@MANUFACTURING WORKS

February 2013

Ted Hall, a neuroscience professor at Duke University, built plywood boats as a hobby. His frustration with using hand tools to cut panels for curved hulls caused Ted to consider purchasing a computerized cutting tool called a CNC router. This entry-level machine cost $40,000. Ted concluded he could make the tool himself. The success of his first model inspired Ted to put his technology into the hands of more people like him. Fifteen years later, Ted's ShopBot Tools has placed CNC routers in nearly 6,000 small businesses and manufacturing shops in the U.S. and around the world. ShopBot's routers cost as little as $5,000.

ShopBot Tools, located in Durham, NC, relies on modern technology to cut, carve, drill or machine different kinds of products from a variety of materials. Manufacturers use the included software to custom design parts on a computer. The computer controls the cutter to precisely cut the parts, which can be repeated once or thousands of times. Following his tool's success, Ted created an online community, 100kGarages, in which digital fabricators and designers connect with one another for project inspiration, job matching, best practices and other forms of collaboration. ShopBot Tools and 100K Garages are features of the new face of manufacturing.

Producing everything from customized t-shirts to solar panels, today's manufacturing companies are using new technologies and networks to innovate products and processes. They are integrating operations within and across sectors and selling their products across the world, often only with a click of a computer button. These technologies are not just reserved for new companies, existing firms are adapting to remain competitive as well. All of this change has the Economist magazine declaring that the world may be on the brink of a "Third Industrial Revolution."

North Carolina was a regional leader in manufacturing in the last industrial revolution, and our vision for the next should be no less lofty.

A group of IEI-convened leaders from across the state emphatically stated their vision for the future:

North Carolina's manufacturing sector leads a vibrant, innovative economy with networked communities, a growing entrepreneurial and maker culture, and a strong commercial finance sector. Through strong statewide leadership, North Carolina will emphasize the critical importance of traditional and next generation manufacturing to its core economy. North Carolina commits to investments in strong supporting institutions, a highly skilled workforce, developing globally and locally networked communities and a world-class infrastructure that creates logistical advantages and the agility to respond to the technological pace of change.

This paper is divided into two sections. The first section outlines how manufacturing is evolving, here at home and across the country. The second section focuses on strategies for ensuring that North Carolina remains a leading manufacturing state in the future. The strategies were developed by the Institute for Emerging Issues' Manufacturing Working Group.

MANUFACTURING MADE NEW

Amidst change, manufacturing remains a cornerstone of North Carolina's economy.

Some who grew up in this state thought - for a moment - that manufacturing was a thing of the past. As factories closed by the score in recent decades, devastating local economies and leaving thousands without jobs, many lost hope in the sector. And yet, North Carolina stands as the fourth largest manufacturing state in the country today. Here, as in much of the country, manufacturing is not dead; it's just different - very different.

New technologies now allow us to produce more with far fewer people. Today, one factory worker can accomplish what required three workers a generation earlier. Largely due to these technological advances, manufacturing productivity increased more than 120 percent over the past 15 years.

As productivity increased, manufacturing employment decreased and the jobs that remained changed. Today's manufacturing workers are likely to be found in jobs calling for skills far advanced than in years past. The upside is the work pays higher wages.

The payoff extends beyond employee wages. Every dollar spent in the sector creates $1.35 of output elsewhere in the economy. And for every job created in manufacturing, three jobs are produced in supporting sectors. In a manufacturing intensive community, most of the jobs created will be found outside the sector.

26% *Manufacturing output rose 26% from 1997 to 2010, even as employment fell 46.1%.*

The Benefits of Manufacturing Are Broad and Changing

With technology eroding employment levels, manufacturing will never be the large employer it was in past decades. Nevertheless, other important benefits remain and new ones are emerging. Local tax bases continue to be bolstered by the millions of dollars—in some cases hundreds of millions of dollars—of investment in buildings and equipment in manufacturing facilities across the state. A growing school of thought that future innovation will depend on the ability of research and development to take place side-by-side with the manufacturing process holds new promise for broad benefits.

The top five manufacturing sectors by output in 2010 were food, beverage and tobacco products, chemicals, machinery, computer and electronic products and electrical equipment, appliances and components.

The Future Is Ours...If We Seize It

Many argue that American manufacturing is on the verge of a watershed moment in history. A perfect storm of global economic forces and technological innovation sits on the horizon. If carefully harnessed, some North Carolina communities could see a resurgence of manufacturing.

Boston Consulting Group claims that American manufacturing is reaching a "tipping point." Exports are on the rise and rapid innovations in technologies continue to offer new opportunities to manufacture goods, both new and old, at affordable cost. At the same time, changing global economic conditions, rising wages in developing nations and increasing transportation costs are evening the playing field and making manufacturing in America more attractive.

The fastest growing sectors by employment include both higher paying (pharmaceuticals and medicines, aerospace products, parts) and lower paying sectors (animal slaughtering, processing).

North Carolina is already benefitting from these national and global trends. Lenovo, the second largest PC manufacturer in the world will produce computers in Whitsett, NC to be more responsive to its U.S. client demand and to reduce shipping costs. While Lenovo's announcement that it would manufacture in the state was good news for North Carolina, there is much that can be done to help spread Whitsett's good fortune to other communities.

1,337 *An average of 1,337 new manufacturing businesses were created each year between 1990 and 2009.*

MAKING NEW MANUFACTURING WORK

Business, governments and educational institutions must work collaboratively to create an ecosystem conducive to manufacturing growth.

REBRANDING

New machineries, novel materials, increased automation and smarter logistics define modern manufacturing. It is lean and connected, relying on a host of globally integrated suppliers, outside research organizations and other external expertise to remain on the cutting edge. The increasing importance of networks is creating a host of entrepreneurial opportunities, and as costs decrease for production technologies, niche firms and solopreneurs are finding profitable opportunities.

Professional and managerial occupations represented 15% of the manufacturing workforce in 1980 and over 25% in 2005.

Despite the fact that modern manufacturing compensation is, on average, more than twice the state average, our state's manufacturers struggle to attract young people to the field. Instead of seeing the technology, creativity and opportunities for growth that manufacturing has to offer, many students, teachers, and parents view the sector through an outdated lens: as requiring few skills, offering low wages and in decline.

Smart communities are stepping up to support the sector by changing its image. The City of Monroe, NC recently launched a new Manufacturing Awareness Campaign. This public-private partnership, funded entirely by the private sector, encourages young people to consider manufacturing careers. In the first phase of the two-year program, the city brought all ten of the county's high school principals to tour several manufacturing facilities in the area. None of the principals had been to any of the plants before.

Working group recommendation: Identify a strong, state-level organization/voice to carry the communications/advocacy message of the impact of manufacturing on NC's economy and attract talent to the sector.

Working group recommendation: Create a public relations and communications campaign that emphasizes the new opportunities in next generation manufacturing; is transparent about the number of jobs, income potential and required training; and highlights community impact.

Between 1992 and 2010, the number of manufacturing establishments rose 33.8 percent.

TRAINING AND RETRAINING

As technological change accelerates, so must the skill of the workforce that engages with it. Manufacturing companies increasingly report moderate-to-severe shortages of skilled workers. The extent of, and reasons for, the skills gap are hotly debated; but, there is little disagreement that manufacturing will have continued need for specialized training.

"We face a skills gap in this country," says Siemens Energy executive Amogh Bhonde. Unable to find the needed expertise locally, the company is meeting its short-term needs by recruiting talent from outside the state and, in some cases, the country. As baby boomers, a substantial portion of the Siemens workforce, near retirement, retraining is a top priority for the company. Siemens recently partnered with Central Piedmont Community College to train new workers as well as retrain current ones with newly required skills. The objective is to hire locally to meet long-term business needs.

Siemens is just one of many companies that are working to produce solutions to workforce issues. In Lee County, Caterpillar, Lee County Schools, Central Carolina Community College (CCCC) and the NC Department of Labor recently launched an apprenticeship program to train high school students for critical jobs in manufacturing. In fall 2012, 16 high school juniors enrolled, taking a mixture of high school and community college classes while working and training at a Caterpillar facility three days a week.

When they finish the two-year program, graduates will have earned a high school diploma, a welding certificate from CCCC, completed the Caterpillar Accelerated Training Program and gained valuable work experience. As word of the program spreads locally, additional companies are expressing interest in this model to fill other types of manufacturing jobs.

The top five manufacturing sectors by employment accounted for 51.7% of all manufacturing employment in 1992, compared to 40.8% in 2010.

Worker training—and retraining—is critical to retaining and growing North Carolina's manufacturing footprint. The regular introduction of new technologies on factory floors is an important driver in both the short- and long-terms. A crucial challenge lies in replacing today's manufacturing workforce.

About 30% of the workforce in the top paying sectors had an Associate's degree or higher compared to 7% in the lowest paying sectors.

Working group recommendation: Create a statewide manufacturing apprenticeship program that is easily accessible (i.e. less paperwork for businesses to participate, not as complex) and includes small- and medium-sized companies. Encourage businesses to make ongoing investments in the training and retraining of workers. Examples include the Charlotte-based "Apprenticeship 2000" program and the Manufacturing Institute's Endorsed Skills Certification System.

RETOOLING

According to a Deloitte survey of more than 400 manufacturing executives, "talent-driven innovation" is the most important driver of U.S. global competitiveness. A firm's competitive strategy must include integrating new innovations and best practices as well as understanding changing international markets , rules and standards. Small- and medium-sized firms without staff to devote to these specialized tasks are finding it difficult to keep up. "That's where we come in," says Terri Helminger Ratcliff, Director of the Industrial Extension Service (IES) at NC State University. Support organizations, such as IES act as a "catalyst for the transfer of knowledge and technology" for manufacturers.

Working group recommendation: Increase support to strengthen existing resource providers including the NC Department of Commerce, NC Small Business and Technology Development Center, the Industrial Extension Service, and other organizations. Consider a 1:3 match for smaller firms to access these agencies' for-fee services (i.e, pay $1 for $4 of services).

Western Carolina University's Rapid Prototype Center is another university-based example of how companies can take advantage of and benefit from support organizations that offer new and more efficient tools. The school's 16 labs provide tools that meet or exceed industry standards for 3D imaging, CNC and laser machining, rapid polymer prototyping and more. In partnership with faculty, staff and senior capstone students, local businesses can take advantage of these labs and ensure they are able to manufacture quickly and efficiently.

Working group recommendation: Help manufacturers grow and innovate through increased education and awareness opportunities including: manufacturing supply chains, how to complete necessary certifications, increasing export opportunities, and how enhanced profits can be obtained from higher volumes and alternate products. Best practices should be disseminated. This can be accomplished through business-to-business networking/mentorship, regional-level workshops and other methods.

Manufacturing for Years to Come

Companies like ShopBot and Siemens are a part of the future of manufacturing in our state. They use modern technology to fuel innovation, collaborate with others, and design the best product possible. They produce at a higher output level, and pay higher wages. This is the new face of manufacturing and it is creating wealth for workers and communities. For North Carolina to take advantage of the incredible potential this sector has to offer, we will need to partner with the sector to rebrand manufacturing's image, train and retrain workers with the right skills and support company efforts to retool.

NORTH CAROLINA IS IN A UNIQUE POSITION TO SEIZE UPON EMERGING MANUFACTURING OPPORTUNITIES. IT STARTS IN EACH FIRM IN EACH COMMUNITY. IT STARTS NOW.