Digital Innovation in Consumer-Goods Manufacturing

written by Lauri Moon | December 1, 2016

Consumer-goods companies have begun to capture value by applying digital tools to manufacturing. Here's a look at how they're doing this today—and how they might do so tomorrow.

(McKinsey Quarterly — Søren Fritzen, Frédéric Lefort, Oscar Lovera-Perez, and Frank Sänger: November 2016) Consumer-goods companies have been at the forefront of digital innovation in commercial areas such as marketing and sales. Supply chain and operations have been less of a focus for their digital efforts, but *recently, leading consumer-goods companies have started to explore the use of digital solutions in manufacturing processes*. This is a natural development as Industry 4.0—the digitization of the entire manufacturing value chain—is slowly becoming a reality.

Some consumer-goods companies, however, are unsure where to start: Which aspects of manufacturing can benefit most from today's digital technologies? And what should leading-edge companies set their sights on next? In this article, we examine the two most prevalent ways in which consumer-goods companies are using digitization in manufacturing: applying digital tools to lean transformations and using advanced analytics to optimize specific manufacturing processes. We then look at the next horizon of opportunity for digital manufacturing in the consumer-goods sector. Finally, we discuss the organizational enablers that can help digital-manufacturing efforts succeed.

Taking lean to a new level

Lean transformations have already had a dramatic impact on many companies, but digital solutions are taking lean operations to a new level. Consider the case of a food-manufacturing company that invested in lean techniques but didn't have a standard process or system for collecting data, tracking performance, and sharing information. The company's data—sales- and operations-planning data, machine-

level data (such as those in sensors), benchmarks, operating standards for equipment, training materials, work plans, and so on—resided in several different databases and repositories, making it difficult for supervisors to find and analyze information. For instance, due to ad hoc tracking of equipment downtimes, supervisors never knew the exact quantity of goods produced until shipping time, when shortages could disrupt the entire supply chain.

Following a practice that has worked well in other industries, the company consolidated data and assets into a cloud-based digital hub. The hub contains three suites of tools to support day-to-day lean operations: a performance-tracking and management system, a set of modules for assessing operational capabilities and planning improvement initiatives, and a platform for best-practice sharing and real-time collaboration.

Supervisors can now access company-wide information on intuitive dashboards and heat maps, allowing them to detect performance gaps and compare metrics by product, site, and region. They can easily access detailed historical performance data or information on specific operational topics, such as the breakdown of overall equipment efficiency (OEE) by category. Since the hub automates data collection, data exports, tracking of key performance indicators, and generation of email reports, employees' paperwork has substantially decreased.

The digital hub also introduced a new culture of collaboration and continuous improvement. For instance, all functions now systematically track and share equipment-downtime information via the hub. The shared data enable more productive cross-functional discussions about production problems, including root causes and potential solutions. Frontline workers are thus more likely to discover and resolve issues in real time, preventing small problems from becoming major disruptions. Staff members can submit new best practices or improvement ideas at any time, which makes them feel more invested in the transformation. And scaling up is easy, with managers able to deploy the new digital tools to new sites or business lines rapidly, using minimal resources.

After launching the digital hub, some of the company's factories improved OEE by as much as 20 percent within a few months.

Unlocking manufacturing insights through advanced analytics

Leading consumer-goods companies have already scored big wins by using advanced analytics in a number of manufacturing processes. In our view, some of the highest-impact developments have been in *quality control* … *predictive maintenance* … and *supply-chain optimization*.

Quality control. A potato-chip manufacturer wanted to ensure that its products had a consistent taste, especially when it came to "hotness," or spiciness. In the past, it had assessed hotness by conducting taste tests in which a panel of human testers rated various taste parameters (for example, rating the hotness level on a scale of one to ten)—an expensive and unreliable process, since taste is subjective. To increase accuracy, the manufacturer began using infrared sensors to identify and measure recipe parameters associated with hotness. It then developed customized algorithms to process the sensor data and determine how they were correlated with the recipe. Researchers also compared the sensor data with the results of a taste-test panel for each batch. Together, this information allowed the company to create a quantitative model for predicting hotness and taste consistency. Within a year of implementing the program, customer complaints about variability in the flavor of the company's chips dropped from 7,000 a year to fewer than 150—a decrease of 90 percent.

A margarine producer took a similar approach when attempting to understand how variations in multiple process settings could change product viscosity, an important quality parameter. During a pilot, the company tested variations of a number of parameters (such as temperature) and used sensors to evaluate emulsion crystal size, the primary determinant of viscosity. After analyzing data from the pilot—much more detailed and extensive than what it would have obtained in the past—the company was able to correlate viscosity levels with certain parameter variations. With this information, analysts created a model that predicted the viscosity that other parameter combinations would produce, which reduced the need for additional testing and helped the company identify optimum operational settings. This approach reduced the fraction of margarine tubs that had to be discarded because of quality issues from 7 percent to almost zero.

Predictive maintenance. Consumer-goods companies have begun to apply predictive analytics to maintenance activities, *decreasing maintenance costs by 10 to 40 percent*. A diaper manufacturer had historically replaced all cutting blades at certain intervals, regardless of their condition. This sometimes resulted in blades being replaced too soon—which increased costs—or too late, after their dullness had already affected diaper quality. To address these problems, the company turned to sensors that could detect microfibers and other debris—indications of blade dullness—by analyzing video feeds of diapers during the manufacturing process. After uploading the results of the analysis to the cloud, the company analyzed them in real time, using customized algorithms to determine the optimal time for blade replacement. By making adjustments to the maintenance schedule, the company lowered costs while improving product quality.

Supply-chain optimization. At a leading European dairy company, raw-milk purchases represented almost 50 percent of the cost base. Most of the raw milk was used to produce pasteurized milk; the company had to decide how much of the rest to use making butter, cheese, or powdered milk. The profits associated with each of these product categories fluctuated significantly, adding another layer of complexity. In the past, the company gave its regional businesses the freedom to make their own raw-milk allocation decisions, provided they followed a set of simple guidelines. In an effort to reduce costs and optimize supply-chain planning, the company used an analytics software solution that determined the best allocation plans for each region, taking into account variables such as available milk supply, regional factory capacity, and global demand. The improved allocation helped the company *increase profits by about 5 percent* without changing production volumes or capacity.

The next horizon for digital manufacturing

Consumer companies may also soon reap greater benefits from new digital tools that are continually being refined. Consider the following innovations:

- Augmented-reality tools. These tools provide data about the user's environment in real time and facilitate information sharing. With smart glasses, for instance, employees can see and view new work orders while on the factory floor, or take and transmit photos of broken machines to offsite

experts. We estimate that smart glasses could improve productivity by 5 to 10 percent by increasing the speed of operations, improving communication, and enabling paperless processes. Other augmented-reality tools could provide instructions to technicians responsible for complex changeovers or to warehouse workers searching for particular items.

- 3-D printing. Consumer-goods companies could use 3-D technology to facilitate product design and the manufacture of samples. At one shoe manufacturer, 3-D technology reduced the number of employees needed to create prototypes from 12 to 2, significantly decreasing costs. Companies could also use 3-D printing to print low-frequency replacement spare parts on demand at a production site rather than keeping them in stock or having them shipped after a breakdown. This approach would reduce the cost of holding spare parts, facilitate maintenance processes, and reduce downtime.
- Connected sensors and controls. Companies across industries have recognized the potential of the Internet of Things (IoT) and invested in connected sensors, such as those that can detect unusual machine vibrations and transmit their findings to monitors in a remote location, allowing offsite staff to direct corrective actions without having to travel to the facility. In heavy industries like mining, IoT sensors have reduced costs by 40 percent and downtime by half. While some consumer companies (such as the diaper manufacturer mentioned earlier) have invested in IoT sensors, most lag behind their peers in other sectors. We believe this will change as IoT offerings become more sophisticated and consumer companies realize the value at stake.

Organizational enablers for digital manufacturing

Some companies, especially those in the services sector, have already made changes to their organizational structures and strategy to support digitization efforts—for example, by buying niche technology players or creating innovation labs in talent-rich locations. Consumer-goods companies must now follow their example to gain maximum benefits as they digitize their own production lines. Since few consumer-goods companies today have the in-house capabilities needed to support the development and use of innovative digital manufacturing tools, they must upgrade their strategies for recruiting, training, and retaining data scientists, software

engineers, and other technology staff. Competition for this talent is stiff, with demand four times higher than supply for some positions.

Corporate governance must also become more agile to promote digital manufacturing. The technology staff responsible for developing and testing tools should generally have the authority to set budgets and priorities, since they will lose momentum if they have to wait weeks for approval from upper management. When a major initiative does require leadership support or input, local teams should have easy access to decision makers.

Finally, large consumer-goods companies may need to pursue partnerships with smaller players or start-ups to gain essential digital capabilities. Many companies in other sectors have already pursued this strategy, with good results. For instance, *Amazon* acquired Kiva Systems, a small robotics company, to develop the cutting-edge robot technology now in widespread use across its warehouses. Partnerships among large players can also contribute to the development of solid digital platforms. Consider the recent collaboration between *SAP*, the enterprise-software giant, and *UPS*, a large package-delivery company. The companies ultimately hope to create a global network that provides industrial 3-D-printing services, on-demand production capabilities, and other services.

Consumer companies are already benefiting from the use of digital tools in marketing and sales—applying them to manufacturing is therefore an obvious next step. What is also clear, however, is that companies cannot simply implement digital solutions and hope to achieve lasting impact. *They must also undertake an organizational transformation that involves acquiring new talent and capabilities, streamlining the decision-making process, making governance more flexible, and collaborating with external partners.* This transformation touches every group within the company and will require the full commitment of employees at all levels. But the long-term benefits of digital solutions, which will usher in a new era of manufacturing efficiency, more than justify the effort.

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Smart Manufacturing: Enabling Three Key Areas of Excellence

written by Lauri Moon | December 1, 2016

(IW – Jonathan Katz: 11-5-16) A disruptive force known as the fourth industrial revolution is already underway. Known as the Industrial Internet of Things (IIot), the digital enterprise or simply "smart manufacturing," it's a phenomenon that's creating a host of opportunities for manufacturers around the world.

This interconnected system of machines, products and parts can help manufacturers reduce costs and time to market, dramatically increase productivity and take machine reliability and performance to new levels. While the competitive advantages are clear, some manufacturers are slow to digitize their operations because they're unaware of the technologies available to them or are concerned about the required time, cost and infrastructure investments.

This white paper explores three key benefits of IIoT and some practical steps manufacturers can take to make digitization a reality.

Benefit #1: Stamp Out Downtime

Repeated downtime leads to lost productivity, late deliveries and dissatisfied customers. Downtime costs plants an average of $500 per hour, per stand-alone machine. Plants often struggle with reliability because they lack advanced predictive technologies. Traditional preventive maintenance is based on the assumption that machines will follow failure patterns as they age. But this only applies to 18% of assets, according to ARC Advisory Group. The majority of assets display random failure patterns.

Smart-manufacturing technologies can help manufacturers increase visibility into machine performance and reduce unexpected failures. For example, predictive asset analytics software can identify subtle deviations in operating behavior that are often

the early warning signs of equipment problems. The software can be integrated with existing machinery sensors, historians, and control and monitoring systems for increased data access and ease of implementation.

Toyota Motor North America has already achieved significant maintenance savings from a smartmanufacturing

program that it implemented at its North American plants. The company developed a system using smart technologies to capture data in real time, conduct automated analysis of the information and create visualizations for team members, including information displayed on mobile devices. Toyota Motor North America has slashed 40,000 minutes in downtime at one plant for a total cost savings of $6 million.

Benefit #2: Supercharge Productivity

Knowledge is power. Employees who have more information at their fingertips also are more productive. But many plants are struggling to boost productivity as skilled workers retire. Smartmanufacturing technologies can help reduce the learning curve for new operators.

Referred to sometimes as the "augmented operator," mobility tools enable operator autonomy and faster decision-making. Tasks that previously required two operators can instead be accomplished with a single worker. Sensors affixed to equipment or materials can feed critical information, such as energy usage, machine speed, maintenance or inventory, to employees' mobile devices. Previously, such tasks may have required a second operator to inspect equipment and log data.

In fact, the primary benefits from IIoT technologies are productivity improvements, McKinsey & Co. reports. Several manufacturers are experiencing measurable productivity spikes related to IIoT implementations.

Stanley Black & Decker's DeWalt Power Tools plant in Reynosa, Mexico, for example, has implemented a system of RFID (radio-frequency identification) tags working in sync with routers to form a real-time location system. The tags provide real-time location and line status to workers, shift supervisors and plant managers, helping them spot problems faster. The workers can signal an issue by pressing a

button on the line, which sends data to a software system. The software system generates messages with the location of the issue and suggestions on how to correct the problem. The system helped the plant improve line efficiency by 96%, increase throughput by 10% and reduce material inventory carrying costs by 10%.

Benefit #3: Boost Quality

Smart technologies can help manufacturers quickly identify and troubleshoot product quality issues during production and in the field. Quality is among the primary reasons why many manufacturers adopt IIoT solutions. In one survey, 58% of respondents said product quality is one of the top five reasons they're implementing IIoT technologies.

Manufacturers can embed smart technologies, such as sensors, into products to receive real-time, automated information about warranty claims or product defects. IIoT technologies also can help manufacturers with post-sales service, such as scheduled maintenance. For example, Xerox has a central data warehouse that logs data from its devices located at customer sites. The company has set parameters that signal maintenance needs or possible equipment failure. The result is fewer on-site trips and more efficient maintenance.

Sensing technologies also can help reduce scrap, rework and defects. In a machine-to-machine, or networked, environment, sensors affixed to equipment can communicate output variations to downstream machines, which automatically make adjustments to ensure the product is within specifications.

For example, MFC Netform, a producer of powertrain parts for the automotive industry, ties its automated quality inspections to standards specified within its cloud Enterprise Resource Planning system. If the system indicates a part failure, the operator has the option to shut down the machine. Also, communication between the company's vision and ERP systems allows operators to calculate the true cost of rejected parts.

The Next Steps

The path to smart manufacturing may seem daunting. Many manufacturers cite

cybersecurity, integration and the management of business requirements as major challenges to implementing an IIoT infrastructure.

However, there are steps manufacturers can take to overcome these hurdles, including:

- Seeking devices that can integrate with existing legacy systems. This “wrap and reuse” approach minimizes the need for a complete infrastructure overhaul. Examine how well the sensors or actuators interact with the manufacturing execution or ERP system. Consider Ethernet-ready devices or sensors that can connect wirelessly to the cloud. Also, consult with an integrator who can design modular architectures that are easily adaptable for future upgrades.
- Partnering with IIoT experts and vendors who can help interpret the data generated by smart technologies. These experts can help identify gaps between business needs and current IT capabilities. Some experts, such as Schneider Electric, provide simulation services, asset performance consulting and energy-consumption assessments. They also may offer cybersecurity and workforce training services. Training is critical because it shortens the learning curve for employees and ensures they can maximize the benefits of IIoT technologies.

Conclusion

IIoT technologies offer game-changing potential for manufacturers. Schneider Electric research shows that manufacturers can save up to 40% on maintenance costs, 50% on machine downtime and 18% on energy consumption, and increase productivity up to 55% through the use of smart technologies.

But unlocking the full value of IIoT often requires *interoperability of multiple systems*.

In fact, in the worksite setting, 60% of the potential value of IIoT is dependent upon the ability to integrate and analyze data from various systems. In addition, most data companies are not using most of the data they collect from existing smart technologies, according to McKinsey & Co.

Strategic partners can help manufacturers design, install and integrate IIoT technologies with minimal disruption to their current operations. They also can provide the support that manufacturers need to ensure they're gaining the full benefits from their smart operations.

Clearly, creating the digital enterprise doesn't have to be a cumbersome, disruptive process.

(Jonathan Katz is a journalist with more than 15 years' experience in the publishing industry, owner of JSK Communications, and former managing editor of IW magazine.)

An Optimist's Guide to Manufacturing Innovation

written by Lauri Moon | December 1, 2016

Once largely focused on large manufacturers, EWI is broadening the scope of its research and engineering efforts to also help small-to-mid size manufacturing firms put advanced technologies on the shop floor.

(IW – Steve Minter: 10-30-16) "We're all optimists here," says Henry Cialone, the president and CEO of engineering and technology organization EWI, referring to his team of more than 160 engineers, technicians and other experts.

One would expect optimism from the leader of any company but it may be especially valuable at EWI, which is dedicated to helping manufacturers benefit from innovative technologies. That pursuit of innovation necessarily involves failure and that can be a tough concept for any group of highly trained professionals to accept.

"That is probably the biggest challenge because we have an expert culture. People don't want to be wrong," Cialone observes. "They don't want to have to say they need help."

But since joining EWI in 2005, one of Cialone's objectives has been to mold a culture of smart people who are willing to take risks and accept failure as a step toward success.

"What I encourage my people to do is be troublemakers. People find that odd – how do you run a business if it's okay to cause trouble. But if they're not unruly, they're not going to change the world and I want my people to change the world, at least the world of manufacturing," he says. "I'm not saying be obnoxious or be abusive. Come up with the occasional crazy idea. Try it out. It might work."

That combination of expertise in a broad range of disciplines and the willingness to try new things has helped fuel EWI's growth over the past decade. *EWI began in 1984 as the Edison Welding Institute* in Columbus, Ohio, one of a group of state-funded technology centers. Today, the non-profit company no longer receives state funding and, unlike many R&D organizations, is focused on helping commercial customers, a part of the business that is growing at a 15% annual rate.

EWI also has expanded its footprint with two other laboratories in Buffalo, N.Y. and Loveland, Colo. EWI is considering adding another site in Phoenix. Cialone said these new facilities allow it to be closer to more customers, an important consideration in a custom business where it is critical to understand what a manufacturer is trying to accomplish.

"We hone in on an idea and then put together a proposal," says Cialone. "The closer you are, the more feasible it is to do that more often."

The direction of EWI Colorado illustrates how far EWI has come from its roots in welding. The new facility, which will have its opening on November 9, is focused on advanced quality measurement technologies. The lab will have capabilities in real-time manufacturing process monitoring and analysis, advanced nondestructive (NDE) evaluation, computer vision inspection, non-contact metrology and structural health monitoring.

Over the years, says Cialone, "We've added a lot of other technologies. We still do welding but we do machining and forming and robotics and inspection and 3D printing. Anything that a manufacturer does, we are probably involved in it."

For example, the paint on airplanes periodically has to be stripped in order for the plane to be inspected. The paint stripping traditionally was done with either a solvent, which is

environmentally toxic, or with plastic pellets or with sanding. EWI developed a high-power laser scanner for paint stripping applications. The laser system is precise enough that it can stop at the primer or strip the paint down to the substrate.

“We take a laser and raster it across the surface. When it hits the atmosphere, the paint combusts and all you have is a little ash to dispose of,” Cialone explains.

To keep at the forefront of technology, EWI needs to hire and retain talented technologists. Doing so is a challenge, Cialone admits. He says the company offers competitive pay but that is not a primary motivator for the people EWI wants to attract.

“People want autonomy. They want a sense of purpose,” says Cialone. “We think our mission has a sense of purpose to it – to shape the future of manufacturing.”

The diversity of the work is also attractive to employees, Cialone posits.

“They like the fact that they have so many different activities going on at any given time. We have customers in every manufacturing sector from snack foods on up to commercial spaceships. Talk about diversity – you have to have a certain amount of ADD to work in our place,” he quips.

Help for Smaller Manufacturers

EWI traditionally has worked with larger manufacturers, whose technical experts would seek them out for help with a problem where EWI’s expertise was recognized. Cialone said he once thought small-to-mid-size firms could not afford EWI’s services but came to recognize that was not the case. As a result, EWI recently set up a service for smaller firms called Advanced Manufacturing Implementation Strategy.

“It is a consultative advisory service – a little bit of management consulting and a little bit of technology coming together,” Cialone explains. “We’ll walk into a small to medium manufacturer, understand their business, understand their product set, understand their customers and the demands of the customers, and suggest places where technology could differentiate them, either by making them more efficient or providing faster turnaround or better product quality or all of the above.”

Cialone says smaller manufacturers need more help with new technologies because of the

increasing dynamism in the industrial sector. Large OEMs are facing demands for faster product development in the market. Since many of them largely assemble products from supply chains of smaller manufacturers, they are passing those pressures down the line and, says Cialone, often leaving smaller firms to figure out how to cope on their own.

“Think about the businesses that no longer exist that were rocking and rolling 5 years ago. While manufacturing is not quite that crazy, it is moving in that direction,” Cialone observes. “Shorter product cycles, increasing demand for typically quality but also performance as well so they are now having to deal with different design approaches, different materials and different manufacturing methods.”

What are manufacturers looking for help with? While that differs somewhat by industry, Cialone said there is a broad interest in automation. That is being spurred by robots that can be used in close proximity with workers. While smaller firms want to incorporate these “cobots,” Cialone says they don’t necessarily have the expertise to evaluate them or the ability to shut down production while they test out a new robot.

“So for them, we have set up a factory automation pilot – come to our lab, we have a gazillion robots and different types of automation equipment. We’ll lay it out with you in our shop,” Cialone explains. “You can do the one-off here and then we’ll rapidly implement it in your shop without any false steps.”

With its expertise in joining and forming materials, EWI has been helping automotive manufacturers cope with the twin challenges of lightweighting vehicles – reducing their weight to comply with higher CAFÉ mileage standards while also maintaining structural safety. Cialone notes that automakers have been experimenting with a variety of new materials – – high-strength steels, aluminum, magnesium and combinations of these materials. Working with these new materials presents challenges from stamping them to joining different materials.

When EWI surveyed its customers about technical challenges facing them, automotive firms mentioned nondestructive testing as their top issue. That concern was prompted by the move to high-strength steels.

Automakers used to be able to test a spot weld with a screwdriver and hammer, Cialone noted. They would shove the screwdriver between two plates of steel, tap it and if it was a bad weld, it would break. If it was a good weld, it would be fine.

“It doesn’t work that way anymore. With the higher strength steels, they’re so strong you can’t iron the wrinkle back out,” Cialone says. EWI took medical imaging technology, upped the power levels and changed the underlying algorithms to work with the new steels. The result was a nondestructive way to test the welds.

Seeking a Package Deal

While EWI largely works on the basis that customers own any intellectual property arising out of their projects, the company has been moving into some commercialization and seeking to license its IP. That arose, says Cialone, out of customers questioning how they were going to implement new technology solutions.

“Some of our customers said, ‘We like working with you guys but if your project succeeds and you have invented a new way to do something, we’ll need to buy a new machine to do that and we’re dead in the water for 12 months or 18 months. We’re not going to do the project. If you can help us by producing some prototypes, we can test while we’re waiting for our machine.’ We started doing that.”

EWI has spun out a handful of projects. In 2014, EWI sold a live arc welding training system and the associated IP it had developed, RealWeld Systems Inc., to Lincoln Electric.

At the time, Cialone said “We are thrilled that Lincoln Electric shares our vision for the RealWeld Trainer in its ability to educate and deliver skilled, production-ready welders for the manufacturing workforce.”

The transaction was important for EWI, Cialone says. “We couldn’t get anybody to license it when we first put it together. Nobody took it seriously because we didn’t have a track record of commercializing IP.” But after Lincoln Electric purchased the technology, he says, “It changed our profile in the market. People view us differently now, as more serious developers of technology.”

Packaging is another area where EWI is seeking to profit from its IP. The company has developed an ultrasonic sealing technology it calls SonicSeal. Snack packages typically are filled from a gravity-fed hopper and the bags are heat-sealed. The seal won’t work if there is grease or salt in the way, so the bag is made large enough that the product dropping into it is clear of the sealing area. This leaves a tab of excess material.

EWI set a goal of reducing the material in the tab by 50% to 75% and began experimenting with the ultrasonic technology. EWI tested the technology with a major food manufacturer and produced 5 million packages. The SonicSeal packages used 8% less material and achieved a 40% reduction in the scrap rate. The packages provided 10% more efficient shelf space at retailers and can extend product shelf life by up to 4 weeks.

EWI has been in discussions with packaging machine manufacturers about the new technology and showcased it at the PackExpo show in Chicago last Nov. 6-9.

“I think this is going to revolutionize food packaging,” Cialone predicts.

No-Cost Energy Assessments for Small to Midsized Manufacturers

written by Lauri Moon | December 1, 2016

Save Money Through Pollution Prevention and Energy Efficiency Strategies

IMC, in partnership with PennTAP, is providing free energy assessments for manufacturers to reduce pollution, improve energy efficiency and decrease greenhouse gas emissions that will result in reduced operating costs. Technical advisors will perform these pollution prevention and energy efficiency assessments through onsite visits, provide recommendations for improvements in energy utilization and waste reduction, prepare and deliver site assessment reports and provide assistance completing grant applications for follow-up project implementation.

To take advantage of your no-cost energy assessment email info@imcpa.com or call 570-329-3200 to get in touch with your IMC Business Advisor.

Operational Excellence Offers Paths to New Technologies

written by Lauri Moon | December 1, 2016

(IW – Steve Minter: 10-24-16) The Industrial Internet of Things promises more efficient operations, higher quality products and new levels of integration with suppliers and customers. Those promises, though, come at a price. For companies large and small, sluggish demand is reining in capital expenditures and making many manufacturers hesitate to commit to investments in advanced technologies.

Emerson Process Automation Executive President Mike Train, however, says that *companies that invest in advanced automation and follow industry best practices can realize the kinds of significant savings that will make the investment in new technologies pay off*. In fact, companies can achieve improved earnings of up to 15% through new technology and improved operating practices, Train told the Emerson Global Users Exchange in Austin, Texas.

“After years of running at maximum production, postponing improvements, dealing with an aging workforce and delayed turnarounds, many companies are living on borrowed time,” Train said. “They desperately need to invest in improvements, maintenance and upgrades.”

Emerson and research partners have been studying what separates top-performing companies from their peers in terms of operating performance over the past year, Train said.

“If you look across the broad industrial sector globally, as much as $1 trillion of company value is lost every year to sub-optimal operating performance,” he said.

Top quartile performers show significant operational performance in four areas that can affect their financial results, Train told attendees. They include:

- Safety – Top performers have three times fewer safety incidents than companies performing at an average level, said Train.
- Reliability – Companies in the top 25% of process firms have 4% higher availability of equipment (an extra 15 days per year) and spend half as much on maintenance.
- Production – Operating costs are 20% lower for top performing companies than their average performing peers, Train said.
- Energy and Emissions – Top performing plants have 30% lower CO2 emissions than their average performing peers and spend a third as much on energy.

Train said this data will help companies which "lacked the confidence in knowing which investment option will move the needle on financial performance."

IIoT an Evolution, Not a Revolution

While noting that the Industrial Internet of Things is a hot buzzword these days, Train said it did not represent a revolution but rather "a logical evolution of the past 25 years of technology innovation." He pointed out that process manufacturing companies have long invested in intelligent sensors, digital valve controllers and other technologies. As a result, he said, "Your IoT strategy must take into account the investments you have already made and leverage the infrastructure you already have. It all starts with having the right business case."

At the user event, Emerson announced an expanded array of products and services it is calling the PlantWeb digital ecosystem. They include PlantWeb architecture to serve the enterprise as well as new sensing technologies, Secure First Mile products and services to securely connect data to the cloud, two suites of analytical software and an AMS ARES platform that allows companies to aggregate assets from multiple business systems and send that data to plant personnel either on desktop or mobile devices. Emerson said these solutions were scalable and would allow companies to begin the IoT journey with "limited effort or investments."

Emerson is also providing real-time monitoring services where its experts will "constantly monitor and report on asset and operational performance, prioritized repair and asset trending." Emerson will use Microsoft Azure as the cloud service

for its connected services.

Train said that much of the current discussion about IIoT is “visionary” but “kind of hard to act on.” He continued that with the introduction of these products, Emerson will help customers develop a “clear, practical roadmap for how to make Industrial IoT actionable.”

R&D Tax Credit Myths that may be Costing You Money

written by Lauri Moon | December 1, 2016

(RSM – Tom Windram: 9-30-16) The federal research and development (R&D) credit gives companies conducting qualified research the ability to generate a net research tax credit of 13 percent (9.1 percent under an alternative simplified method) of incremental qualified R&D spending* in order to lower their regular tax bill. This credit can result in significant tax savings for manufacturing companies, however studies have shown that it is surprisingly under-claimed. While nearly $9 billion in R&D credits were claimed in 2010, National Science Foundation1 statistics indicate that another $4 billion in R&D credits could have been claimed but were not. Manufacturing companies that develop new products, make improvements to existing products and develop or improve manufacturing processes are likely to qualify for the R&D credit. Middle market companies are among those least likely to take advantage of this beneficial credit.

The Protecting Americans from Tax Hikes Act of 2015, signed into law by President Obama on Dec. 18, 2015, modifies and makes permanent the R&D tax credit. Eligible small businesses may now claim the credit against alternative minimum tax. Additionally, a small business start-up is now able to claim a credit of up to $250,000 against its FICA payroll tax liability if it had less than $5 million in gross receipts for the current taxable year and no gross receipts for any taxable year prior to the five-

taxable-year period ending with the current taxable year. These modifications are retroactive to Jan. 1, 2015.

In our experience, many companies that have eligible activity erroneously disqualify themselves from claiming the R&D tax credit because of one or more of the following assumptions:

Myth #1:	The R&D tax credit is only for companies that invent something revolutionary.
Reality:	The R&D tax credit is designed to encourage innovation. As such, it is equally available to companies that attempt evolutionary improvements to existing products or processes and companies that undertake revolutionary activities. The development or improvement effort does not have to equate to a moon shot. The regulations define research as activities constituting a process of experimentation "intended to eliminate uncertainty" based on information available to the taxpayer at the outset of the project. An experienced R&D tax professional can help you understand what types of activities meet the qualifying criteria.
Myth #2:	The R&D tax credit is only for companies engaged in basic research.
Reality:	The R&D tax credit also extends to applied science, something that many companies perform on a daily basis as they try to improve their business and production processes through the use of technology and science.
Myth #3:	The R&D tax credit is not available for companies that fail in their research.
Reality:	You do not have to be successful to claim the credit. The R&D tax credit is an efforts-based credit. In fact, the regulations specifically state that success is not required in order to be eligible.
Myth #4:	The R&D tax credit won't help my company because my company is not profitable.

Reality:	It is true that the federal R&D tax credit is a credit against taxes, meaning you must be profitable to utilize the credit. However, the credit carries forward 20 years and back one year. Thus, it could be of immediate benefit if your company was profitable in the prior year and can be banked for use in future profitable years. Also, small start-up companies may now be able claim a credit against their payroll tax even if they pay no income tax. In addition, some state R&D credit programs provide for refundable credits.
Myth #5:	The R&D tax credit is only for big companies.
Reality:	While large companies may claim the biggest and most headline-grabbing credits, the program is open to all companies. There are no company size requirements; the credit is only based on engaging in qualified activities. The credit, however, must be actively claimed; it is not automatically granted. In 2010, more than 12,900 companies claimed the credit. Eleven percent, or 1,441, of these companies had business revenues below $25,000, and 39 percent, or 5,015, companies had revenues below $5 million.2 In other words, approximately half of the companies that claim the federal research tax credit are considered middle market companies or small businesses.
Myth #6:	The R&D tax credit is not available to my company because our research is funded by the government.
Reality:	This is an understandable misconception that invites deeper consideration. The R&D tax credit requires both technical uncertainty and financial risk. If a contract between the government (or other party) and the taxpayer requires the taxpayer to succeed or return funds, or to incur costs beyond what the government is paying, the taxpayer is at financial risk and thus eligible for the R&D tax credit. A determination can only be made by reviewing all of the contractual payment provisions. Taking the time for a thorough review usually proves rewarding.
Myth #7:	The R&D tax credit doesn’t reduce state taxes.

Reality:	About two-thirds of states have an R&D credit program. As mentioned previously, some of these offer refundable credits, while others offer credits that can be carried forward. Most state eligibility requirements mimic federal eligibility requirements, though some may restrict, include or provide for enhanced credits for specific types of research. The most common differences between federal and state R&D credit computations relate to the credit rate and base amount computations.
Myth #8:	The R&D tax credit is not a big deal since my company is already getting a deduction.
Reality:	Smart tax planning includes taking advantage of all available benefits. An election under section 280C(c)(3) allows a taxpayer to take a reduced credit without disallowing the deduction for R&D expenses. Thus, a taxpayer may take a deduction for qualified R&D expenses in addition to a reduced credit at the tax-effected rate of 65 percent. The reduced credit is in addition to the deduction and represents a dollar-for-dollar reduction in regular income tax liability. Why leave money on the table and potentially put your business at a competitive disadvantage?
Myth #9:	The R&D tax credit is for increasing research; since my spending is flat, my company is not eligible.
Reality:	This is another tricky area full of misconceptions. The R&D credit does require an increase in research spending. However, current-year spending is compared to a base, which is 50 percent of the average spend for the prior three years, calculated under the ASC method*. In reality, your company's research spending could actually be decreasing, and your company could still be eligible for the credit.

If any of these nine assumptions have discouraged your business from claiming the benefits of the R&D tax credit, think again. It is not too late. Key owners of pass-through entities should be consulted, as this would require extending their individual return filings as well. Under some situations, businesses may also be able to amend prior-year tax returns and retroactively claim the credit. Amended returns will invite IRS scrutiny, and a well-documented study is essential to sustain the refund claim. Additionally, many state claim periods are also open, including some

that offer refundable credits–meaning you don't even have to wait until you are profitable to see the dollars enhance your bottom line.

We recommend you work with your tax team and tax advisors and enlist them to take a look at your various business activities to see whether you qualify. By uncovering the truth behind a frequently misunderstood credit program, you may bring substantial dollars to your bottom line.

*Credit calculation note: The standard credit is 20 percent (13 percent under the reduced credit election) of the current-year qualified research expenses (QREs) over a historical base amount computed by applying a fixed-base percentage to the average of the prior four years' gross receipts. The fixed-base percentage is a function of aggregate QREs divided by gross receipts for the 1984 through 1988 base period. Companies that do not have QREs in at least three of the five base years use a start-up method based on a complex, five-year sliding scale formula. Under an alternative simplified credit (ASC) method, the credit is 14 percent (9.1 percent under the reduced credit election) of current-year qualified research expenses over 50 percent of the prior three years' QREs. Because the regular method can penalize companies whose R&D spending grows more slowly than revenues and the difficulties associated with documenting QREs in the base years, the ASC is often the more favorable approach.

[1]National Science Foundation, National Center for Science and Engineering Statistics; U.S. R&D Resumes Growth in 2011 and 2012, Ahead of the Pace of the Gross Domestic Product, Arlington, VA (NSF 14-307, December 2013). http://www.nsf.gov/statistics/infbrief/nsf14307/

[2] Statistics of Income Division: 2001 – 2010 Corporate Returns Data; Figure B. Corporations Claiming a Credit for Increasing Research Activities; Number of Credit Claimants by Size of Business Receipts; Tax Years 1990-2010

(Tom Windram is a partner at RSM LLP)

Communities Save $250K in Annual Energy Costs

written by Lauri Moon | December 1, 2016
Millheim and Selinsgrove boroughs are starting to save $250,000 in annual energy costs, reaching an anticipated $1 million in savings within five years. This concludes a two-year effort by SEDA-COG's Energy Resource Center.

This project, similar to the successful community-wide project completed in New Berlin in 2013, was primarily funded by the Appalachian Regional Commission.

Many partnering organizations contributed to the project via funding and/or technical assistance, including SEDA-COG's Weatherization Program, Selinsgrove Area School District, Innovative Manufacturers Center (IMC), PennTAP, Selinsgrove and Union County Area Agency on Aging, Selinsgrove Area School District, PPL Electric Utilities, Central PA Community Action Agency, Snyder County Planning Department, Centre County Planning Department, Selinsgrove Borough Council, and Millheim Borough Council.

Commissioners Proclaim October 7th Lycoming County Manufacturing Day

written by Lauri Moon | December 1, 2016
IMC's Lauri Moon accepts a proclamation from Commissioners claiming October 7th Lycoming County Manufacturing Day.

Thank you Commissioners R. Jack McKernan, Tony R. Mussare and Richard Mirabito

for recognizing the importance of manufacturing in Lycoming County.

PROCLAMATION

"Lycoming County Manufacturing Day"

COUNTY OF LYCOMING

Research and Development Tax Credit Myths that May be Costing You Money

written by Lauri Moon | December 1, 2016

(RSM Insight – Tom Windram: 9-30-16) The federal research and development (R&D) tax credit gives companies conducting qualified research the ability to generate a net research tax credit of 13 percent (9.1 percent under an alternative simplified method) of incremental qualified R&D spending* in order to lower their regular tax bill.

This credit can result in significant tax savings for manufacturing companies. However, *studies have shown that it is surprisingly under-claimed.* While nearly $9 billion in R&D credits were claimed in 2010, National Science Foundation (1) statistics indicate that another $4 billion in R&D credits could have been claimed but were not.

Manufacturing companies that develop new products, make improvements to existing products and develop or improve manufacturing processes are likely to qualify for the R&D credit. Middle market companies are among those least likely to take advantage of this beneficial credit.

The *Protecting Americans from Tax Hikes Act of 2015*, signed into law on Dec. 18, 2015, modifies and makes permanent the R&D tax credit. Eligible small businesses may now claim the credit against alternative minimum tax. Additionally, a small business start-up is now able to claim a credit of up to $250,000 against its FICA payroll tax liability if it had less than $5 million in gross receipts for the current taxable year and no gross receipts for any taxable year prior to the five-taxable-year period ending with the current taxable year. These modifications are retroactive to Jan. 1, 2015.

In our experience, many companies that have eligible activity erroneously disqualify themselves from claiming the R&D tax credit because of one or more of the following assumptions:

Myth #1:	The R&D tax credit is only for companies that invent something revolutionary.

Reality:	The R&D tax credit is designed to encourage innovation. As such, it is equally available to companies that attempt evolutionary improvements to existing products or processes and companies that undertake revolutionary activities. The development or improvement effort does not have to equate to a moon shot. The regulations define research as activities constituting a process of experimentation "intended to eliminate uncertainty" based on information available to the taxpayer at the outset of the project. An experienced R&D tax professional can help you understand what types of activities meet the qualifying criteria.
Myth #2:	The R&D tax credit is only for companies engaged in basic research.
Reality:	The R&D tax credit also extends to applied science, something that many companies perform on a daily basis as they try to improve their business and production processes through the use of technology and science.
Myth #3:	The R&D tax credit is not available for companies that fail in their research.
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MFG Day: How Manufacturing Drives the Economy

written by Lauri Moon | December 1, 2016

Expert panel discusses value of Manufacturing Day, including the downstream sales chain, and how manufacturing accounts for an estimated 33% of GDP and 33% of employment.

(Supply Chain 24/7 – Staff: 10-7-16) To kick off the nationwide celebration of Manufacturing Day today, October 7, an expert panel hosted by the Fabricators & Manufacturers Association, International (FMA) has highlighted the significant role manufacturing plays in bolstering America's economy and the critical need to ensure that the sector remains a positive force.

Sharing insights at the "How Manufacturing Drives the Economy" program are;

- *Stephen Gold*, president and CEO of the Manufacturers Alliance for Productivity and Innovation;
- *Scott Mayer*, chairman and CEO of QPS Employment Group;
- *Chris Kuehl*, managing partner at Armada Corporate Intelligence and FMA economic analyst; and
- *Kenneth Voytek*, chief economist for the Hollings Manufacturing Extension Partnership Program (MEP).
- Panel Moderator is *Eric Lundin*, Editor of The Fabricator magazine and Tube & Pipe Journal.

"Manufacturing is a much more significant factor in our economy than official government statistics show, as those numbers only measure the value of the upstream supply chain and only include goods sold to 'final demand'," Gold said. As an example, he cited motor vehicle manufacturing, which includes production and transport of materials, R&D and corporate services in the upstream chain.

"When you include the downstream sales chain, the impact is magnified and multiplied," he said. In his example, this encompasses retail auto dealers, transport and import of the finished vehicles, wholesale operations and aftermarket services."

Using the traditional upstream supply formula across all segments, manufacturing represents 11% of GDP and 9% of employment, Gold said. The downstream sales chain analysis provides a more complete picture at 33% of GDP and 33% of employment."

Chris Kuehl looked at the significance of U.S. manufacturing from a global perspective. "The manufacturing sector is the dominant player in U.S. exports, particularly with heavy machinery and other capital goods," he said.

"And the U.S. is more export dependent than people realize; it accounts for 14% of GDP, almost matching export-driven Japan at its 14.7% of GDP. What most people don't recognize is that the U.S. accounts for 30% of all global manufacturing by value. China accounts for only 10%."

According to Gold, it is important for policymakers to understand the dramatic impact manufacturing brings to the economy and to develop public policy to ensure a dynamic manufacturing base is ever-present. Such developments can help manufacturers themselves gain greater confidence to spend more capital and invest in new productivity techniques.

Smaller Manufacturers as Catalysts While acknowledging the sector's rebound over the past several years, Voytek said manufacturing performance has leveled off and slowed, the result of several broad macro trends that include a stronger dollar, declining commodity prices (particularly oil) and weaker demand globally for manufactured goods.

Voytek sees smaller firms as the key to combating these trends. The fact that 99% of manufacturers fall in this category (less than 500 employees) reflects the increasing share smaller establishments bring to the manufacturing landscape.

"It must be recognized that small firms do face a different set of challenges when compared to larger firms," Voytek said. "They don't have the deep pockets and deep resources like those competitors. But opportunities are available for them to improve in the areas of operational excellence, strategies, new product development and entering new markets."

A new study of the greatest challenges manufacturers face revealed that employee recruitment concerns have increased the most in recent years, cited by 45% of respondents in 2015, but only 19% in 2009. Voytek shared another chart highlighting how job openings are outpacing hiring in manufacturing. Scott Mayer focused on the reasons for such numbers.

“Every day the baby boomers are retiring at a high rate and a new generation of workers in this sector is needed,” Mayer said. However, filling this gap continues to be an issue. According to Mayer, high school teachers and counselors continue to direct too many students to attend college for traditional four-year degrees when a large number of young people may be better suited to focus on the skilled trades.

“You can’t put everyone in the same bucket,” he said. “There is not enough recognition that manufacturing today offers many good, well-paid middle-class jobs. Sadly, such jobs are usually not considered an ‘in’ thing.”

Mayer points to a need for more “grass roots” efforts that involve parents and educators alike. “Parents need to steer their kids in the right direction when it comes to career choices,” he said. “Kids are impressionable and will listen to their teachers. Words mean a lot.”

Manufacturing Day Shines Spotlight on Needs, Opportunities Each panelist asserted that Manufacturing Day – marking its fifth year anniversary today, October 7 – exemplifies this comprehensive grass roots approach and delivers effective, educational programs. Thousands of manufacturers will again host students, teachers, parents, job seekers and community leaders at open houses, plant tours and educational sessions to showcase modern manufacturing technology and the attractive jobs that are available. It is a chance for students to see diverse career options that are innovative, impactful and durable, and understand how to apply their studies in math and science to those careers.

“Manufacturing Day truly dispels old, negative myths about manufacturing and highlights the shift from a labor-intense environment to one of high-tech, robotics and computers,” said Kuehl. “It also provides opportunities to communicate how manufacturing is a big part of GDP and our economy.

Both Gold and Mayer note the 3,000 events to be held throughout the country raise the profile of the industry. In addition to the program's ability to "put manufacturing on the map," Voytek views Manufacturing Day as a way to highlight a distinctive personal benefit for those who select the industry as a career.

"Manufacturing enables workers to show their accomplishments in a very tangible way," he said. "They can say, 'I made this piece of machinery, equipment or product.' It's another way to position manufacturing in a positive light."