How Technology is Reshaping the Modern Supply Chain

written by Lauri Moon | September 28, 2016

(C3 Solutions – Gregory Braun: 9-21-16)   It's no secret that tech innovations have become key to the evolution of business processes. Whether born of necessity, to fill a niche need, or developed as a blue-sky invention that business adopts, new technologies power much of the growth and development we see in supply chain operations. But early adoption of new technologies, until very recently, was the preserve of the large, well-capitalized corporation.

Tech investments used to be major projects, time-consuming and expensive, requiring the assets and human resources capabilities of big players that needed to leverage big investments in order to compete. Think about the early adoption of mobile scanners by the large last-mile couriers—in 1985 FedEx developed tracking and equipped its drivers with handheld scanners, enabling real time package tracking. P&G introduced continuous replenishment in 1987, thanks to mainframe software from IBM. ERP software was introduced in the 1990s, as the preserve of big enterprise, motivated by the recognition that the data in various parts of a business could be linked together to help deliver better bottom line results, but also out of fear of the Y2K crisis.

However, although these all began as the preserve of the massive, many of these and other supply chain technologies have since evolved into more scalable and affordable options for businesses across the spectrum—from the truly small to the massive enterprise. As they mature, the cost of entry has declined, making many technologies accessible to all businesses. It is said that, thanks to these developments, supply chains are on the cusp of a digital revolution. But as outlined by Georgia Tech, which is a leader in supply chain education notes: "Since the 1980s, computer technology has advanced at such a phenomenal rate that it is currently far ahead of the ability of the supply and logistics field to adequately utilize the new technologies."

So, as the pace of adoption continues to accelerate, there is still plenty of opportunity for technologies to be adapted to supply chain operations. At the moment, there are several that are quickly gaining traction. **This paper is going to explore the current influence of mobile technology … Software as a Service (SaaS) … big data**, … **web APIs**. These four

have come a long way recently and continue to evolve rapidly. We're going to take a look at where they are now and where they might be headed.

Mobility

From the first use of mobile scanners on delivery trucks back in the 1980s, the potential for mobile devices has long been recognized as a boon for supply chain operations.

Numerous factors contribute to this utility. First, the need for communications between widely dispersed and moving members of the supply chain—drivers, dispatch and destination, for example—meant adopting mobility was an obvious advantage. Suddenly, disparate parts of the supply chain network could communicate instantly, and not just by voice—wireless data transmission was a huge advancement. But it has been the advent of personal handhelds—smartphone and tablets—that has really increased the viability of mobile tech options for supply chain operations.

As the devices proliferate to the point of ubiquity and become ever-more sophisticated, the barriers to entry continue to fall. Prices are dropping and because nearly everyone has one, businesses can take advantage of "bring your own device" (BYOD) options for some applications, further decreasing the cost, and even shifting it from capital to operating budgets.

And, as we noted in our Whitepaper, "The Internet of Things and the Modern Supply Chain," the average smartphone is a truly powerful tool. An Apple iPhone 5 has 2.7 times the processing capacity of the 1985 Cray-2 supercomputer, the gold standard of the time. With this kind of power at users' fingertips, it's no wonder that new avenues for mobile technology continue to open.

According to The 2016 MHI Annual Industry Report, 36 percent of respondents said these technologies had the potential to either provide competitive advantage or disrupt supply chains. While current adoption rate of mobile technologies in supply chains is 26 percent, it is expected to surge to 75 percent over the next six to 10 years.

Increasing competition, the need for speed in the e-commerce environment, the growing drive to use available data to better operations efficiency are also contributing to the demand for mobile solutions that provide more than just immediate communications. The combined data that is gained from the application, device and user contribute to more informed and

faster considerations, however that organizations need to consider before jumping into a mobile strategy.

Managing security, especially with employees' own devices, can be a challenge. There are also potential dangers in a piecemeal approach to apps that, far from bringing data into one big useful pool for analysis, can end up creating data silos. Caution also needs to be exercised in selecting apps that are tailored to supply chain by experienced providers.

Some of the most popular and successful application areas for mobile technologies in logistics at present, according to recent research, are navigation and routing using GPS, dispatch management and dock scheduling, parcel tracking, proof of delivery, telematics and customer service. Growing areas include fleet management and yard management.

Looking at yard management provides an example of how using mobile technology can pay off. By using an application on a device that most drivers have already, a mobile YMS can reduce costs, speed up operations and simplify processes.

Payoffs for mobile adoption can be measured in improved productivity, reduced operating costs, improved customer loyalty, faster decision-making, better collaboration between staff and departments and an enhanced bottom line.

While mobile applications have not yet become the mainstream for supply chain, they are rapidly gaining traction. The benefits they convey in terms of immediacy and building collaborative networks within supply chains cannot be discounted. According to some analysts, mobility is "morphing into the backbone of IT infrastructure" for many in the supply chain, and will only continue to grow in popularity.

SaaS

Software-as-a-service or SaaS (also known as cloud-based software), like mobile technology, has been around for a while. But like mobile supply chain apps, cloud computing is still immature and has yet to truly develop its potential.

SaaS offers numerous benefits for companies occupying the sweet spot where it makes sense. (To find out where that sweet spot is, read our blog: "SaaS vs Licensed Software: Factors to Consider in your Cost Analysis".) It affords a lower cost of acquisition, with monthly fees instead of capital costs. SaaS offerings are kept up to date by the provider, and are also

secured by the provider.

SaaS is gaining in acceptance because it is also native to the increasingly digital nature of supply chain. In conjunction with the connectivity of The Internet of Things, cloud-based apps help to bring the data together for analysis.

Cloud technology is also permitting greater integration of different platforms through the use of standardized protocols. This contributes as well to reduced IT costs, as you can refocus personnel to other areas when you outsource to a SaaS provider. The cost savings in this area have been quantified: In a recent study it was shown that: "costs for IT resources were 16 percent in a SaaS model, while for licensed software 41 percent of the cost was allocated to in-house IT resources."

SaaS apps are easily scaled to your business needs, and create opportunities for collaboration across your business and with clients and suppliers. Cloud-based systems also work across geographical and international boundaries, effectively shortening supply chains by bringing far-flung parties digitally closer together. Collaboration is a highly valued feature of SaaS, according to a recent SCM World study. In fact, 94 percent of respondents believe that more collaboration equates to problems being solved more quickly.

Possibly the greatest benefit of SaaS applications is that it will allow smaller companies to gain access to types of software that were previously beyond their reach for reasons of cost. SaaS erodes the leverage that larger enterprises once had with their big IT departments and a provides cushion to cope with peaks and valleys in demand. With SaaS all companies have the potential to get software that was previously only available to the large.

In *The 2016 MHI Annual Industry Report*, over 70% of the respondents said SaaS is having some impact on operations. Forty-five percent claim to be using the cloud already, while another 22% expect they will adopt SaaS within the next couple of years. Overall, adoption rates of cloud computing are anticipated to achieve 86% in the next six to 10 years.

While adoption of SaaS solutions is not yet widespread in the supply chain, it is being touted as an almost inevitable solution. Oracle's CEO recently said he thinks that by 2025 fully 80% of all applications will be cloud-based.

The Internet of Things is widely identified as one of the main sources of the supply chain data

that's now available for analysis. But even before it was highlighted, there was plenty of information available, coming in from sources such as ERP systems, and more recently the data coming in from GPS devices being used for last mile deliveries, and other applications.

Big data includes discrete bits of information about items, locations, movements, usage and demand. Being able to extract actionable analysis from that requires extremely advanced algorithms and computing power—these are the new parts of the equation. New technologies are able to interpret data from disparate systems— ERP, pricing and competitive intelligence systems, for example—bring it together and turn a spotlight on previously dark corners of business operations.

When these techniques are deployed consistently, organizations stand to benefit. A recent study by Accenture noted: At the moment, properly analyzed big data can be used to optimize distribution, logistics, and production

networks. Demand forecasting is another important area the data can illuminate, helping to create more accurate predictions, and uncovering demand patterns that previously would have been unknown. Furthermore, information collected from products in use can be used to improve uptime, anticipate when maintenance is required and even improve customer service.

Risk mitigation and chain of custody are also enhanced by data analytics, potentially streamlining processes around product tracing and recalls, which are increasingly important for both food and pharma supply chains. All of these benefits contribute to creating more efficient supply chain networks, with lower inventories, faster turns, better throughputs and ultimately superior bottom line results. Good demand forecasting can cut 20 to 30% from inventories and ultimately deliver a couple percentage points in profit.

Utilizing big data analytics in operations can improve reaction time to supply chain issues (41%) and can lead to a 4.25-times improvement in order-to-cycle delivery times, according to Accenture.

In this year's MHI report, 44% of respondents believe analytics has the potential to be a disruptive or competitive force in their industry. In this year's MHI report, 44% of respondents believe analytics has the potential to be a disruptive or competitive force in their industry.

Big Data

Big data is not new. What's different now is the velocity, the volume and the availability of analytical tools to use it.

"Although the adoption rate in supply chains stands at just 22%, according to the report, it is expected to grow to 80% over the next six to 10 years." Similarly, 64% of supply chain executives surveyed in an SCM World study consider big data analytics a disruptive and important technology, that will "set the foundation for long-term change management in their organizations."

The key for managers in this is to not be deterred by the impression that big data requires a big corporation to use it. MHI proffers this advice: "Options could range from simple spreadsheets to complex visualization layers. A key is to start with something small enough to be achievable, yet big enough to matter – and then iterate and improve from there."

What does this mean for supply chain? Essentially, they speed up and streamline communications. They also are the enablers for all the other tech innovations we've mentioned in this paper. APIs are used in SaaS applications; sensor-interpreting software uses them; contextually based mobile apps rely on them; and the data that goes into the big-data crunching systems gets there through APIs. Estimates say that about 24% of web apps and 15% of mobile apps are taking advantage of APIs. And by the end of 2018, these numbers are expected to climb to 80%.

A current example of how APIs can help is seen in a recent crackdown by retail giant Target on its suppliers. In an attempt to curb stockouts, the company reduced the delivery window for shipments to distribution centres from two to 12 days down to one day. They also announced plans to increase penalties for deliveries that didn't arrive in the scheduled window.

Target's suppliers now have a communications problem if they are still using EDI to transact business with the retailer. EDI bundles information and sends it in packets at timed intervals. The information is captured and forwarded without confirmation. This can result in delays of between 30 minutes and four hours.

This means that companies using EDI can be four hours out of date in responding to orders, and when there is a one-day window for delivery, that's just not acceptable. APIs and web services can solve the problem with instantaneous communication.

As APIs come to the fore as a tool enabling the revolution in supply chain technology, it will be important to ensure your organization is onboard. They "unlock data, increase agility, encourage innovation and speed time-to-value," making them a crucial piece of the coming IT toolkit for successful supply chain management.

Web APIs

APIs (Application Programming Interfaces) enable communications between different apps. Together with the connections between them they've been described as "the plumbing of the Internet of Things," as well as the EDI of the 21st century.

While we don't want to invoke apocalyptic scenarios, there is a danger that those who are not on the lookout will run afoul of that tech juggernaut in a Titanic manner. Strategic and tactical employment of these new technologies can result in significant supply chain optimization. Increased visibility, better cost control, better integration within and across businesses, improved planning of demand and networks, better tracking and regulatory compliance — these are just some of the many advantages that can accrue through the adoption of some or all these innovations.

And there's more to come. Supply chain 2.0, disruptive technology, the always-on supply chain—these are themes that are occupying the top supply chain analysts these days.

What will it mean for the supply chain manager trying to stay on top of trends?

Keep looking for the technology that will offer competitive advantage in your sector. That may not always mean the most recent, or the most expensive; it will depend on the task that needs to be accomplished. That much hasn't changed.

But what has changed—and will continue to change—is the environment in which you operate. A few years ago we laughed at drones, wearable tech in the warehouse was a goofy fad, and autonomous vehicles were sci-fi.

Now autonomous truck platoons have been proved in Europe with a recently successful cross-continental trip, wearables are being used successfully in DC operations and drones are delivering packages.

Next up is artificial intelligence. Hopefully it will be smart enough to help us avoid hitting the

new technology iceberg lurking on the near horizon.

The Future

Where is all this going to take us? While we see increasing adoption predicted for all the technologies explored here, that information on its own shows only a tiny sliver of the looming iceberg that technological change currently represents.

(C3 Solutions is an information technology company specialized in yard management (YMS) and dock scheduling (DSS) systems.)

Commissioners Proclaim October 7th Centre County Manufacturing Day

written by Lauri Moon | September 28, 2016

IMC's Lauri Moon accepts a Proclamation by the Centre County Board of Commissioners on September 27th announcing October 7th as Centre County Manufacturing Day. #MFGday16 portion starts at 26:57.

To learn more about #MFGday16 visit www.mfgday.com.

Manufacturing Practices that will be Outdated within the Decade

written by Lauri Moon | September 28, 2016

(Manufacturing Transformation – Jon Wikstrom: 6-30-16)　Do your manufacturing processes still rely on analog or paper-based components?　Perhaps now is the time to embrace digitization as a strategy?

As you read this article, the manufacturing industry is moving towards a fourth massive revolution.

The first came in the 18th century in Britain, when machines started arriving in textile mills across the continent and the second came when Henry Ford introduced the world to the powers of mass production.

Since then manufacturing practices remained pretty static until the advent of the computer, which set in motion a series of technology advances that are now gaining momentum. The addition of the Internet to devices promises to further accelerate the innovation that is to come.

We live in a time when a number of very useful technologies are only just beginning to converge. With new materials, innovative software, more capable machines and better processes, we are in the midst of a perfect storm for evolution in the manufacturing industry.

And it won't be long before many of today's practices become obsolete, or even illegal.

Here I take a look at five common manufacturing practices I believe won't survive the next decade.

Reliance on Human Labor.　At the start of the first industrial revolution, factories had to be run around the clock in order to be profitable, so workers often toiled away for up to 16 hours a day. Although conditions have changed dramatically in the developed world, you still can't go more than a few weeks without reading about a

sweatshop in Bangladesh, forced labor in Qatar or child labor in India.

This may be on the cusp of change though. Factories have been using automated robots in some form since the 1960's. Now these bots have evolved enough to take over many of the repetitive tasks humans used to do in factories.

This is one of the reasons companies like Apple and GM have been shifting jobs back to the US for the first time in many decades. Robots can work day and night, be more precise and don't need to be paid. Advanced robotics will most likely make many repetitive, assembly jobs obsolete in the coming years, both in developed and developing nations. Our human resources will then need to be applied to the programming of processes and optimization of production throughput instead.

Analog to Digital Management. Digital technologies have transformed many industries in the past decade alone. In the coming decade they are expected to dramatically change the way manufacturing operates. For example, the convergence of virtual and real worlds in manufacturing is now in full swing. Digitization has also enabled the introduction of mobile apps across the shop floor, which can help assure quality, maintain labor records, track vehicles and shipments, and provide high-quality data all in real time. Legacy paper-based, analog systems will soon be virtually non-existent as the digital revolution continues its transformation.

Two-Dimensions. If you'd mentioned printing to anyone prior to a few years ago, nearly everyone would have talked to you about home computers and paper. If you'd mentioned machines that could print real 3D objects like toys and bricks and even cars, they would have assumed you were talking about the latest sci-fi blockbuster.

But 3D printing is very much a reality now and is become a bigger part of practical engineering every day. After years of research and development, we're finally able to produce objects by creating designs on a computer and having a printer lay it down, layer after layer, till we've made something from the inside-out.

Also known as Additive manufacturing, this process will undoubtedly change the way we produce objects. There are already ideas for creating lighter airplane wings and complex prosthetics with the technology. While the next decade may not see us depending entirely on 3D printing, you can be sure that a great many will

incorporate the printers for some components of their production.

Wasting Water. It's not often given much thought, but a staggering amount of water is used for cleaning at different stages of the manufacturing process. The traditional processes result in a great deal of waste water, hazardous materials and messy residues.

Using water in this way is not only inefficient but also an environmental hazard, especially considering the fact that many places in the world are starting to experience more and more water shortage crises. It's clear that the use of water in manufacturing has to be seriously rethought in order for manufacturing to be at all sustainable for the planet and human survival.

But how do you replace water? On example being used at innovative companies is the use of carbon dioxide (CO_2), which can be stored in liquid or gaseous form. The gas is recycled from other industrial processes and is, thus, very eco-friendly. And, CO_2 can be used to clean anything from clothes to complex medical equipment. It's easy to obtain, cheap to use, very effective and leaves no residue.

Traditional Hierarchies. With the rapid rate at which new technologies are developing, it is starting to make less and less sense to have distinct separations between the production and engineering teams. Given the fact that participating in the line at almost any level will soon involve some expertise in engineering and robotics, more and more companies are moving towards vertical relationships between employees at every level.

Furthermore, the level of education and knowledge necessary to work at the operating level will be higher than it's ever been before. Companies that want to retain their experienced and loyal operations teams will now have to begin training them for a different kind of work requiring more advanced skill sets.

Technology is developing at an exponential rate that will only become more rapid in the years to come. Simultaneously, environmental concerns are becoming such that the government is intervening in order to force corporations to change the way they do things.

These and other factors are combining to make dramatic change imminent in the manufacturing industry. As has always been true on the eve of massive shifts, those who want to stay relevant and successful will innovate. Those who don't will soon find their skills in less demand.

(Jon Wikstrom is a technology and manufacturing writer, former U.S. Air Force Reserves Major and the founder and CEO of Cool Clean Technologies, a company that designs custom dry CO_2 cooling and cleaning systems for a wide variety of industries.)

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Manufacturing Transformation and the People Challenge

The Evolution of the Supply Chain [INFOGRAPHIC]

The 4th Industrial Revolution is Coming – But What Is It?

How to Bring Back Manufacturing Jobs

written by Lauri Moon | September 28, 2016

(strategy+business – Daniel Gross: 9-7-16)   America has a long-running crisis in manufacturing employment. Quite simply, year after year, the number of people employed in making things declines — the figure is down by nearly 5 million since 1996. And in election years like this one, it is common to hear politicians talk about how they will bring manufacturing jobs back.

Across the board — on both sides of the aisle, in every part of the country — there is an overwhelming desire to have more manufacturing jobs. This is partly due to nostalgia and symbolism. But it's also driven largely by economics: Generally speaking, the manufacturing

jobs that have been lost (and that remain) offer better pay, benefits, and job security than the service jobs that have replaced them. What's more, manufacturing has a big multiplier effect — when you build machines at a factory, it calls an array of suppliers and service providers into action. Thanks to the power of manufacturing's economic impact, states and cities are often willing to offer significant financial incentives to companies that are willing to open plants.

Now, if they were being honest, politicians would note that the vast majority of the millions of manufacturing jobs lost can't return. They left due to globalization and competition. And many were rendered obsolete by technology. The reality is that the value and volume of stuff factories produce tends to rise each year, even if employment falls, because software, machines, and computers are doing more of the work.

However, there are at least a few hundred thousand manufacturing posts that could be "brought back" without turning back the clock on globalization and making factories less productive. All that would have to happen is for America's companies to fill the hundreds of thousands of open positions.

I've written before about the strange state of affairs in the job market. Markets everywhere have become more efficient, thanks to technology and brilliant new platforms that grant buyers and sellers of goods and services the ability to meet one another online and agree on product and prices. And yet the labor market has become less efficient. As the most recent JOLTS report notes, there were some 5.6 million jobs open in the U.S. at the end of June, up from 2.4 million in June 2009. If human resources professionals could be 10 percent more effective at filling posts than they are, there would be an additional 560,000 people working today.

Last week, the Wall Street Journal noted that a decent chunk of those openings are in manufacturing. "The number of open manufacturing jobs has been rising since 2009, and this year stands at the highest level in 15 years, according to Labor Department data," the Journal reported. "Openings for manufacturing jobs this year have averaged 353,000 a month, up from 311,000 in 2015 and 122,000 in 2009." That's a lot! There are 12.28 million manufacturing jobs total in the U.S., and in the past year, 39,000 have been lost.

To put it differently: *If U.S. manufacturers were willing and able to fill the positions they have open, we'd be bringing manufacturing jobs back in a big way.*

So why isn't it happening? How can it be that the number of manufacturing openings has

tripled in the past seven years even as millions of manufacturing workers have been forced to find other work? Well, it's complicated.

Markets may be efficient most of the time, but they're far from perfect. It could be that there are lots of openings in geographic regions where the population has been declining. It could be that employers, who have to compete for labor in ways they haven't had to in more than a decade — the unemployment rate is just 4.9 percent — aren't offering enough money to lure workers away from their current jobs.

But in manufacturing, there's something else at work. As the Journal noted, the manufacturing industry has changed a great deal in recent years. It is more technology-intensive, more specialized, and depends on higher-value-added goods. As is the case with many other professions — including journalism and retail — the jobs have evolved to the point where they are fundamentally different. It's one thing to weld a fender to a car body; it's quite another to program, manage, and maintain the machines and robots that do the welding. All of which is to say that the level of skills and competencies manufacturing employers are seeking in their employees may be significantly higher than the level they were seeking 10, or 20, or 30 years ago.

In most instances, especially in service industries such as retail and food service, labor shortages can be solved by the simple application of higher wages. But when it comes to manufacturing, higher wages may be only part of the solution. Sure, you can entice a skilled operator of machine tooling to walk across the street by doubling her salary. But if the market — i.e., other companies, the educational system, and training programs — hasn't been endowing sufficient numbers of workers with those skills, higher pay will only get you so far.

The most direct way to bring back manufacturing jobs, then, may be for companies to decide that they are prepared to invest in programs or direct efforts that will produce workers with the skills they need. *The solution to outsourcing production elsewhere may be to insource training.*

(Daniel Gross is executive editor of strategy+business.)

Building the Next-Generation Manufacturing Workforce

written by Lauri Moon | September 28, 2016

(IW – Ed Potoczak: 9-6-16)   Manufacturers must do more than promote the "coolness" of today's technologies. They need to communicate the educational requirements for succeeding in manufacturing careers, so that students can understand the skills they will need.

There's no doubt: Manufacturers today are stuck between a rock and hard place. On the one hand, many face an aging workforce that may retire without sharing key knowledge. In fact, the Pew Research Center predicts that 10,000 baby boomers will retire each day over the next 19 years.

On the other, some 80% of businesses are struggling to bring new talent into the door and up through the ranks. *Unless things change, 2 million jobs will go unfilled even as manufacturers face a growing skills gap on their teams.*

Clearly, it's a complex challenge, one that won't be solved by a single silver bullet. However a number of innovative manufacturers, generational researchers and talent acquisition professionals have developed effective strategies for attracting, engaging, developing and retaining the team members who will be central to driving manufacturing businesses forward.

Here is a look at the most promising of those strategies:

Update Manufacturing's Reputation

Attracting a new generation of employees first means changing outdated pre-conceptions about the industry. Despite decades of advances, many people visualize an antiquated manufacturing scenario with equipment straight out of the Industrial Age. They have little understanding of how advances in computer-aided design, 3D printing, robotics and computer numerical control (CNC) machining, among others, drive modern manufacturing operations.

Manufacturers should consider ongoing initiatives to engage with the community, whether that involves regularly scheduled manufacturing tours, joint career education initiatives at colleges and high schools, virtual events or social media engagement.

One of the best platforms for educating students and parents is *Manufacturing Day*, which aims to address misperceptions by showing what manufacturing is—and isn't. More than 733 events across North America are scheduled around Manufacturing Day 2016, which is set for October 7. It is not too late to host an event or join an existing one this year by visiting MFG DAY.

Manufacturers also must do more than promote the "coolness" of today's technologies. They need to communicate the educational requirements for succeeding in manufacturing careers, so that students can understand the skills they will need. And with millennials' desire to make a difference, manufacturers should provide insights into how employees can contribute to the success of the company and customers, as well as participate in any corporate causes.

Broaden the Potential Talent Pool

Millennials will be key to long-term growth, but manufacturers should not discount GenXers seeking new opportunities or a career shift. GenXers are tech-literate, and the youngest of the generation will be working for another 25-30 years. Moreover, with many having started families, GenXers tend to value job stability. By contrast, research indicates that more than 90% of millennial workers will leave a job after less than three years.

Go "Old School" and Invest in Internships

Whether recruiting millennials or GenXers, many industries require specialized expertise that is difficult to learn in a classroom or doesn't transfer well from other job experiences. Savvy manufacturers are investing in internships to help people develop these specialized skills—whether to build products or provide maintenance for sophisticated systems.

A blue ribbon program is Aviation High School in Long Island City, N.Y. Accredited by the Federal Aviation Administration (FAA), the school works with John F. Kennedy International Airport (JFK) to provide airline maintenance certification. Some 2,200 students take standard high school classes, but they also attend courses on the mechanics of how a jet airplane operates and get hands-on experience with maintenance. When students graduate, *they earn both a diploma and a certificate to work in the aviation industry*.

Manufacturers do not need to be Fortune 500 companies to offer internships. Many mom-and-pop shops and mid-size firms also offer part-time after-school jobs and individual internships through partnerships with local high schools and community colleges. Other manufacturers

work with government agencies, career assistance organizations, or other non-profits. Companies may find that they qualify for federal, state and local economic development funds to create skilled-trades apprenticeship training programs.

50 Strong, a subsidiary of mid-size manufacturer Precision Thermoplastic Components, is taking another approach. It has launched the *50 Strong Foundation*, which awards scholarships to those engaged in or interested in pursuing careers in manufacturing. The scholarship assists recipients with the cost of attending a technical, vocational or trade school in order to enhance their manufacturing skills and knowledge.

Engage New Employees

Millenials want to tackle new challenges and opportunities, and boredom is a deal-breaker. This is good news for manufacturing, which thrives on innovation and has been so transformed that it is nearly unrecognizable to people familiar with the factories of 20 years ago.

With this in mind, manufacturers should be prepared to assign meaningful responsibilities to new employees, not simply have them "pay their dues" with menial tasks. When there is a real need for new hires to assist in administrative cleanup, managers should provide a perspective on how this less-than-exciting work helps colleagues and even customers.

Management teams should also seek to engage employees, whether Millennials or GenXers, by asking them to *consider developmental assignments* in particular areas of the company, listening to their goals and hopes for enrichment or advancement and then mapping out personalized career plans with them. Also consider assigning a member of senior management to serve as an executive mentor to advise them on how to add more value to their work and the business. Don't limit mentoring to new hires; it can also unlock untapped potential among current employees.

Build Cohesive, Cross-Generational Teams

Beyond formal mentorship, consider establishing cross-generational project teams or special committees. Newer employees can gain important knowledge and build their skill sets from senior team leads. Meanwhile, more experienced employees should be encouraged to take advantage of the enthusiasm, creativity and comfort with technology that the younger generation brings.

To ensure the success of these teams, it is important for everyone to recognize the differing values and motivators for each generation, and that no one perspective is best. Millennials tend to be collaborative and tech-savvy, and they desire to make a difference early in their tenure. GenXers usually are self-reliant and analytical, and they want work/life balance. Boomers were raised with a strong work ethic, and they focus on process, desire personal gratification and are determined to perform well. Like Millennials, they tend to be optimistic. Senior management, in particular, should incorporate this understanding in strategies to create a culture, policies and plans that empower members of each generation to be successful contributors.

Empower Teams Through Technology

Cross-generational teams help foster knowledge transfer from the Baby Boomers, who are thinking about retiring, to younger team members. However, it is also important to invest in technology to capture vital company information. This may take the form of audio/video recordings of employees explaining key processes or a document management system that catalogs and stores work instructions and other data.

Using technology will make the work environment more appealing to tech-savvy millennial and GenX employees. They rely on smartphones, tablets and web apps that store, organize, search and display information on an almost unlimited number of topics in business and technology, and they want to have the same power and flexibility at work. Additionally, many modern enterprise resource planning (ERP) systems help minimize redundant work that frustrates all employees, empowering all team members to become more productive.

(Ed Potoczak, IQMS industry manager, brings extensive expertise in manufacturing and engineering; he is certified in Design for Manufacture and Assembly and Value Analysis/Value Engineering.)

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Where is Manufacturing Really Going?

written by Lauri Moon | September 28, 2016

A rational explanation of the two divergent views of U.S. manufacturing's future.

(IW – Becky Morgan: 9-7-16)   It is true that some U.S. headquartered companies are shutting down operations here and moving them to Mexico or elsewhere. It is also true that some U.S. companies are reshoring their operations to the U.S. We are undergoing a significant adjustment in the location of manufacturing operations around the world. It's a logical one, especially following the often short-sighted decision to chase cheap Asian labor several years ago. But it's also a strategic one.

So what can we expect?

A continuation of this relocation process over at least the next decade. Why?

Because just as "right-sizing" occurs as markets shift, so will "right-locating." Sometimes this is to correct prior bad decisions; occasionally because of changing strategies; often because of the pursuit of new markets. The decision of where to locate manufacturing operations is not a simple one, especially as global environments change. And this is true for global companies headquartered around the world, not just those here.

Why has Toyota invested in significant manufacturing capability in North America? Because it believes in locating in its major markets. It is a strategy they continually evaluate and, so far, continually implement. With multiple foreign companies producing in the U.S. and U.S. companies producing worldwide, "buy American" is confusing at best.

Why are major U.S. manufacturers moving facilities? Primarily for two reasons: (1) to be close to their markets, and (2) to reduce costs. Globalization leads the first. The second is a bit tougher to generalize. The short-term focus on earnings that executives of publicly held U.S. companies have results from compensation plans and the active stock market here. Accounting

rules often support those short-term decisions, at the expense of long-term thinking. And unfortunately, too many executives make choices aimed at minimizing taxes rather than creating a thriving future for their company. But those factors don't mean that all decisions to locate abroad are bad ones. A company must be competitive and frequently that impacts optimum production location.

Lamentably, MillerCoors recently decided to shutter one of the best plants I've ever seen in favor of one a bit newer about 200 miles away. The Eden, N.C., operations team had created an outstanding culture and was regularly named one of the best U.S. plants in the company, but that wasn't enough. The newer facility in Virginia may quickly become just as good, but tell that to the former employees in North Carolina. This was a market access decision initiated by declining demand. A business decision, as they say. While that feels cold, the reality is the company had to right-size, which in this case also meant "right-locate.

Mergers, divestitures, infrastructure, capital requirements, work contracts, laws and regulations, water access and availability of a qualified workforce all impact location decisions. So does the location of markets and raw materials. Top executives who make these determinations, virtually always after an extensive study of options, are rarely bad people. They have multiple constituencies to consider, and employees are only one of those. An important one, but only one.

Effective product design coupled with speed-to-market with market-verified products can make labor costs inconsequential. But that doesn't mean locating capacity in the U.S. is more attractive. It just eliminates one of the simple factors that begat the offshoring craze several years ago.

Manufacturing is not dead, nor is it dying. As with anything else, it evolves. The how and the where are rapidly changing now for reasons we can expect to continue for at least a decade, if not longer.

New technologies and increasing expectations of immediate delivery are accelerating relocation decisions for both market and cost reasons.

So where is manufacturing really going? *Towards speed, technology, and a qualified workforce.* Wherever that may be tomorrow. If we want manufacturing to remain strong in the United States, focus on improving those factors that matter most.

(Becky Morgan is President, Fulcrum ConsultingWorks Inc.)

Industry 4.0: The Future of Competitiveness in U.S. Manufacturing

written by Lauri Moon | September 28, 2016

(Reshoring Initiative Blog — Sandy Montalbano D'Amico: 8-20-16)   Industry 4.0 is defined as a fourth wave of technological advancement, driven by nine technology advances that will increase manufacturing productivity and increase competitiveness in manufacturing industries.

According to the Boston Consulting Group (BCG), "In this transformation, sensors, machines, workpieces and IT systems will be connected along the value chain beyond a single enterprise. These connected systems (also referred to as cyber physical systems) can interact with one another using standard Internet-based protocols and analyze data to predict failure, configure themselves, and adapt to changes. *Industry 4.0 will make it possible to gather and analyze data across machines, enabling faster, more flexible, and more efficient processes to produce higher-quality goods at reduced costs.*"

A Level Playing Field

Industry 4.0 has the potential to level the global playing field for U.S. firms and give them the opportunity to reshore more U.S. manufacturing. As American companies adopt a more comprehensive total cost analysis, they are finding that rising offshore labor rates combined with other "hidden costs" of offshoring often counterbalance any remaining savings from cheap price or labor abroad. They are also finding that separating research and development from manufacturing has a negative impact on

innovation.

American companies that more accurately evaluate sourcing alternatives and adopt 4.0 technologies will be in an optimum position to increase competitiveness, take advantage of the benefits of localization, and manufacture profitably in the U.S. for the North American market.

The Future of Productivity and Growth

The Fourth Industrial Revolution was the focus of this year's World Economic Forum meeting in Davos. The scope and impact of this industrial revolution is expected to be transformational, and disrupt almost every industry in every country, changing entire systems of production, management, and governance. According to the global agenda, "there is clear evidence that the technologies that underpin the Fourth Industrial Revolution are having a major impact on businesses." A recent BCG report shows how connectivity and interaction among parts, machines, and humans will make production systems as much as 30 percent faster and 25 percent more efficient. Industry 4.0 has the potential to have a dramatic impact on U.S. manufacturing competitiveness and reshoring of U.S. jobs.

The Challenge for the United States

According to the Reshoring Initiative data report, the bleeding of manufacturing jobs to offshore has stopped. Reshoring, including FDI, balanced offshoring in 2015 as it did in 2014. In comparison, in 2000-2007 the United States had a net loss of about 200,000 manufacturing jobs per year to offshoring.

According to Reshoring Initiative calculations, about 265,000 manufacturing jobs have been brought to the U.S. from offshore in the last seven years. That job gain is the result of both new reshoring—the return of manufacturing work by U.S. headquartered companies—and foreign direct investment (FDI) in the manufacturing sector by foreign headquartered companies. Those 265,000 jobs represent about 30% of the total increase in U.S. manufacturing jobs since the recent low of 11.45 million in February 2010.

Now, the challenge is to bring back another 3-4 million manufacturing jobs that are

still offshore as measured by our $500 billion/year trade deficit. Between the health of the industry overall and the balancing of the job flow, the beginnings of a manufacturing renaissance are evident, but many actions are required to maintain the momentum.

How Modern Technology Solutions and Better Sourcing Decisions Impact Reshoring

We need continuous improvement in operations and in sourcing decisions to make domestic production the clear first choice in more cases.

Corporate Investment

The benefit of Industry 4.0 for U.S. companies is the increased productivity and efficiency that enable more flexible and efficient processes to produce higher-quality goods at reduced costs. The first step then must be continued corporate investment in the nine technologies that are transforming industrial production – the building blocks of Industry 4.0:

- Big data and analytics
- Robots
- Simulation
- Horizontal and Vertical System Integration
- The Industrial Internet of Things
- Cyber Security
- The Cloud
- Additive Manufacturing
- Augmented Reality

Government Action

Second, government action to make the U.S. more competitive: skills training, lower nominal corporate tax rate, and a combination of an overall lower USD and an end of offshore currency manipulation.

Better Sourcing Decisions

Third, consistent, disciplined use of Total Cost of Ownership (TCO) analysis so companies recognize that domestic manufacture is in most cases their best choice.

Reporting Success Stories

Finally, thorough reporting on reshoring success stories so that corporations realize that reshoring is worth reevaluating and investing in ... and so prospective skilled workers realize that their best career opportunities might again be in manufacturing.

The Winning Strategy

The impact of offshoring on the U.S. economy and the environment has been significant. According to the Economic Policy Institute, the growing U.S. trade deficit with China alone cost 3.2 million jobs between 2001 and 2013. Job losses occurred in every state, primarily in manufacturing. Offshored jobs have diminished American employment opportunities, helped contribute to wage erosion, had a dramatic and negative effect on the domestic economy, and negatively impacted the environment through higher carbon emissions and other pollution from some developing countries and from long distance transport.

The winning strategy is balancing the trade deficit with a strong investment in new technology and skills training and increased corporate use of total cost for sourcing and plant siting decisions.

By reducing our trade deficit, reshoring has the potential to increase US manufacturing by 25%, curtail unemployment and the budget deficit, improve income equality, strengthen our defense industry and motivate skilled workforce recruitment. Achieving this potential requires your help at your company and in your community!

In summary, Industry 4.0 solutions give manufacturers the tools to increase speed to market, and boost productivity and the competitiveness needed to support reshoring efforts.

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The Reshoring Initiative provides a broad range of free resources to bring back more manufacturing, including:

- Total Cost of Ownership Estimator® — A free online tool to help OEMs evaluate sourcing alternatives and suppliers.
- Reshoring Library — Contains 3500+ linked articles on reshoring. See what your competitors are reshoring. Learn from them. See what companies in your customers' industries are reshoring. Sell to them.
- Case Studies — Submit your own reshoring case for free publicity and to make reshoring more visible. Receive a free "Manufacturing is Cool" T-shirt.
- Economic Development Program — Strengthen your region by replacing imports with local production, ideally yours. Have your local economic developers contact us.

(Sandy Montalbano D'Amico is Consultant to the Reshoring Initiative®)

This New GE Factory is a Blueprint for the Future of Manufacturing

written by Lauri Moon | September 28, 2016
The brilliant factory is GE's new take on how we make things. It involves machines are embedded with sensors and connected to the Industrial Internet. The factory uses GE's Predix software platform to stream data …more….

Read the full article at www.gereports.com.

Companies Bringing Manufacturing Jobs Back to US

written by Lauri Moon | September 28, 2016

(IW – Adrienne Selko: 8-25-16)   From January 2010 until July 2016 the Reshoring Initiative estimates that 265,000 jobs have come back to the United States from abroad.

The Reshoring Initiative's 2015 Reshoring Report found that the reasons companies gave for coming back to the U.S. included:

- Government incentives
- Ecosystems/localization
- Proximity to customers
- Skilled workforce

At the same time, companies cited lower quality, supply interruption (this category had the largest increase from last year), high freight costs and delivery as leading problems offshore. Cumulatively, rising wages and total cost have been major drivers in reshoring decisions.

Regionally, the trend remained strongest in the Southeast and Texas, but in 2015 the West displaced the Midwest to hold second place for most jobs shifted from offshore.

See below the list of some of the companies that have brought jobs back. The list was compiled by the Reshoring Initiative for 24/7 Wall St. and is based on company announcements.

Ford – 3200 jobs that went to Georgia

Boeing – 2200 jobs that went to Missouri

General Electric – 2656 jobs that went to Kentucky, New York and Ohio

General Motors – 2345 jobs that went to Tennessee and Michigan

Caterpillar – 2100 jobs that went to Georgia and Texas

Flextronics – 1700 jobs that went to Texas

Farouk Systems – 1200 jobs that went to Texas

Mars – 1000 jobs that went to Kansas

Why Manufacturing Will Make or Break the Future of Energy

written by Lauri Moon | September 28, 2016

Increasingly efficient manufacturing processes are poised to accelerate commercialization of clean technologies.

(GreenBiz – Lauren Hepler: 8-23-16)   From solar panels a decade ago to energy storage today, the history of clean tech is littered with capital-intensive concepts poised to radically alter the relationship between industrialized society and the environment.

But why do these widely heralded breakthroughs always seem to limp along so slowly when it comes to actually hitting the market? The dreaded valley of death between conception and commercialization is one increasingly recognized explanation, dooming novel technologies to relegation in never-ending pilot projects as follow-on investment lags.

For Mark Johnson, the Department of Energy's resident innovation expert, the real problem often boils down to production. That is, not just inventing a new energy-centric technologies, but making sure those new tools can be reliably made in a cost-effective manner.

"We can do a lot to invent new technologies relevant to energy," Johnson, director of the DOE's Advanced Manufacturing Office, told GreenBiz. "But where you get those real breakthrough adoption moments is when the technology drives to the point where it reaches cost parity because of manufacturing innovation."

The "maker" craze has gripped consumer imagination in the form of 3D-printed plastic trinkets. Meanwhile, government labs and corporate innovation clusters at automakers, electronics giants and all manner of other companies are focused on advanced manufacturing at scale.

It's a field that encompasses everything from additive manufacturing to high-tech materials to Internet of Things sensors to a range of robotics possibilities, with the latter poised to crack open a Pandora's box of labor automation anxiety.

Johnson's agency aims to help make sense of it all, particularly as the world grapples with fallout from fossil fuel-powered manufacturing and a shift toward renewable energy.

The Advanced Manufacturing Institute has embarked on a number of efforts aimed at not just inventing and patenting new technologies related to energy generation, grid integration and related areas, but also building better infrastructure for advanced manufacturing techniques that they hope will wring waste — and costs — out of the production process.

Those efforts include a network of 15 new U.S. "manufacturing innovation institutes" promised by President Barack Obama in his last State of the Union address. A separate Smart Manufacturing Institute based at the University of California, Los Angeles is one of multiple public-private efforts aimed at advancing nascent energy technologies with a potential manufacturing efficiency upside, such as applying Internet of Things connectivity and data analytics to factories.

The promise of advanced manufacturing doesn't stop with products explicitly associated with clean energy, though. The overall goal of the Clean Energy Manufacturing Initiative at the DOE is "to increase U.S. competitiveness in manufacturing clean energy technologies and increase U.S. manufacturing competitiveness across the board by boosting energy productivity and leveraging low-cost domestic energy resources and feedstocks."

Where you get those real breakthrough adoption moments is when the technology drives to the point where it reaches cost parity because of manufacturing innovation.

That could mean finding ways to economically produce lighter-weight consumer vehicles, or, as the energy agency's new REMADE program hopes to do, encouraging more aggressive recycling or circular economy approaches to production.

Still, increasingly fragmented global supply chains complicate the production puzzle. It's not just businesses, but also their many suppliers wrestling with the financial and technical feasibility of major manufacturing upgrades.

"We don't have vertically integrated companies anymore," Johnson said. "Ford controlled everything from iron mines to dealerships they could get the value out of everything in that supply chain. Now they have tier 1, tier 2, tier 3 suppliers."

The challenge now is getting all those moving parts working together, particularly as the DOE and a range of consortia partners such as federal laboratories and universities blaze the trail on nascent clean technologies.

Moving the needle on manufacturing

Manufacturing is by no means a monolithic category. From small-scale upcycled products to massive factories churning out cars, textiles or smartphones, the scope and environmental impact of manufacturing operations varies dramatically by scale and geography.

At a high level, however, federal data from recent years does show that the way we power production systems is beginning to change. As global energy intensity falls, the U.S. Energy Information Agency also documented a 17 percent decline in

manufacturing energy consumption from 2002 to 2010, with the coal, oil and petrochemical industries remaining the biggest users in production.

"If you look at the use of energy in the manufacturing sector, over half of that energy goes to just a limited set of energy-intensive industries," Johnson said.

Producing the ethylene that serves as the foundation of the myriad plastics used in different products is one of the most energy-intensive industrial processes, along with production of ammonia for use in fertilizer, he said. Pulp and paper and primary metals manufacturing are also both energy- and resource-intensive.

Advanced materials such as carbon fiber and graphene represent one field that could start changing the way a range of products are made — if it makes sense to make them in the first place.

"The challenge is that the cost is about three to four times higher than the cost of competing materials," Johnson said, noting that the process of making carbon fiber is both time- and capital-intensive.

Going in circles — in a good way

In addition to the emissions and ecological impacts that can result from heavy manufacturing, there's also the issue of waste to contend with.

"Up to 50 percent of the materials we produce wind up in a landfill within 12 months of their production," Johnson said. "The embodied energy — in other words, all the energy it took to make those things — is essentially being put into a landfill."

That's where he hopes some circular logic can come in handy.

Rather than trashing used products, their packaging and other manufacturing scraps, Johnson hopes to use them as "feedstocks" for new things — a core tenet of the circular economy push among sustainability advocates for production built on reuse rather than non-renewable virgin materials.

"Can you use those wasted materials, whether it's at the end of life or used as some mid-stream product, and wind up actually using it again?" he said. "The limiting

factors are cost and energy."

A range of companies are already experimenting in the space, although what's really a variation on recycling and what represents a truly circular model varies depending on who you ask.

Tech companies such as Apple are focused on cutting e-waste by investing in reverse logistics, in this case iPhone-dismantling robots, to break down — and ideally, to find and repurpose — electronics components. In an example from the world of weird materials, Ford is partnering with Jose Cuervo to evaluate ways to use agave left over from tequila production in bioplastic car parts.

While the possibilities are vast, Johnson said the breakthroughs for clean energy manufacturing ultimately will have to come from the supply chain.

"A lot of OEMs have sustainability programs, whether its automotive, aviation, textiles," he said. "*What they need is a supply chain that can wind up applying those processes.*"