, as demonstrated in Table 2 below:

Table 2. Strategies employers considered to address challenges in staffing jobs

	N of respondents
Introducing automation to some components of your operations	6
Training incumbent workers to fill different jobs	4
Outsourcing some components of your operations to (sub)contractors	3
Bringing in labor from abroad	3
Relocating your manufacturing facility domestically	1
Relocating your manufacturing facility globally	0
Total respondents[2]	9

Though globalization and outsourcing have historically been viewed as threats to American manufacturing, none of the employers were considering international relocation. Domestic relocation was not much more popular. However, filling the gaps by retraining incumbent workers, or bringing labor in via subcontractors or foreign workers, were two strategies considered by some of the employers.

We next asked respondents if they had automated any processes in their manufacturing facilities in the past 5 years. Six of 9 responding employers reported that they had. Asked if they had any interest in increasing automation of their manufacturing processes in the next 5-10 years, 7 of 9 responding answered in the affirmative.

Respondents were then presented with a list of 9 factors that might be important as they considered adding automation to their factory. We asked them to select up to three factors that resonated with their decision making. Increased safety, speed, and competition were the most-often cited reasons to automate. In order of importance, these included:

Table 3. Factors that are important to employers' decision to add automation to their operations

	N of respondents
Increasing safety on the shop floor	6
Increasing speed of production	6
Remaining competitive with manufacturers in the US	6
Reducing waste in production	5
Reducing physically demanding tasks for employees	5
Meeting industry demand for your company's products	4
Saving on labor costs	4
Adjusting for shortages in qualified workers	4
Remaining competitive with global manufacturers	3
Total respondents	9

[2] The total respondents varied by item, with earlier survey questions yielding 10 respondents and later questions yielding 9.

Reduction in waste and physically demanding tasks for workers was also a common consideration. In a similar vein, in EERC's interviews the improved accuracy of production was identified as factor in respect to automation. One respondent noted: "Every time someone – every time an operator touches a part, there's a risk for failure."

Of note, among the responding employers, workforce considerations were not at the top of their list. Only four indicated saving on labor costs and adjusting for shortages in qualified workers. Instead, safety was the top factor, efficiency (speed, competitive edge, reduced waste) loomed large, later echoed in the interview data.

EFFICIENCY AND THE COST OF AUTOMATION

Many of the manufacturers interviewed view automation as part of a larger conversation about efficiency. In discussing the challenge of automation, efficiency was most frequently cited and emerged as the factor which often makes or breaks the decision to add automation to the manufacturing floor and the extent to which they automated. Given that automation is time and resource intensive, it did not make sense for all industries. Further, even automation poses workforce challenges. In short, when automation is perceived to increase efficiency and capital is available, it is considered or adopted. When there are barriers that might limit efficiency or the cost is prohibitive, automation is not considered or adopted.

Interviewees stated that the time required to implement automation – getting automated processes up and running smoothly as a significant challenge. This start-up phase can take a considerable amount of time. As one manufacturer noted,

> We've dabbled in it, but it's not as easy as what you want to think …. I visited a company in California that I thought was absolutely phenomenal just last week and they had one robot and it took them 12 months to get it set up to run one single part number, to do a little deburring, brush finishes on it. It took a full year. So it's not an easy thing."

The payoff in industries and small companies which have changing products or equipment needs, such as the medical industry, automation may not be an efficient or cost effective strategy. In contrast, the time investment makes sense for industries with large, unchanging production lines. When capital exists to introduce computerization or robotics, automation can help these manufacturers become more competitive.

At the same time, capital investments can be considerable, even if the investment pays off in the long run. This can be a deterrent for even manufacturers with stable needs. Reflecting on the sizeable investment in technology, one manufacturer noted,

> The trick with a machine shop to be profitable is it has to run around the clock. Machineries – the machine we were buying, our average cost probably would be around

> half a million dollars per machine, the types of things we have, up to a million per machine. So we want that to run at least 20 hours a day for us to make money.

Finally, workforce factors can make or break an automated shop. Employee skills are something employers must consider as automation requires a new set of skill on the manufacturing floor. When EERC asked survey respondents what training their employees would need if they automated, 5 respondents reported minor on-site job training, and 3 reported major on-site job training. No respondents selected minimal or no training. Further, no respondent cited off-site training at a technical school or college, or employment of new employees in lieu of retraining their current workforce.

These findings were mirrored in EERC's interviews with manufacturers in which employers frequently spoke of the symbiotic relationship between a more highly skilled workforce and automation. Automation reduces the needs for a sizeable workforce, but is only possible if a highly skilled workforce is available to operate the machinery. Automation greatly increases efficiency, and automation increases the importance of that skilled workforce. As one manufacturer who had successfully automated tasks noted,

> We're driven really by cost to automate. But again, having an extremely stable and well trained workforce allows us to keep that automation running at a super high efficiency rate.

Another interview respondent noted, "That's one of the challenges, finding people. That's why the manufacturing engineers are so important."

CONCERNS ABOUT AUTOMATION

Finally, using a four point Likert-type scale, EERC asked survey respondents to consider the negative factors they associated with automation.[3] We calculated the mean score on this scale for all respondents, and present the results in Table 4. The mean scores are arranged in the order of employer concern. The highest mean score was 2.86 (nearing "concerned") in respect to the cost of automation; and a mean score of 2.14 (slightly higher than "somewhat concern") for employees lack the training for automation. Five out of the 7 factors had mean scores under 2 bordering between "no concern" and "somewhat concerned."

We then looked at the frequency of answers for each factor. Again, most concern was about the cost of acquiring the tools for automation – 72 percent reporting they were "concerned" or "very concerned." Seventy-one percent of employers indicated they were "somewhat concerned" about the cost of training incumbent workers to operate automated components, but 29 percent indicating they were not concerned. Of interest, both employee resistance to automation and discomfort with automation received frequency scores of over 60 percent (combining "somewhat concerned" and "concerned"). It is unclear the basis of these employer

[3] On this scale 1=not concerned at all, 2=somewhat concerned, 3=concerned, 4=very concerned.

perceptions, but per the Thomas Theorem in sociology, "what is real is real in its consequences." Therefore, if employers sense employee resistance to retraining they may be less willing to invest in extensive and are more likely to hire new employees with the requisite skills.

Table 4. Employers' concerns when considering automation

		Frequency of Responses			
	Mean LIKERT scores	(1) Not concerned at all	(2) Somewhat concerned	(3) Concerned	(4) Very concerned
Acquiring the tools for automation will be cost prohibitive.	**2.86**	14%	14%	43%	29%
Employees do not have the training necessary to deal with automated components.	**2.14**	14%	57%	29%	0%
Employees will be resistant to automation.	**1.86**	29%	57%	14%	0%
Employees will be uncomfortable working with automated components.	**1.71**	43%	43%	14%	0%
Training incumbent workers to operate automated components will be expensive.	**1.71**	29%	71%	0%	0%
The public will be resistant to automation.	**1.43**	57%	43%	0%	0%
Automation will make the manufacturing floor less safe for workers than before.	**1.43**	86%	14%	0%	0%

NEXT STEPS

The findings presented in this brief are exploratory. Future research is required to make more robust statements about the state of automation in manufacturing. We are continuing to examine these trends in other manufacturing projects at the Education & Employment Research Center.

However, these findings offer a glimpse into the mindset of the American manufacturing employer. These employers perceive workforce shortages that may make them more inclined to automate processes on their manufacturing floors, if they can balance cost and efficiency, and if they can find skilled workers to work with the automated processes. For educators and advocates working with the manufacturing workforce, training toward higher level skills may be the best bet to prepare individuals to succeed in this market.