

Planning for Developments in Automation and the Changing Skills of the Workforce

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Abstract

The manufacturing industry is undergoing a new revolution. The pace that technology is moving forward is pushing the development of automation and Artificial Intelligence (AI.) This is occurring while workforce demographics are also changing. The future of manufacturing depends on an integration of man and machine together. This paper is exploring possibilities of how to utilize this relationship to develop a plan to sustain the continued growth of the workforce and technology.

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1. Introduction

Automation is a valuable component of manufacturing. The decrease in non-value-added labor, improved quality, and increased throughput yield make it a great asset. An important part of developing automated manufacturing process is its integration with the work force and community. If the workforce does not see the value automation adds, it may appear to be a threat to their job. For example, in England during the year of 1811, a weaving machine was created. Dozens of machines were powered by a coal fired motor. This increased efficiency and output. The problem with this efficiency was that jobs were eliminated, and poverty increased as wages decreased. By 1812, \$2 million worth of machines and places of work had been destroyed by unemployed weavers. The development of successful integration between workers and automation is critical to the future success of the industry.

Most manufacturing companies in the United States agree that their largest concern for their future is the shrinking pool of skilled laborers. Currently the U.S. has an aging labor force with a growing segment of 50 – 65-year-old workers. They are retiring faster than new skilled workers are being trained. The number of students that attend technical high schools or enter the workforce after high school is decreasing. The attained education levels for the workforce has and will continue to rise. What do we do as our aging labor force retires? Where do we find skilled workers in a prime age? How do we train unskilled workers to fill these positions? How do we keep our employees vested as we train and invest in their future? These are important questions that manufacturing companies in the U.S. and worldwide are asking right now.

2. Manufacturing in 2020

Today's increased cost of living and medical insurance costs make it difficult for most of the middle class to retire before their social security and Medicare benefits begin. Older skilled workers need to find work with medical benefits. That growing segment of the work force will be retiring in the next ten years. Companies will need to replace them with skilled laborers in the prime age of 25-45 years old. As of 2019 in the U.S., a third of machinists are over 55 years old and the average age of machinist is 49 years old [4].

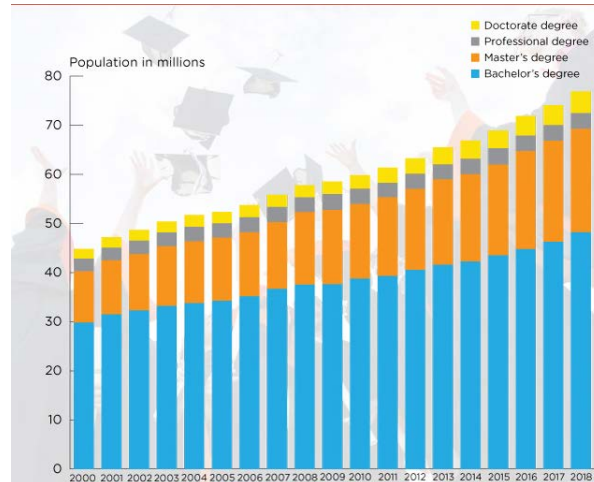


Fig. 1- Educational attainment by year (source: U.S. Census Bureau)

As time goes on, the segment of the population which has finished high school but has not attained their bachelor's degree will continue to shrink. In 1990 that segment was 70% of the U.S. population, but by 2015 it was 60% of the population. The manufacturing industry is looking at a shrinking pool for its labor positions. The success of the manufacturing industry in the U.S. involves planning on how to utilize the skills of this changing labor force.

3. The Future of Manufacturing

Today a new industrial revolution has begun. Industry is being impacted by the digitization and integration of technology. Industry has been driven forward by automation since the beginning of the industrial revolution. Now technology is driving automation's rate of acceleration. The technological skills of the workforce need to keep pace with these changes. Occupations that will grow are Software Developers, Engineers and Computer System Analysts.

The increase in automation will grow predictive maintenance. Higher level technical skills will be needed for trained labor positions. Technicians will need quantitative and statistical skills. They will spend more of their time monitoring trends.

Businesses need to grow with the workforce. The business structure will change to utilize new technology and the speed it evolves at. Having the capability to satisfy customer demands at a faster rate requires having a flexible system that is ready to make continuous changes.

Human Resources departments will have to adjust for a work force with continuously evolving skills. As the technology of automation grows the skill level of the workforce will need to also evolve. Growth will depend on having the foresight to see what skills are needed and planning the education to supply the workforce with those skills.

It is predicted that from 2016 – 2030 that predictable manual jobs will decrease from 46% of the manufacturing workforce to 32%. That will still be the largest segment of the workforce. The largest increase in jobs will be with technological skills. Existing skilled labor positions will also require basic digital skills to maintain the process. Advanced Information Technology (IT) skills are needed by Software Developers. Statisticians and Research Analysts require more advanced data analysis skills. The constant improvements to the automated systems will be driven by the Engineers and Robotics Experts. Scientists push the future with their research and development of new technologies.

It will be important to work as a team with Academia to develop a road map for continuously updating the skills of the workforce. Table I shows that between 2008 and 2019 college educated women and men, as a percentage of the total population of women and men, has grown by 9.3 % and 5.9% respectively [6]. The number of jobs did not keep

up with the number of graduates however. It also shows the job shares growing by 5.1% by women and 3.3% by men. The share of college educated individuals is increasing, but that doesn't mean they have a place in industry. Businesses need to work with municipalities and schools to ensure that the workforce is trained with relevant technology.

Table I. Prime-Age Employment and Education

Group	2008	2019	Change
Women			
Total	63,580,812	63,978,852	0.63%
College-educated	20,932,984	27,020,544	29.08%
College-ed share	32.93%	42.23%	9.30%
Men			
Total	62,107,180	62,284,345	0.29%
College-educated	18,821,718	22,567,705	19.90%
College-ed share	30.31%	36.23%	5.92%

4. Utilizing the workforce

As the segment of U.S. citizens without a college education decreases, the need for skills increases. Unskilled labor will still be the largest group of workers in manufacturing, but it will see the largest decline in jobs throughout the industry. These jobs are filled by the segment of the population without a college education which is also decreasing. Skilled workers are important to manufacturing and the ageing workforce of skilled workers is retiring. As automation continues forward the technology behind it advances and the skills of those workers will need to advance as well [7]. This is where companies moving forward with automation and AI need to be proactive.

Finding sources of skills will always be a focus of manufacturing. Companies need the foresight to identify the technology that will be used in their future, then recognize the skills needed to optimize that technology. As technology moves forward at a faster and faster pace, skills need to be improved with it.

The continuing education and development of employee's skills are an important component of a business that is moving forward with the automation of their manufacturing process. A Human Resources department can be vital in the restructuring of these businesses and their employee's future skills. Being proactive in the development of a workforce's skills means always seeing the gap in needed skills before it happens. The experts in these skills need to be identified and the methods that the skills are taught need to be planned.

Skilled workers need a foundation of STEM skills. The manufacturing industry can work with municipalities, technical high schools, community colleges and universities to define these skills. As the pace of technology moving forward increases, academia will need to be flexible. For schools to sell their product (students) to their end customer (manufacturing industry) adjusting to the customers specifications (curriculum) is a continuous process. If skills for automation grow at the pace of technology, it will be harder to find an off-the-shelf product. For the U.S. to be a leader in manufacturing, education will always need to be optimized.

The current workforce is creating a growing problem for businesses that do not move forward with technology and automation. The workforce that retires in the next 15 years will contain 32% of machinists, 27% of lapping and grinding technicians and 33% of tool and die makers. The pool of potential candidates for filling the current positions in manufacturing is shrinking. With a shrinking pool of workers to draw from, it will become more expensive to maintain the same quality and efficiency of today's process.

5. Conclusion

Moore's law states that the number of transistors on a microchip double every two years. As the pace of digital technology's growth increases so does the capabilities of automation and AI. Utilizing this technology is a necessity if a company is going to be a leader in manufacturing. To move forward companies need employees that continually develop and grow. To lead the competition means attracting and retaining the best talent. The challenges in

developing automation and AI may be the most important assets in building a workforce that drives manufacturing forward.

As the segment of citizens with post high school education increases, a more educated work force is available. A company that is keeping pace with technology and automation will increase the number of potential workers for its team. To move forward companies need to plan their development. Today's lack of skilled labor will not disappear. The definition of what skills are needed is changing. The new generation will work side-by-side with increasing automation and AI. The workforce will always need a continuous increase in technological skills.

A plan for how the skills of the workforce are developed is important. The need for predictable manual labor will decrease by 14% by 2030. These employees could be a significant source for future skilled labor if they are trained with new skills. An evolving plan for the skills that are needed is key. Technical schools, community colleges and universities are an asset if they are teaching an appropriate curriculum. Working side-by-side with schools to stay ahead of industry's needs will supply the consistent flow of new ideas and technology that is needed in this new industrial revolution.

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