



OKLAHOMA KEY BUSINESS SYSTEMS

MANUFACTURING

Makes It Happen

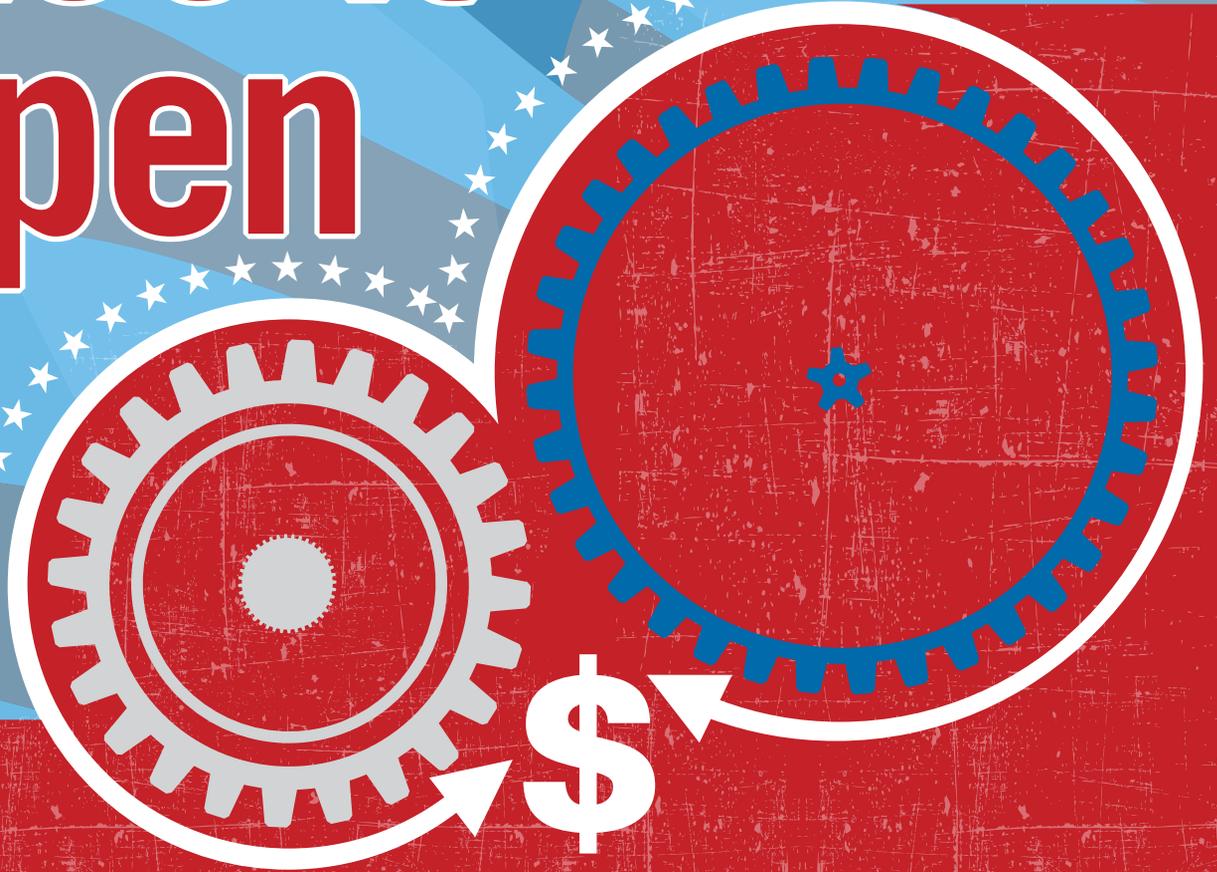


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Shawnee Mills

nie.newsok.com

My name is Chuck Mills, and I'm a 3rd generation custom manufacturer of earth drilling tools and bits for shallow drilling industries worldwide. The real reason that I'm a manufacturer is because I love to work with steel and provide solutions for my customer's drilling problems. It's magical to be able to take a raw piece of steel and with the help of a machine make it into a useful tool that someone can use to make money.



Like my family, manufacturing has enjoyed a long history in Oklahoma. Not only does Oklahoma's manufacturing industry remain one of its largest economic sectors, it was named #1 in the nation for manufacturing job growth in 2011. This success can be directly attributed to the people who take pride and ownership to create, build, and deliver a quality product that people both here in Oklahoma and around the world want to buy.

The manufacturing industry no longer fits the image of a hot, dirty sweatshop. It now requires a high level of math and an understanding of technology to operate and program the computerized machinery. Let this knowledge that you will gather about a career in manufacturing encourage you to excel in your education especially in your science, technology, engineering and mathematics subjects.

It takes all kinds of people with different skills and degrees to make the magic of manufacturing happen. Consider yourself invited to discover a career in manufacturing where you too can love what you do and share that legacy for generations to come.

Chuck is the President and CEO of Mills Machine Company (est. 1908) located in Shawnee, OK and the current Chairman of the State Chamber of Oklahoma

In ***Manufacturing: Makes it Happen*** students take an inside look into the world of manufacturing, gain understanding of its importance for Oklahoma's economy, and discover lucrative career options by studying the following:

- Oklahoma's manufacturing history
- Raw materials: it's role and importance
- How modern day manufacturing technology has transformed production
- The practice of lean process improvement and its application for efficiency
- How manufacturing builds and contributes wealth to the community
- Career options and training for manufacturing employment
- The skills and character traits employers want to hire
- The diversity of employment available in Oklahoma manufacturing businesses

Find Your Manufacturing Fit

Answer these six questions to help you identify an area of manufacturing that may be most interesting to you. Circle the letter of the answer that fits you best.

- A. From allowance to extra credit, I'm good at negotiating.

B. I like to sketch out new ideas.

C. I like to fix things.

D. Mixing up chemicals into new solutions is appealing to me.

E. I'm the kind of person that others come to if they need advice.
- A. Numbers are cool to work with.

B. I am a good writer.

C. I like working with high-tech tools.

D. Technology is fascinating to me.

E. I have a knack for explaining complicated stuff to people.
- A. I like working on projects with people.

B. Imagining solutions to complex problems comes easily to me.

C. I'd be bored sitting at a desk all day crunching numbers or doing paperwork; I want a more active job.

D. I'm interested in the environment and keeping people healthy.

E. People feel safe with me. I keep an eye out to make sure my friends are OK.
- A. I'm happiest when I'm organized.

B. I learn by looking.

C. Give me tools and a few random materials to build with and I'm happy.

D. I'm pretty methodical in my thinking. I like to carefully test out my ideas.

E. My ears are as big as my mouth. I'm a good listener.
- A. I can sell anything to anybody.

B. I've invented all sorts of cool things – even if only in my imagination.

C. In order to understand something, I need to get my hands on it, feel it, and even take it apart.

D. I like conducting experiments.

E. I like speaking in front of big groups of people.
- A. I admire Donald Trump.

B. I admire Sofia Coppola.

C. I admire Ty Pennington.

D. I admire Linus Torvalds.

E. I admire Oprah Winfrey.

How many of each letter did you circle? A ___ B ___ C ___ D ___ E ___

Which letter did you circle most? Turn to page 17 to find out what area of manufacturing might be your best fit.

Lifestyle Goals:

to establish a manner of living at some designated point in time that reflects the person's values and attitudes

What Will I Be When I Grow Up?

Everybody at one time or another gets asked the question, 'what do you want to be when you grow up?' The answers seem to be a predictable response such as: a doctor, a basketball player, a fireman or a pop star. Why do you think that is? The answer is simple. Kids are simply unaware of all the occupations and career choices that are really available. The real question that needs to be asked is this: *What talents and skills do you have that you can develop through education that will enable you to get a job, take care of a family, and contribute to the goodness of the community of which you are a part?* This is a different kind of question for which the answer takes some time to discover.

Take Responsibility for your Career Plan

No matter who or how old you are, you're on a career or job path. Whether you take initiative to choose the path and prepare for it or you don't, you will find yourself in some career or job. Either way you look at it you will need to work to make money. It is always a better situation when you can choose to work at something that you enjoy and take pride in, continue to develop your skills, contribute to the community and all-the-while earn a paycheck. This is precisely the reason why students are encouraged to explore a career or job in manufacturing. A career plan in manufacturing can provide a good income for personal and family expenses and help fulfill **lifestyle goals**.

Discover a Career in Manufacturing

Make no mistake; a career in today's manufacturing industry requires skills. The classes taught in middle and high school are an excellent foundation for the necessary skills. You don't have to be the smartest student in the class. You do, however, need to take an active interest in learning what affects our everyday life such as science, technology, engineering, and math (STEM). STEM is for everyone! This basic information is the foundation for further study at a technology center, college or university.

The skills learned in middle and high school, combined with the certification of skills through technology centers, is how you get in the door with manufacturing. If desired, college or university can combine those skills with advanced knowledge to move your career or job to higher levels. Manufacturing is **sustainable** employment because there will always be a need to solve problems in the world by creating a solution. In manufacturing you will always be learning because of the interesting, ever-changing technologies. Many manufacturing companies assist employees with continuing education.

Sustainable:

able to last or continue for a long time

Oklahoma's Manufacturing History

During the twentieth century and into the twenty-first Oklahoma's economy has been based on agriculture, although manufacturing has always played a role. Oklahoma has been most widely known for its extractive industries, particularly coal, lead and zinc, and petroleum. But under the heading of "manufacturing," defined as the creation of "value added" products, a considerable number of industries have successfully operated since the late nineteenth century. The availability of raw materials has stimulated some of these. An example of some of these are the clay products industry which involves making bricks, pottery, and tile, and the lumber industry that flourished from the late Territorial Era through the twentieth century. Beginning with the 1889 land run and continuing with successive openings, an available work force grew larger and around the turn of the century, railroads' rapid development enabled the movement of raw materials and finished products throughout and into and out of the territory and state. Most goods made in Oklahoma were shipped to consumers elsewhere in the nation.

In the last half of the nineteenth century most residents of Indian and Oklahoma territories were involved in agriculture. Still in its infancy, manufacturing was characterized by semi-cottage production, or "hand work," that met local needs. Therefore, it was widely dispersed,

with most towns having a newspaper, a flour mill, a tinsmith, a brick factory, a bakery, a boot and saddle maker, a cigar maker, a milliner, and so on. As the twentieth century progressed, industry became more diversified and technological, requiring larger facilities, or plants, with equipment and teams of managers and laborers. By 1899 only 495 manufacturing establishments existed. But as the region developed, their numbers increased 200 percent from 1899 to 1904 and 119 percent from 1904 to 1909.

Within two years of Oklahoma's 1907 statehood, the Bureau of the Census conducted a survey of manufacturers, assessing Oklahoma's industrial production and describing the characteristics of its workers. There were 2,310 establishments involving 18,034 individuals. These plants had a capital investment of \$38.6 million and produced a total value of \$53.6 million dollars in product. Oklahoma ranked thirty-ninth and fortieth of forty-eight states, in the number of establishments and workers. By contrast, the value of Oklahoma's agricultural crop output in 1910 was \$133.4 million, ranking twenty-second in the nation.¹

¹Dianna Everett, "Manufacturing," Encyclopedia of Oklahoma History and Culture, ed. D. Everett et al. (Oklahoma City: Oklahoma Historical Society, 2009), 2: 886-88.

Oklahoma Furniture Manufacturing Co. plant, Oklahoma City circa 1915
This building now houses Spaghetti Warehouse located in Bricktown.



The Oklahoman
September 24,
1916, Pg. 6



The Oklahoman Mattress
Advertisement
January 31, 1924, Pg 11

Value Added:

the dollar amount that best represents the net wealth created by manufacturing operations

1909

2011

TOP FIVE OKLAHOMA MANUFACTURING PRODUCTS

Industry	Number of Employees	Total Value of Production	Value Added by Manufacturing	Industry	Number of Employees	Total Value of Production	Value Added by Manufacturing
Flour Milling and Gristmills	842	19,444,000	2,051,000	Machinery	24,366	1,340,136	819,712
Cottonseed/Oil Milling	581	5,187,000	942,000	Petroleum and Coal Products	2791	23,865,983	3,290,545
Lumber and Timber	3,175	4,489,000	2,052,000	Fabricated Metal Products	21,397	6,922,762	3,383,214
Printing and Publishing	1008	3,989,000	2,085,000	Food, Beverage, and Tobacco Product	15,997	7,330,015	2,348,190
Bread and Other Bakery Products	418	1,794,000	825,000	Transportation and Equipment	11,686	4,699,753	2,300,695

TOTAL NUMBER OF MANUFACTURING BUSINESSES

2,310

3,559

OKLAHOMA POPULATION

Total State Population	1,657,155	3,785,534
Total amount of people employed and working	598,629	1,577,700
Total people employed by the manufacturing industry	18,034	129,800
Percentage of total employed working in manufacturing	3%	8.20%

Source: U.S. Census Bureau



Shawnee Milling
201 S. Broadway
Shawnee, OK
74801

The original Mill started in 1906 with less than 10 people. The company now employees 250 people with 200 located Shawnee and the remainder in western Oklahoma.



Oklahoma Centennial Companies

There are several Oklahoma manufacturing companies that are over 100 years old and still operating today. Each company has had to embrace the challenges of changing times and have stayed in business because they have learned, through innovation, how to produce and distribute items that customers want to buy. Listed below are just a few of these 'centennial' companies and the products for which they are known.

How familiar are you with these companies? Test your product knowledge. Match the company name with the product descriptions you believe they make.

- A. Red Devil, Inc., Est. 1872**
- B. Eureka Water Company, Est. 1897**
- C. Swanda Brothers, Inc., Est. 1902**
- D. The Oklahoma Publishing Company, Est. 1903**
- E. Mills Machine Company, Est. 1908**
- F. Gardner Spring, Inc., Est. 1909**
- G. Schwab Meat Company, Est. 1912**

_____ This company is a female-owned business that makes and stocks thousands of sizes and variety of industrial and hardware springs including disc springs, torsion springs, extension and compression springs.

_____ With more than 400 different products in all, this company produces caulks, sealants and tools under our own brand name. They also manufacture private label products for some of the nation's largest hardware and home center chains.

_____ This company used to be known as Ozarka Water Company. They bottle these three products: Ozarka drinking water, Ozarka spring water and Shamrock distilled water.

_____ This fourth-generation, family owned company is an international leader in the construction and installation of aviation, environmental and architectural metal projects, including custom-designed and engineered projects.

_____ This company, located in Shawnee, OK, has developed into a full line manufacturer of specialty earth boring tools and accessories for water, mining, construction, utility and environmental applications.

_____ This family owned company uses only the finest ingredients to create the highest quality smoked meats and sausages.

_____ This company's specialty items include print and online advertising, website development and design, direct mail, commercial printing, video production, market research and analysis, search engine optimization, social media management, and publishing.

Answers: F, A, B, C, G, E, G, D

What is a Factory?

written by Kate Shannon, former secondary science teacher

Think about it:

Look around the room, can you find an item that has not been processed or altered from its original form in some way? Share your reasoning for selecting that item.

Where are the items we use every day made? For the item you selected, where is it created?

Manufactured (factory-produced) items are commonly found in our homes and classrooms. What do you imagine when you think of a "factory"?

1. Draw a quick sketch and write a sentence that communicates what you are imagining.

Think about your image of a factory:

What experiences have you had or what have you seen or heard that influences your image and ideas of factories?

2. List and share what influences your factory image.
3. Take a look at these images and descriptions of automobile factories. (Another option is to "Google" images for modern and early 20th century factories.)
Then: <http://theoldmotor.com/?tag=automobile-factories&paged=9>
Now: <https://www.flickr.com/photos/sub5zero/7593066478/in/photostream/>
4. See other automobile factories: The Ferrari factory then and now: <http://autoweek.com/article/car-life/ferrari-factory-then-and-now>
5. Cisco manufacturing then and now : <http://blogs.cisco.com/manufacturing/then-and-now-why-manufacturing-isnt-what-it-used-to-be/>

Think about it:

How do "Then" and "Now" factories compare? What differences do you see between them? What similarities do you see?

6. Read about the possible future of food packaging: <http://www.fooddive.com/news/6-futuristic-food-packaging-technologies-that-could-change-everything/94763/>

The Importance of Raw Materials

Raw materials are so important to the production process that the success of a country's economy can be determined by the amount of natural resources the country has within its own borders. A country that has abundant natural resources does not need to import as many raw materials, and has an opportunity to export the materials to other countries.

Raw Materials:

a material or substance used in the primary production or manufacturing of goods. Raw materials are often natural resources such as oil, iron and wood.

Before being used in the manufacturing process, raw materials often are altered to be used in different processes.

Raw materials are often referred to as commodities, which are bought and sold on commodities exchanges around the world.

What do toothpaste, wall boards and Twinkies® have in common?



Answer: Gypsum

Let's Explore!

Oklahoma's Geological Raw Material Fun Facts

Stan Krukowski, Industrial Minerals Geologist at the Oklahoma Geological Survey

Mining is one of Oklahoma's best kept secrets; there are over 750 mines permitted by the Oklahoma Department of Mines.

Oklahoma's mineral value averages about \$500 million per year. The mineral value is the amount of money earned through the sale of the mineral. Aggregate (crushed stone) accounts for 45% of this dollar amount and three cement plants in Oklahoma represent about 33%. This means that aggregate production and cement create an average of 390 million dollars a year in mineral value for Oklahoma. These are used mostly to make concrete for roads, driveways, sidewalks, foundations, parking lots, and more. The major ingredients of concrete are Portland cement, sand, crushed stone, and water.

One of the world's largest deposits of gypsum is found in western Oklahoma. Trillions of tons of gypsum are known to occur at Alabaster Caverns near Freedom, OK.

Oklahoma mines enough each year to place it in the top five gypsum-producing states. Gypsum is used to manufacture cement, plaster, and wallboard aka drywall. It's also used as a food additive in such foods as pizza dough, bread, and even Twinkies®.

Oklahoma has two high purity silica sand mines. Silica is used for a wide range of industrial and scientific application. It provides the silicon for computer processing chips. It also is used as fracking sand for various types of oil well drilling and production. Silica sand provides the major raw material for making glass in windows, jars, bottles, optic cable, computer and TV screens, and much, much more.

Oklahoma is one of only two states that produce iodine. It's used in the following applications:

- Disinfecting chemicals
- Water disinfecting
- Synthetic rubber
- Plastic (drinking bottles in particular)
- Adhesives
- Nylon for carpet
- LCD screens in smart phones, computers, and TVs
- Medical devices

Feldspar mined from Arkansas River sand is used to make:

- Glass – It lowers the melting temperature to make mixing components easier.
- Ceramics
- Paint filler
- Rubber filler

Common clay is used to make brick. Oklahoma has the capacity to produce over 500 million bricks per year.

Helium is used in the following:

- Cryogenics - the study of very low temperatures, how to produce them, and how materials behave at those temperatures. MRIs and CT-scans use helium to lower the temperature for superconducting electronic circuits.
- Breathing mixtures used for respiration purpose such as medical equipment, SCUBA tanks, and recompression chambers.
- Welding

Think About It

What would life be like without industrial minerals?

Occupations Working with Geologic Raw Materials

Architects, civil engineers, and construction workers use construction materials such as cement, crushed stone (aggregate), wallboard, and asphalt to build structures such as bridges, roads, homes, commercial buildings, sports stadiums, etc.

Chemists use various elements in the chemicals industry for such things as detergents, fuels and fuel additives, plastics, fertilizers, water treatment, etc.

Glassmakers use silica sand, dolomite, limestone, and soda ash to make windows, bottles, jars, optic cable, computer and television screens, etc.

Iron workers use iron ore, limestone, fluorite, and carbon in the form of coke (a fuel with few impurities and a high carbon content usually made from coal) to make steel which is used to make everything from staples and paperclips to automobiles and skyscrapers.



EMPLOYEE NAME: Donovan Tahkofper
COMPANY NAME: Centek Inc.
CURRENT OCCUPATION: Laser Programmer
HOW LONG SERVING IN THIS CURRENT POSITION: 1.5 Years
EDUCATION LEVEL ATTAINED: High School Diploma

Did you know in middle school or high school this is type of industry/work you wanted to be in?

No, I actually wanted to open up a classic car restoration business.

If so, what gave you that understanding? If not, when did you begin to realize your career path?

I realized my career path shortly after I began working with CNC's. I was fascinated with the functionality and capability of the machines. It's never boring and you're always learning something new every day.

What apprenticeships or workplace experience contributed to your expertise?

I have benefited the most from on the job training. I had the opportunity to run a CNC for production which helped me understand the controls. As I developed in understanding, I had opportunities to receive training on CNC controls and programming.

What challenges and/or obstacles did you personally overcome to succeed?

I had never taken formal CNC training or drafting classes.

Who was the most influential person(s) along the way that supported you to be where you are today?

When I first started working around CNC machines my supervisor at the time opened my eyes to what I could accomplish if I applied myself correctly. A previous warehouse manager used to tell me to take every opportunity you were offered to learn something new because the more you knew the more great opportunities would arise. That's what stuck with me the most. Seize every opportunity to learn something new because it only makes you better. Besides CNC, I started out helping with Internal Audits with the quality department and I was able to learn the inner workings of the manufacturing workplace. This is opening up further opportunities to help me provide for me and my family with a career in manufacturing.

What career goals or professional aspirations do you have now?

I have recently enrolled in community college and am working towards an associate's degree in business. My plans are to move into a supervisor position and later into a management role.

What advice do you have for students who want to work in this industry?

Take CareerTech while in high school it'll make the transition into the manufacturing work force all the easier. Also take advantage of getting the free education while it is available. It is something you can always fall back on.

Electricians and electrical engineers use copper wires to deliver and use electricity in your home; coal to generate electricity at an electric power plant; gold, silver, copper, gallium, magnesium, platinum, tungsten, and petroleum are just some of the raw materials used in a typical cell phone.

Here are a couple websites you may want to check out to learn more about occupations



www.womeninmining.org

that depend on raw materials to make the things we use every day.

www.mineraleducationcoalition.org

What is a CNC?

CNC stands for Computer Numerical Control. It is a process that is used in manufacturing to control machine tools.

Top 25 Manufacturing Companies by Sales Volume

Company Name	Oklahoma Location	Primary Business Description	Actual Employee Size at Location	Actual Sales Volume at Location
IC Bus	Tulsa	Buses	1000	\$1,443,823,000
Oil States Barlow-Hunt	Tulsa	Oil Field Equipment	400	\$1,013,282,000
Goodyear Tire & Rubber Co	Lawton	Tires	2300	\$970,314,000
Solae LLC	Pryor	Soybean Oil Mills	250	\$698,027,000
Whirlpool Corp	Broken Arrow	Household Appliances	1700	\$560,246,000
Stainless Products	Mannford	Tubular Metal Products	195	\$540,901,000
Navistar Inc	Tulsa	Truck and Bus Bodies	1700	\$536,522,000
L-3 Communications Westwood	Tulsa	Communications Equipment	200	\$479,926,000
S & R Equipment	Tulsa	Compressors - Air and Gas	180	\$455,977,000
Johnson Controls Inc	Norman	Refrigerating Equip Supplies and Parts	1200	\$448,283,000
Airgas Central	Tulsa	Gas Equipment, Tools and Welding Products	150	\$440,995,000
Tyson Foods Inc	Broken Bow	Poultry Processing Plants	1500	\$417,045,000
W-W Trailer	Madill	Trailers - Livestock	200	\$404,464,000
Bar-S Foods Co	Altus	Meat Products	600	\$400,000,000
Baker Hughes	Sand Springs	Oil Field Chemicals	150	\$399,307,000
KERR Pump Corp	Sulphur	Pumps	155	\$392,647,000
Pepsi Bottling Group	Tulsa	Bottlers	400	\$361,116,000
Michelin North America Inc	Ardmore	Tire	2000	\$349,364,000
York International Corp	Norman	Air Conditioning Equipment	900	\$336,212,000
Pelco Products Inc	Edmond	Traffic Signs Signals and Equipment	260	\$328,562,000
Aaon Inc	Tulsa	Air Conditioning Room Units	1167	\$321,140,000
Baker Hughes - Petrolite Speciality	Barnsdall	Polymers	120	\$319,446,000
Terra Nitrogen Co	Claremore	Fertilizers	160	\$309,504,000
Baker Hughes	Claremore	Oil Field Equipment	650	\$301,431,000
Shawnee Milling Co	Shawnee	Milling	250	\$299,231,000

Dun and Bradstreet 2014

Manufacturer Scavenger Hunt

written by Quentin Bidy, former middle school science teacher

1. Make a list of the things you or your family normally buys.
2. Somewhere a skilled worker in a factory turned those raw materials into the products you use. There are over 4,000 manufacturers in Oklahoma making products. They provide quality jobs to skilled people.
3. See if you can match any of the products you buy to a manufacturer in Oklahoma that makes that product or a similar type of product.
4. Next time you go shopping at a particular store, see how many products you can find that were manufactured right here in Oklahoma.
For example, if you go to a home improvement store, look for items produced by M-D Building Products. They are a company located in Oklahoma City.

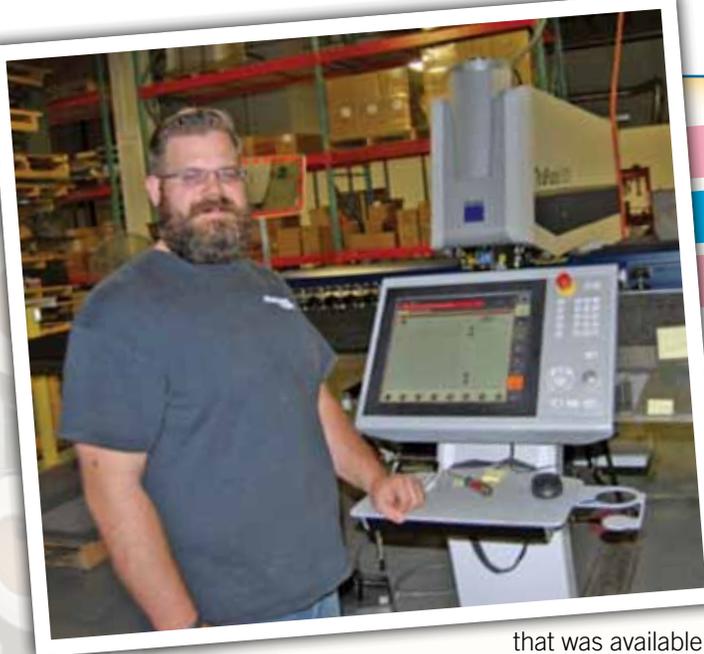
Think about it:

What raw materials do you think were used to manufacture those products?

Think about it:

How does knowing that Oklahoma produces so many things make you think about the products you buy and how they are made?

What kind of workers do you think these companies might need?



EMPLOYEE NAME: Adam Davidson

COMPANY NAME: Progressive Stamping, Inc.

CURRENT OCCUPATION: Tru-Punch and Tru-Bend (Machine) Programmer

HOW LONG SERVING IN THIS

CURRENT POSITION: 10 Months

EDUCATION LEVEL ATTAINED: Some college.

Did you know in middle school or high school this is type of industry/work you wanted to be in?

No. I attended a trade school during HS, a Career Tech program that was available. There I studied electrical trades including residential, commercial and industrial wiring. Having gone to Career Tech, I certainly had the expectation of going into the electrical trades.

If so, what gave you that understanding? If not, when did you begin to realize your career path?

Family background. Two uncles worked in or own their own fabrication shops and my Dad was an automotive mechanic. Being around it growing up helped provide a fair understanding of this type of business and this industry. Particularly after getting out of the military and starting work with one of my uncles, I gained a number of skills including CNC plasma operation, press break operations and mig welding. I found I like the work and especially liked working in job shops because every project is a puzzle that you need to figure out. It was during this time that I realized this is the right industry and the right type of work for me.

What educational path did you follow to gain knowledge about this industry?

I gained experience through training at Career Tech and the time working with OEM Products, Inc., my uncle's company. The CNC software I learned at OEM helped with the transition from plasma to the punch technology that I use in my current position.

What apprenticeships or workplace experience contributed to your expertise?

Tru-Punch programming and Tru-Bend programming certifications which were provided by the manufacturer of the machines I work with.

What challenges and/or obstacles did you personally overcome to succeed?

Understanding the intricacies of working with metal, the mathematics and specifically learning the formulas I use for punching and bending metal to make sure I achieve the needed results without over stressing the machinery.

Who was the most influential person(s) along the way that supported you to be where you are today?

Rex and Roy Davidson, my uncles. They taught me the "nuts and bolts" of what I knew before I showed up at Progressive Stamping. Teaching me the nuts and bolts was enough, it was all I needed.

What career goals or professional aspirations do you have now?

There is still a lot left to learn for the programming side, adding automation to the machinery and increasing productivity and efficiency. I plan to grow with the company as capabilities and capacities are expanded.

What advice do you have for students who want to work in this industry?

Try to find a good trade school that is well rounded and goes into detail. For my specific industry, learn metallurgy.

I'm a programmer, while it might be enough to simply understand the programming, understanding metallurgy helps me to do a better job of it. Furthermore, learning the job of the person in front of you and behind you in the production process also helps.

Find books and reading material to increase and improve your skills. I am still reading. The learning the never stops.

How does it get here?

Written by Kate Shannon, former secondary science teacher

1. Select an item from the list of products made by one of the top 25 companies listed (page 8) and trace the path that brings it from raw materials to where it is today. Create a diagram to communicate the path you think it takes to get from beginning (raw material) to end (manufactured item you find in a store).
2. Next research where it comes from and modify your diagram chart if necessary. Some resources to help you with your research are below:
 - A. Visit the website of the Oklahoma Manufacturing company that makes your product.
 - B. Watch a video about the product you selected:

"How to Make Almost Everything" video library <http://science.howstuffworks.com/how-its-made-videos-playlist.htm>

"How it is made" episode guide: <http://www.tv.com/shows/how-its-made/episodes/>

Think about it:

How many people come into contact with the product you selected before it reaches you?

How many miles does it travel? Who else in the country or world uses this product?



MANUFACTURING

★ *in America* ★

ECONOMIC AND INNOVATION SUCCESS



FOR EVERY \$1 OF GOODS PRODUCED, MANUFACTURING GENERATES AN ADDITIONAL \$1.32 FOR THE ECONOMY



IN JUST 5 STATES MANUFACTURING ADDS OVER HALF A TRILLION DOLLARS TO THE ECONOMY



MANUFACTURERS ARE RESPONSIBLE FOR ALMOST TWO-THIRDS OF ALL PRIVATE SECTOR R&D



EACH MANUFACTURING JOB CREATES AT LEAST 2.91 MORE JOBS IN OTHER SECTORS

THE DISCONNECT BETWEEN PERCEPTION & FACTS

WHILE MANUFACTURING IS FILLED WITH HIGH PAYING JOBS, PEOPLE AREN'T JOINING THE FIELD.



OVER 70% OF AMERICANS VIEW MANUFACTURING AS THE MOST IMPORTANT INDUSTRY FOR A STRONG ECONOMY AND NATIONAL DEFENSE

BUT...



ONLY 30% OF PARENTS ENCOURAGE THEIR KIDS TO ENTER MANUFACTURING



ONLY 17% OF PEOPLE VIEW MANUFACTURING AS A TOP CAREER CHOICE



77% OF AMERICANS FEAR THE LOSS OF DOMESTIC MANUFACTURING JOBS TO OTHER NATIONS

IN REALITY...



MORE THAN 77% ANNUAL AVERAGE SALARY OF MANUFACTURING WORKERS



NEARLY 60% ANNUAL SALARY OF ENTRY-LEVEL MANUFACTURING ENGINEERS



HIGHEST PAID NEW COLLEGE GRADUATES ARE CHEMICAL MANUFACTURING ENGINEERS



MANUFACTURING WORKERS HAVE HIGHEST JOB TENURE IN PRIVATE SECTOR



90% OF MANUFACTURING WORKERS HAVE MEDICAL BENEFITS

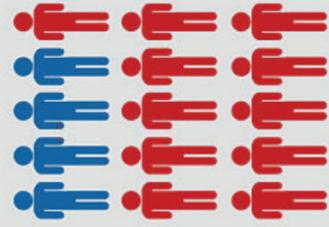


78% OF MANUFACTURING WORKERS GET RETIREMENT CONTRIBUTIONS FROM EMPLOYERS

MANUFACTURING DEPENDS ON A SKILLED WORKFORCE, BUT COMPANIES HAVE JOBS THEY CAN'T FILL. THIS HAS CAUSED A SKILLS GAP.

SKILLED WORKERS NEEDED!

A 2011 SKILLS GAP REPORT FROM THE NATIONAL ASSOCIATION OF MANUFACTURERS SHOWS...

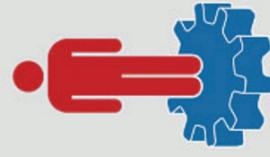


67% 56% 56%

REPORTED A MODERATE TO SEVERE SHORTAGE OF AVAILABLE, QUALIFIED WORKERS

ANTICIPATE THE SHORTAGE TO GROW WORSE IN THE NEXT THREE TO FIVE YEARS

WHY IS THERE A PROBLEM?



BY 2030, 77% OF SKILLED BABY BOOMERS WILL HAVE LEFT THE WORKFORCE

CURRENT WORKFORCE LACKS TECHNICAL SKILLS NEEDED (INDUSTRY CERTIFICATION OR VOCATIONAL TRAINING)



83% OF MANUFACTURERS SAY THE LACK OF SKILLED WORKERS HURTS THEIR BUSINESS

ECONOMIC GROWTH DEPENDS ON MANUFACTURING GROWTH. THE FUTURE OF U.S. MANUFACTURING RELIES ON A SKILLED, TALENTED WORKFORCE.

REFERENCES

In partnership with the **Fabricators and Manufacturers Association**, **International and design by Grass Roots Marketing, Inc.**

The National Association of Manufacturers, Skills Gap Report (2005 & 2011) | Dr. Ira S. Wolfe, "The Perfect Labor Storm 2.0," 2007 | agingstats.gov | Dr. Ira S. Wolfe, "The Perfect Labor Storm 2.0," 2007 | Bureau of Labor Statistics, Employment Statistics: 2010-2020 | Annual Index ("Public Viewpoint on Manufacturing") by Deloitte LLP and The Manufacturing Institute, June 2009 | Deloitte, "Deloitte Unwavering Commitment: The public's view of the manufacturing industry today," 2011 | Annual Index ("Public Viewpoint on Manufacturing") by Deloitte LLP and The Manufacturing Institute, Alexandra R. Moses, "Shop Classes Return -- with a 21st-Century Twist," April 2009 | National Association of Manufacturers, Labor Day Report, 2007 | Economic and Statistics Administration, "The Benefits of Manufacturing Jobs," 2012 | Salary.com | U.S. Bureau of Labor Statistics, Employee Tenure Summary, September 2008 | U.S. Bureau of Labor Statistics, Employee Tenure Summary, September 2010 | Economic and Statistics Administration, "The Benefits of Manufacturing Jobs," 2012 | National Association of Manufacturers, "Securing America's Future: The Case for a Strong Manufacturing Base," 2003 | National Association of Manufacturers, "The Facts about Modern Manufacturing," 2009 | National Association of Manufacturers, "Securing America's Future: The Case for a Strong Manufacturing Base," 2003



MEP • MANUFACTURING EXTENSION PARTNERSHIP



NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Manufacturing Builds Wealth

Real wealth is created by adding value to raw materials. Let's learn more about how this works by taking a look at the process one Oklahoma manufacturing company uses to make corrugated boxes used for shipping.

"In our business we begin in the dirt, 300,000 plus acres of forest land. We plant trees, manage forests, harvest the forests, convert the fiber from the trees into pulp, convert the pulp into paper and convert the paper into boxes in which our customers ship their products. Each step of this process creates wealth by adding value to the material that was created in the previous operation. Each step also requires a wide range of skill, expertise and education from advanced degrees in forestry, engineering, physics and chemistry to highly skilled machine operators, maintenance staff, accounting, quality management, transportation, design, sales, marketing, environmental management and janitorial jobs. All come with opportunities for advancement. Additional wealth and jobs are created via the hundreds of millions of dollars invested to make the machines we buy to perform all of the operations just to make box board and boxes."

—Jory Gromer, General Manager
Green Bay Packaging Inc., Chickasha, OK

Creating Wealth through Added Value

Taking the process used to create corrugated boxes, let's examine just how value is added at each step along the way. As value (what someone is willing to pay) increases so does the amount of wealth created (what is left over after all the wages and bills are paid).

The value added and wealth that accumulates along the way determines the value of the final product.

In this example, in order to produce a box that is worth 50 cents, we start with a seedling that cost 5 cents each. After about 7 years growing time the tree will be ready to harvest. A single tree will make enough fiber for many boxes but the fiber content of our 50 cent box example will cost about 20 cents. Next from the fiber we make about 25 cents worth of strong Kraft paper. Now we are ready to convert the paper into a sheet

and the sheets into boxes that we can sell to a customer for 50 cents.

There is clearly a lot of value added to the 5 cent seedling. To do so requires many millions of dollars invested in machinery and thousands of good paying jobs requiring various different kinds of skills. Wealth is created for all of the workers, the machinery companies, and the companies that service the machines. Owners of the companies will often invest their profits to buy more machines and factories that will create even more jobs. This is why manufacturing is important to our society.

Exports:

to ship (commodities) to other countries or places for sale, exchange, etc.

Sector:

a distinct part, especially of society or of a nation's economy

Manufacturing Builds the Community

Manufacturing today has evolved dramatically since its earliest days. It is characterized by strong **exports**, high productivity, skilled-labor, advanced technology, innovation and growth all of which supports Oklahoma's economy in every way.

More than any other **sector**, manufacturing creates jobs and wealth outside its own sector. These jobs range from construction and mining, to jobs in fields like packaging and telecommunications.

A well rounded community needs a combination of housing, education, retail, healthcare, entertainment, and industry. However, only one of these has the ability to provide for the others. Without a strong manufacturing industry, no one will be able to afford housing, retail, entertainment, or healthcare. In Oklahoma, strong industry and housing provide taxes for education. Without a strong industry, there are fewer dollars for education services.



The manufacturing industry creates jobs in other sectors and is a strong contributor to personal and community wealth.



Packaging Challenge

written by Quentin Bidy, former middle school science teacher

1. Choose one of the products manufactured right here in Oklahoma, listed on page 8.
2. Think about the journey the product must travel from the factory to your home.
3. The manufactured product most likely was placed in a package or box for that journey. The packaged product was probably bundled, making a package in a package!
4. Packaging has many functions.
 - A. It protects the products on the journey from factory to the store.
 - B. It gives information about the product it contains.
 - C. It may be visually appealing to attract consumers to the product.

Think about the product you chose from the list, or any product in your house, how would you package it and decorate it to meet the 3 functions above?

5. Design, create, and decorate a package for the product you chose to meet the 3 functions described in #4.
6. Present the decorated package to an adult and explain how it meets the functions for packaging.

Think about it:

Did you know even the packaging materials like cardboard, plastic and styrofoam had to be manufactured in a factory before it could package your product. How has your thinking about packaging changed?

EMPLOYEE NAME: English Gromer
COMPANY NAME: Green Bay Packaging Inc.
CURRENT OCCUPATION: Design Manager
HOW LONG SERVING IN THIS CURRENT POSITION: 16 years
EDUCATION LEVEL ATTAINED: B.A. Degree

Did you know in middle school or high school this is type of industry/work you wanted to be in?

No

If so, what gave you that understanding? If not, when did you begin to realize your career path?

Took a summer job with a packaging company while in college and was afforded the opportunity to move into a structural and graphic design position after graduation.

What educational path did you follow to gain knowledge about this industry?

My college degree was for advertising and graphic design, with a minor in marketing. There is considerable crossover with the packaging industry. I developed my creative skills and tools in school but much of my education came from the practical experience gained from hands on training.

What apprenticeships or workplace experience contributed to your expertise?

I did participate in a couple of apprenticeships getting “ink under my fingernails” so to speak working in printing companies while I was in college. The packaging company I was working for paid my wages in order for me to get the hands on experience.

What challenges and/or obstacles did you personally overcome to succeed?

Learning to apply my schooling to the market place and vice versa is one of the biggest challenges. Theory and reality do not often match but do blend. While working with experienced designers and machine operators we were able learn from each other. I was able to share the latest trends in design and they were able to help me learn to apply them to the real market place. There will always be opportunity to learn and that is the real value of apprentice programs. I believe apprenticeships actually save rather than cost companies money. There is not enough space here to elaborate but I am certain it is true.

Who was the most influential person(s) along the way that supported you to be where you are today?

That would have to be my father. I have had the honor of being able to work with him the past 26 years.

What career goals or professional aspirations do you have now?

I really like being a design manager. I don't know if I would want to pursue a career in another position or industry. I suppose if the right opportunity presented itself, I could be tempted to try something else. But I really enjoy my present assignment.

What advice do you have for students who want to work in this industry?

Learn to work smart, cultivate a culture of learning, develop good listening skills and never stop improving.

What is Lean Process Improvement?

Every business is a collection of processes. Processes are sequences of steps that must be carried out to create value for customers and managed as a whole, not separately. Lean is a continuous improvement methodology focused on managing processes, and improving them by compressing time, rather than working harder. To put it simply, it is working smarter not harder.

Growing Business through Lean Process Improvement

The Cost Reduction Principle
Traditional thinking dictates that you set your selling price by calculating your **cost** and adding on a margin for **profit**. In today's competitive market the **customer** sets the price and you don't have the luxury of adding a profit margin. The only way to remain profitable and grow your business is to eliminate waste from your value stream (the process followed and product used to make things), thus reducing cost. This is known as the Cost Reduction Principle.

The Cost Reduction Principle determines the price customers are willing to pay then subtracts your cost to produce that item to determine what your profit will be. Customers are very demanding. Not only do customers want to set the price, but they also demand price reductions.

The challenge for any business then becomes to figure out how to make their product with little to no waste (customers do not want to pay for this) and keep the cost to make the product low. This way when the customer buys the item or it is discounted there is a profit for the company to make.

Cost:

an amount that has to be paid or spent to buy or obtain something

Profit:

a financial gain, especially the difference between the amount earned and the amount spent in buying, operating, or producing something

Customer:

someone who buys goods or services from a business

The Goals of Lean Process Improvement

Improve Quality: Quality is the ability of your product or services to meet or exceed your customers' requirements

Eliminate Waste: Waste is the activities that take up time, resources and space but does not add value to a product or service—customers do not want to pay for non-value-added activities

Reduce Lead Time: Lead time is the total time it takes to complete a series of tasks within a process. For example, reducing the time it takes to transform raw materials into finished goods or the time it takes to introduce new products after the design phase is completed. These process examples require many tasks along the way to complete.

Reduce Total Costs: Total costs are the direct and indirect costs associated with the production of a product or service. You must continually balance your products' and services' prices and your operating costs to succeed. If your prices and operating costs are too high you will lose **market share** and profits. To reduce total cost a Lean process must eliminate waste and reduce lead times.

Three Types of Process Activities

Value-added activities include those steps the customer is willing to pay for. To qualify as value-added an activity must meet the following criteria: It changes the form, feature, or function that the customer desires. It must be done right the first time. The customer is willing to pay for it.

Business value-added activities are those things a customer isn't willing to pay for but must be done to comply with regulations, organizational policies, and so on. You must periodically examine these activities to make sure they are necessary, if not they need to be eliminated.

Non-value added activities are the activities the customer is not willing to pay for and can be avoided. Your goal should be to eliminate these activities because they are WASTE.

Market Share:

a company's portion of sales within the entire market in which it operates

Traditional Thinking

$\text{Cost} + \text{Profit} = \text{Selling Price}$

Cost Reduction Principle

$\text{Price Customer Will Pay} - \text{Cost} = \text{Profit}$

Make Lean Process Improvement (LPI) Work for You

- How does LPI apply to setting personal goals?
- How can the practice of lean process thinking help you achieve your goals?
- Could the methodology of LPI fail? Why?

Finding Waste

Waste is anything—time, cost or work that adds no value in the eyes of the customer. Waste exists at all levels and in all activities.

The Eight Deadly Wastes



Defects

Efforts caused by rework, scrap, and incorrect information.



Overproduction

Production that is more than needed or before it is needed.



Waiting

Wasted time waiting for the next stop in a process.



Non-Utilized Talent

Underutilizing people's talents, skills, & knowledge.



Transportation

Unnecessary movements of products & materials.



Inventory

Excess products and materials not being processed.



Motion

Unnecessary movements by people (e.g., walking).



Extra-Processing

More work or higher quality than is required by the customer.

Lean is a way of creating **efficiency** in all businesses. Not just in manufacturing but in all types of businesses. The manufacturing industry regularly applies lean methodology because it is good business management to make a product the customer is ready to buy and all the while keep the cost low and waste to a minimum. The leaders and employees of a manufacturing business desire to excel in this process. When they do, profits increase which translates into higher paid wages and opportunity for the business to expand. Lean can be applied to all businesses.

Efficiency:

the ability to do something or produce something without wasting materials, time, or energy

Assembly Line Production

written by Pat Turner, former elementary school teacher

How do factories make the products we use every day? Your challenge is to plan, create, test and redesign a color block using the most efficient process possible.

A color block can be made from: 2 brown paper lunch bags, paper, markers, a circle shape to trace, ruler, stopwatch.

Color Block Production (A timed task)

1. The block is made of two brown lunch bags
2. Stuff one bag with paper and slide remaining bag to cover the open end of the stuffed bag.
3. Using orange draw 3 large 1 inch diameter polka dots and use green to draw 3 smaller 0.5" diameter polka dots on the larger side of bag.
4. Draw 4 parallel 1 inch purple stripes on the shortest sides.
5. On two remaining empty sides write "Color Block" in black marker.

Think about it:

*How long did it take you to make 1 color block?
How could this have been done more efficiently?*

Make a plan and test it for making this production more efficient. Create and explain your plan using a flow chart to an adult. Include your results.

Think about it:

*How was your second plan more efficient than the first?
How could you automate this process?*

Lesson Adapted from:

<http://www.tryengineering.org/>

Websites to visit: <http://videos.howstuffworks.com/howstuffworks/4169-assembly-line-crayola-crayons-video.htm>

<http://www.history.com/topics/henry-ford/videos/history-of-the-holidays-the-story-of-labor-day>



Brad Croy, President,
and Darren Croy,
Vice-President, CMP
Corporation

Making LEAN Real

Forty-seven years ago, Jon Croy formed a small compressor parts shop in southeast Oklahoma City. The equipment technician had noticed parts were scarce and often hard to come by. There was a need for CMP Corp.

Today, CMP is a world leader in the manufacturing and distribution of HVAC and refrigeration compressor parts. But progressive changes happened after Jon's sons, Brad and Darren, assumed leadership and decided to make the company more efficient than ever before.

"You read about these things in textbooks but they're really abstract ideas," said Brad Croy, who earned a business degree from Oklahoma State University in 2001 and quickly joined the company. "Of course, you want to be more efficient and more profitable, but how do you actually achieve that and what does that look like?"

Those questions resonated for the Croys five years ago when the company started losing clients.

"Our current trajectory was unsustainable. We were very inefficient," Brad Croy said. "Our competitors were starting to gain momentum because they were buying

parts overseas and just reselling them."

Meanwhile, Brad had earned a master's in business administration from the University of Oklahoma and shortly thereafter, became CMP president.

Looking for answers, Brad discovered the local Enterprise Excellence Group, a think tank of Oklahoma City companies involved in Lean Manufacturing. It turned out to be the worst and the best experience they could have imagined.

"The way we were operating here was probably the way companies operated 30 years ago," Brad said of his eye-opening experience. "The world had changed and left us behind. I don't think I've ever been more embarrassed and envious in my life to see how they were doing things down the street compared to us."

To make sense of it all, Brad sought out the advice of the Oklahoma Manufacturing Alliance and manufacturing extension agent, Bob Smith. He is one of 17 manufacturing extension agents working around the state for the Oklahoma Manufacturing Alliance. Smith is sponsored locally by Metro Technology Centers. MEAs are uniquely trained to offer assistance to manufacturers, helping the company become progressively more

CMP Corporation Oklahoma City, OK www.cmpcorp.com

CMP Corporation is a world leader in manufacturing replacement parts for HVAC and refrigeration compressors and re-engineering the compressors themselves. CMP distributes to more than 3,000 clients in more than 95 countries. The company, which was founded in 1966 by Jon Croy, now has more than 100 employees at its plant in southeast Oklahoma City and is now under the leadership of Brad and Darren Croy, sons of Jon.



Christin Griffin, Production Scheduler for custom manufacturing and Roger Turner, Custom Shop Floor Supervisor review a custom job or for scheduling. They are identifying how hard the part is and what machines it will need to go across as well as how long that will take.

successful in their marketplace.

"We immediately started putting employees through Lean 101 and Lean Implementation Training," Brad Croy said of his 98 employees.

Also, CMP completely reorganized and rearranged their facilities to implement Lean Strategies and Ideas. Essentially, nothing went unchanged, from the shop floor to the front offices.

Brad Croy expects revenue to increase 3 percent in the upcoming year, and the company has invested \$1.5 million in capital expenditures over three years.

The average cost reduction in crankshaft production was around 20-25 percent.

"In 12 years, what I'm most proud of is the success we've had with Lean Manufacturing. We've managed to increase our production and become more financially stable than we've ever been."

Impact

- Production lead time went from 85 days to 10 days
- Average cost reduction is around 20-25%
- Distance of travel was reduced 1 mile to 240 feet
- Manpower needed to make a crankshaft reduced 20%

Source: Oklahoma Manufacturing Alliance

Your Manufacturing Fit Descriptions

Mostly A's: "Business" You're outgoing, analytical, goal-oriented, organized, and driven to take a big idea and make it profitable. Watch out, Trump. Sample jobs: accountant; industrial production manager; logistics control; purchasing manager

Mostly B's: "Creative" Your dreams can come true because you have the ability to take your creative ideas and turn them into something real. Whether you have an eye for color and design or a way with words, you love to create something that's entirely new and unique. Sample jobs: CAD designer; copywriter; industrial designer

Mostly C's: "Hands On" You're the one who makes it all happen by, well, making it. You like to work with your hands and your brain to build and fix things. You're happiest when you're in action, seeing the results of your work as you turn nothing into something. Sample jobs: engineer; tool and die maker; robotics technician

Mostly D's: "Scientific" You're full of questions – or maybe it's just two little questions: "Why?" "How?" Your curiosity and investigative spirit, mixed with a knack for making sense of complex scientific issues, are your formula for success. Sample jobs: bioprocesses engineer; chemical technician; nanotechnologist

Mostly E's: "Social" The familiar term "people person" really does apply to you. You are at your best when you're interacting with people. You listen well to people, and in turn they listen to you because your strength is in connecting with and understanding others. Sample jobs: human resources; market research analyst; sales representative



EMPLOYEE NAME: Sharon Guy
COMPANY NAME: M-D Building Products, Inc.
CURRENT OCCUPATION: Production Supervisor
HOW LONG SERVING IN THIS CURRENT POSITION: 10 years
EDUCATION LEVEL ATTAINED: High School, continuing college

Did you know in middle school or high school this is type of industry/work you wanted to be in?
 No

If so, what gave you that understanding? If not, when did you begin to realize your career path?

As I began to attend college classes after high school, I needed to earn money during the summer breaks so I began working for M-D. I enjoyed the environment and the people that I worked with as well as how family oriented the company was.

What educational path did you follow to gain knowledge about this industry?

Vocational training and on-the-job training programs.

What apprenticeships or workplace experience contributed to your expertise?

All of the on-the-job training that I received.

What challenges and/or obstacles did you personally overcome to succeed?

Challenges and obstacles that I overcame included proving that I was the right person for the leadership role I am in today and challenging others to accept my values and vision for my department that have led it to be as successful as it is today.

Who was the most influential person(s) along the way that supported you to be where you are today?

My family, my previous supervisors and managers, and Ballerie Galbreath-Calhoun.

What career goals or professional aspirations do you have now?

To go back to school and finish my education.

What advice do you have for students who want to work in this industry?

Learn as much as you can about science, technology, engineering and math...but also learn about working with other people. Keep in mind that there are many rewarding career paths in this industry including Engineers, Accountants, Machinery Operators, Fork Lift Drivers, Welders, Electricians and Leaders.

You can find out about hundreds of possible careers using the Occupational Outlook Handbook online. Just visit the website and follow the instructions at: www.bls.gov/ooh

Discover your interests! An interest inventory or profile can help relate your interests to career choices. The one listed below is free and easy: www.mynextmove.org

Careers in Manufacturing

As is the case in any profession, the pay range in manufacturing can vary quite a bit, depending on the job selected. Some jobs require more education and training to get to the higher paying jobs, and others require time on the job to develop the skills that lead to higher pay. Let's take a look at some of the highest paying jobs in different areas of manufacturing. Wages are presented as yearly median pay - actual pay could be higher or lower depending on experience, location, industry, etc.



MANUFACTURING PRODUCTION PROCESS DEVELOPMENT

- Chemical Technicians
- Electrical Engineering Technicians
- Fashion Designers
- Nuclear Monitoring Technicians
- Electromechanical Equipment Assemblers

Chemists and Materials Scientists - Bachelor's degree

Pay: over \$69,000/year
Studies the structures, compositions, reactions, and other properties of substances; they use their knowledge to develop new and improved products, processes, and materials.

Electrical/Electronic Engineering Technician - Associate's degree

Pay: over \$56,000/year
Helps engineers design and develop computers, communications equipment, medical monitoring devices, navigational equipment, and other electrical and electronic equipment



HEALTH, SAFETY, AND ENVIRONMENTAL ASSURANCE

- Safety Engineers
- Occupational Health and Safety Specialists
- Chemical Technicians
- Industrial Health and Safety Engineers
- Product Safety Engineers

Health and Safety Engineer - Bachelor's degree

Pay: over \$75,000/year
Develops procedures and designs systems to keep people from getting sick or injured and to keep property from being damaged

Occupational Health and Safety Specialist - Bachelor's degree

Pay: over \$64,000/year
Analyzes many types of work environments and work procedures; inspects workplaces for adherence to regulations on safety, health, and the environment



LOGISTICS AND INVENTORY CONTROL

- Logisticians
- Logistics Engineers
- Transportation Managers
- Storage and Distribution Managers
- Industrial Truck and Tractor Operators
- Cargo and Freight Agents

Logistician - Bachelor's degree

Pay: over \$70,000/year
Analyzes and coordinates a company's supply chain—the system that moves a product from supplier to consumer

Heavy and Tractor-trailer Truck Driver - High school diploma

Pay: over \$37,000/year
Transport goods from one location to another



QUALITY ASSURANCE

- Environmental Engineering Technicians
- Inspectors/Testers/Sorters/Samplers/Weighers
- Quality Assurance

Chemical Technician - Associate's degree

Pay: over \$42,000/year
Uses special instruments and techniques to help chemists and chemical engineers in researching, developing, and producing chemical products and processes

Quality Control Inspector - High school diploma

Pay: over \$33,000/year
Examines products and materials for defects or deviations from manufacturers' or industry specifications



PRODUCTION

- Welders
- Bakers
- Solderers and Brazers
- Tool and Die Makers
- Glass Blowers, Molders, Benders, Finishers

Machinists and Tool and Die Makers - High school diploma

Pay: over \$39,000/year
Sets up and operates computer-controlled or mechanically-controlled machine tools to produce precision metal parts, instruments, and tools

Stationary Engineers and Boiler Operators - High school diploma

Pay: over \$52,000/year
Controls stationary engines, boilers, and other equipment to provide utilities for buildings or industrial purposes



MAINTENANCE, INSTALLATION, AND REPAIR

- Robotics Technicians
- Roustabouts (Oil and Gas)
- Software Developers
- Mapping Technicians
- Engineering Technicians
- Biological Technicians

Biomedical Equipment Repairer - Associate's degree

Pay: over \$44,000/year
Installs, maintains, and repairs medical and patient care equipment

Telecommunications Equipment Installers/Repairers - Post-secondary education/training

Pay: over \$54,000/year
Sets up and maintains devices or equipment that carry communications signals, connect to telephone lines, or access the Internet

Succeeding on the Job Download a Personal Inventory Effective Assessment to help identify the skills you have or need to develop to consistently reach the goals that you set for yourself or an employer. Go to nie.newsok.com/educators/curriculum/oklahoma-key-business-systems-manufacturing/

Do you have them? Discover the characteristics of a Good Employee has and for which employers are looking to hire. Go to nie.newsok.com/educators/curriculum/oklahoma-key-business-systems-manufacturing/

Used with permission from the magazine **Career Focus—Manufacturing Careers**, available from the Curriculum and Instructional Materials Center (CIMC), Oklahoma Department of Career and Technology Education. To order, visit the CIMC online at www.okcimc.com or call 800.654.4502.

Sources for Career Information

- Career consultants
- Counselors
You can find counselors in many places. For example, look in school guidance offices, in school career planning and placement offices, in community organizations, in private counseling agencies and private practices, and in state employment service offices.
- Educational institutions
 - High Schools
 - Career and Technology Education Centers
 - Community Colleges
 - Colleges/Universities
- Employers
- Online networks and resources
- Personal contacts
 - Parents
 - Family members
 - Friends and acquaintances
 - Neighbors
- Professional organizations
- Public libraries, career centers and guidance offices
- Trade associations and magazines

Oklahoma Dream It. Do It.

Today's manufacturing is about advanced technologies, state of the art facilities, and fast paced work environments. But most of all, manufacturing is about those people who like to see the product of a hard day's work. However, this is not the impression of manufacturing that is held by many Americans today.

The Facts: Public Perception of Manufacturing

- 90 percent of American's rate manufacturing as "important" or "very important" for America's economic prosperity and standard of living
- Manufacturing ranks fifth for Americans when choosing to begin their careers behind industries like technology, energy, and healthcare.
- Only 35 percent of Americans say they would encourage their children to pursue careers in manufacturing, despite the advanced skills and above average pay that are characteristic of work in manufacturing today.

Why is this?

This is due to a perception of manufacturing that existed a generation ago but does not represent the current reality of the industry. To put an end to this misperception, The Manufacturing Institute launched the Dream It. Do It. (DiDi) network in 2005. DiDi works to change the perception of the industry and inspire next-generation workers to pursue manufacturing careers. Critical to changing the perception of manufacturing is engaging youth in the advanced manufacturing experience and allowing them to participate first hand in the high-tech, talent-driven innovation



that thrives in a competitive work environment.



In September 2013, the Oklahoma State Department of Commerce became a member of the DiDi and actively supports DiDi Duncan and DiDi Northeast. These two Oklahoma initiatives are connecting

manufacturers with students, parents, and educators to foster a new understanding of the manufacturing renaissance in the United States and salary opportunities over \$60,000 for Oklahoma employees.

DUNCAN OKLAHOMA

As a part of Duncan's DiDi initiative, the Duncan Area Economic Development Foundation (DAEDF) hosts the Duncan Area Youth Engineering Contest. All students from 7th through 12th grades in the Red River Technology Center school district are eligible to participate.

Manufacturing faces a serious skills gap. Part of this gap is the underrepresentation of women in the industry. While women make up approximately 50% of the labor force, that number is only about 24% in the manufacturing labor force.

Lyle Roggow, President of DAEDF, started the contest after noticing the small number of young people in the local manufacturing workforce. Duncan has a huge number of machine and welding/fabrication shops that need the skills related to CO2 cars. The Duncan Area Youth Engineering Contest was first introduced to high school students and teachers in November 2007 at a Career Fair held by DAEDF. At the first contest, held in the spring of 2008, 17 students raced cars. In 2014, 398 students entered the contest and 350 submitted cars for judging. The design and drawing portion of the contest were judged a couple days prior to the race to ensure the cars were within the specifications. Students (150) were given the opportunity to make adjustments to keep them from being disqualified. Ultimately, 310 cars raced (202 middle school and 108 high school students).

Major sponsors include Halliburton, Wilco Machine & Fabrication, Cameron Measurement Systems, MIC Group, and Southern Machine. Additional sponsors are Total Safety, Oklahoma Parks & Recreation, and the Lindley House Bed & Breakfast. This contest is possible because of DAEDF's partnerships with PITSCO, our local middle schools, high schools, Red River Technology Center, and Cameron University. Additional partners include the Oklahoma Department of Commerce, the Southwest Oklahoma Impact Coalition, The Manufacturing Institute, and the National Association of Manufacturers.

NEOKLAHOMA

"Dream It. Do It. develops the workforce pipeline by creating an understanding of careers in manufacturing to increase economic wealth and quality of life for Oklahomans."

For more information about Dream It. Do It. Oklahoma,
Contact: Duncan, OK: www.ok-duncan.com
Northeast OK: www.dreamitdoitok.org



Duncan Area Youth Engineering Contest 2013, Simmons Center Gymnasium, Duncan, OK



95 years of manufacturing excellence made proudly in Oklahoma by Oklahomans

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