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Right-sizing Technology for Manufacturing SMBs

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RIGHT-SIZING TECHNOLOGY FOR MANUFACTURING SMBS

HOW SMBS CAN LEVERAGE BIG BUSINESS TECHNOLOGY.
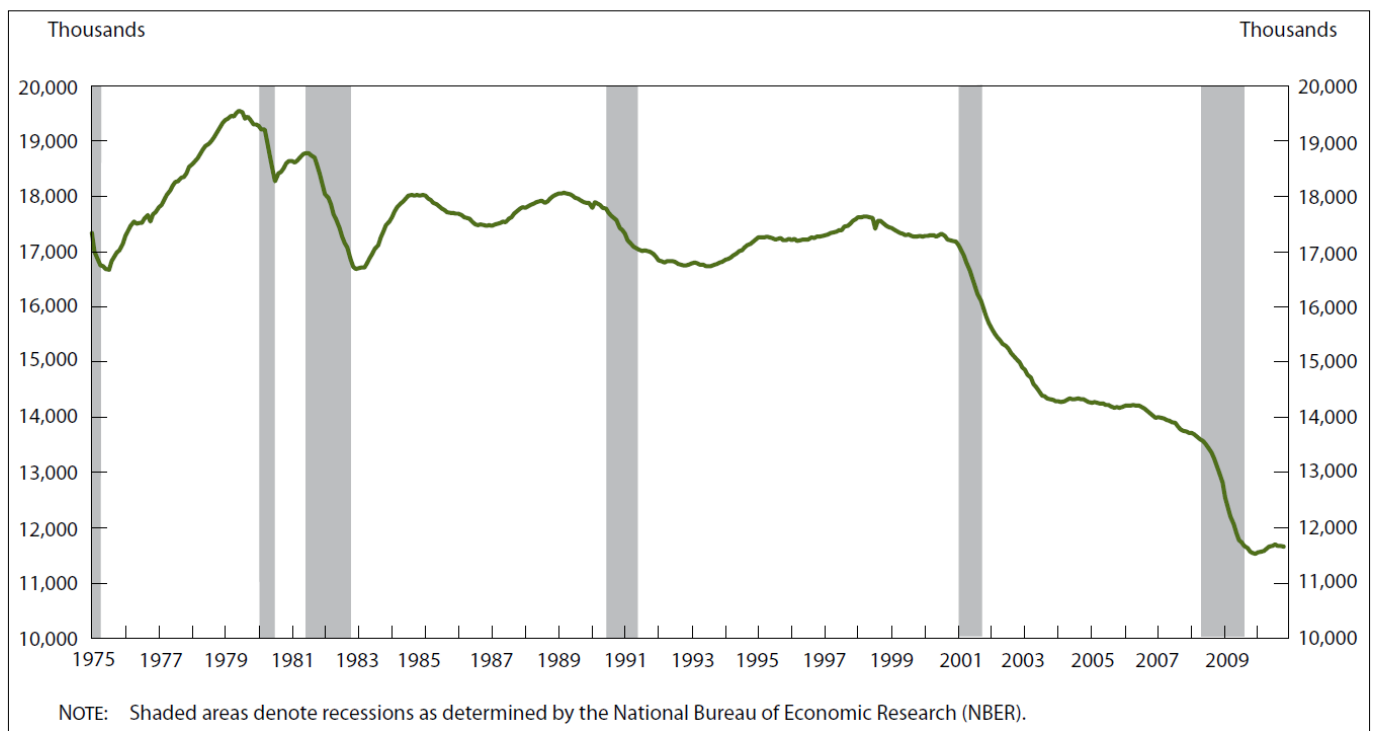
To study manufacturing is to study the health of the world. The World Economic Forum's Future of Jobs Report 2023 outlined several changes expected in the next decade revolving around how people work and what the world's employers will need for their workers.

More than 85 percent of the 803 companies surveyed in the study said that adapting to new technologies will drive corporate transformation. Big data, cloud computing and AI were the technologies at the top of the list for adoption within the next five years. The 2020 version of the survey said that respondents thought 47 percent of business tasks would be automated "in the next five years" but the 2023 survey saw that number drop to 42 percent. Overall, employers expect 44 percent of workers' skills will be disrupted in the next five years, with analytical thinking emerging most often as a core skill.

The Bureau of Labor Statistics records a forty-year decline in manufacturing jobs from the peak in 1979 after steady growth that began during World War II. This drop was particularly large during the 2007-2009 recession, with the average durable goods industry losing 11 percent of its workforce between December 2007 and June 2009.

Manufacturing employment, monthly data, seasonally adjusted.
(Source: 2007-09 Recession: Manufacturing, U.S. Bureau of Labor Statistics.)

NOTE: Shaded areas denote recessions as determined by the National Bureau of Economic Research (NBER).

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The International Monetary Fund, however, has said that this decline in manufacturing jobs might not be as bad as the numbers suggest. As the average wage grows worldwide, a shift can occur as people move from needing the bare necessities to survive toward items higher on the hierarchy of needs. Demand for healthcare, personal care and comfort goods can all point toward a more service-focused economy instead of a full-on manufacturing economy. Advances in technology can also move toward labor savings, requiring fewer labor jobs to maintain the same level of output. Even with a shift toward jobs in the telecommunication, transportation and business sectors, the workers in those fields will need equipment—often highly specialized equipment. That equipment must be manufactured, and a workforce that needs technologically advanced tools will need more advanced manufacturing methods.

The pandemic showed that the interconnectedness of the world economy made for vulnerabilities when disruptions occur. The supply chain for raw materials, remote manufacturing operations and offshore assembly was intricate and delicately balanced—and tipping that balance proved to be easy.

When disruptions occur—such as the breakdown in traveling across international borders, something all but taken for granted in 2019—manufacturing companies who needed materials from their partners were stuck. While the entire system didn't necessarily unravel, it definitely had the potential to grind to a halt. Forbes reported in July 2023 that supply chain issues are lessening and the Global Supply Chain Pressure Index is lower than before the pandemic began. These changes, however, might not take into account the damage done by the previous three years of disruption and the issues facing manufacturers today.

When Anvyl compiled its list of 7 Critical Supply Chain Challenges and Tips To Overcome Them, the item at the top was material shortages. Most of the world at home during 2020 made the demand for electronics and media—and toilet paper—soar. High demand for electronics made for cascading pressures, with demand for semiconductors, packaging materials to protect the products and the shipping and infrastructure required to get the products to consumers. Erratic demand and material availability were also issues hampering a return to normal for the supply chain because the amount of raw material available can change every day, and those changes are felt all the way downstream in the process.

Today, there exists the possibility of leveling the manufacturing playing field. Every manufacturing operation, from small machine shops to medium-sized manufacturers, plus individuals who may have never considered manufacturing as a vocation or had been denied because of where they live, can all get into the action. Any manufacturing concern, whatever its size or location, can have access to technology and talent anywhere. Manufacturers and machine shops in small towns are more able to take part in modern manufacturing than they have ever been before. Robots, automation, AI, broadband, online marketplaces and more, are making this possible.

Manufacturing gets a boost from government initiatives to make supply chains shorter, which favors local suppliers and manufacturing. Manufacturing operations, given new life, are able to provide meaningful employment to the local population. For hard-to-find positions that often don't require boots on the shop floor, manufacturers can contract for tech talent anywhere in the world. Technologies like the cloud, Zoom, chat and easy and reliable translation have made scattered teams whole and allowed them to flourish.

DIGITAL TRANSFORMATION AND THE MANUFACTURER AS A DATA COMPANY

A machining robot at work.
(Image: Dassault Systèmes.)

Michael Buchli, a manufacturing expert at Dassault Systèmes SOLIDWORKS, was trained as a manufacturing engineer and has worked in a variety of manufacturing positions during his career. He now works to help customers and partners navigate the transition to a more digital manufacturing landscape, Industry 4.0 and smart manufacturing. Buchli has great ideas about how companies currently operate and how to successfully complete a digital transformation.

"The biggest piece that companies miss when making the jump to an Industry 4.0 environment is the software and technology," Buchli says. Buying a robot and placing it on your factory floor doesn't mean that you've entered a fully digital environment. At its base function, a robot is a fancy screwdriver that needs to be told when to turn, how many degrees to turn and the torque required during that turning operation. The software and processes that will control that robot need to be operating from a comprehensive data mindset and making data-driven decisions will in turn make the organization more efficient. Upgrading the existing hardware will not bring a company to the next level if the company's culture and systems are not fundamentally changed, as well.

A manufacturer who wants to move toward digital transformation would traditionally start by talking to hardware dealers. Suppliers who sell robots, machining centers or assembly systems will tell the manufacturer that their new top-of-the-line equipment will spark digital transformation. The issue that isn't addressed is the lead time between the agreement and contracts being made, and the equipment on the factory floor being powered up and ready to use in production.

The manufacturing and economic landscapes might see major shifts in that time—new taxes or tariffs can be added, political conflicts or wars can change trade between companies or regions and material availability changes almost daily. Machine tool companies will tell you that upgrades will boost efficiency by ten or fifteen percent, Buchli says, but that boost comes under ideal conditions. If the only thing that changes on the factory floor is an equipment upgrade, the existing issues with systems or processes will still be there hurting efficiencies and dragging down the bottom line.

(Stock photo.)

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Buchli says, "taking the existing equipment on the factory floor and doing an honest deep-dive of the current processes and policies can have a larger impact without the added cost of new equipment." The people part of the process can be the most difficult part of a manufacturer's digital transformation. Every machine shop has its own completely unique culture and identity, and even different shops in the same organization can be different based on leadership and culture. Many manufacturing environments are full of people who've been in their positions for a long time and are used to the way things have always been done. Tribal knowledge and segregation of responsibilities can stand in the way of a digital transformation.

Truly becoming a digital manufacturing space means that all of our best practices and knowledge need to be shared with everyone and available in one accessible spot. Traditional manufacturing thinking can sometimes mean keeping the knowledge you have and making sure that a worker can stay at their current level without having to change or adapt. New hires often have a higher level of computer skills and familiarity with the digital world but there is a hesitation to give them more responsibility.

Moving to a more digital landscape can shine a light on skills gaps within the company and that can make those resistant to change very uncomfortable. A young engineer might not be interested in starting at the bottom, sweeping floors and getting 'manufacturing exposure' the way many older engineers did. Graduates coming out of engineering, technology or manufacturing programs have been working with robotics, computer numerical controls (CNC) and other technologies for years. Older engineers might not want these young engineers to advance right away and threaten job security and younger engineers might not want to start at the lower apprentice levels when they feel trained and ready to do bigger things. These younger engineers leaving to find other opportunities will only widen the skills gap.

Beyond the issue of the skills gap, there is also the issue that manufacturing has faced for decades: the idea that fabrication and making things has to be done in a dirty, oily, loud and smelly factory. Anyone who has toured even a mid-tier factory in the last ten years can tell you that manufacturing environments are bright, clean and give off a vibe of advanced technologies and high efficiency.

The manufacturers who have made the digital shift today are companies that are data driven. The parts being produced are a byproduct of the smart decisions being made in the digital realms. Going into business without focusing on the data will cause a manufacturer to be beaten by companies doing the same thing, except smarter and quicker.

Companies working within outdated cultures might do quoting, for example, based on gut feelings instead of using analytics. This method might have worked with raw material or sub-assembly quotations that were valid for thirty days and the industry saw little disruption. The environment in 2023 is much more likely to have material quotations be good for twenty-four hours and require constant monitoring. Gut feeling quotes might also use an overhead rate from ten years ago because that's how it's always been done, but the addition of new upgraded machines and highly trained workers means that the overhead rate is much higher. Understanding the data being generated by the equipment, workers and the interconnectedness of the organization will lead companies to a much more accurate system of quoting new work.

Buchli points out that other companies might not have a full understanding of month-to-month expenses and profit but feel good about their financial standing because they're in the black every month after payroll and expenses. This type of operation isn't decision-driven but fits the model for many organizations.

It's easy to get stuck in the mindset of knowing that a change is needed but not knowing what to change, how to change or who can help with the changes. This leads the organization to go and talk to hardware companies, who inevitably will tell you that you need new and upgraded hardware and equipment. Buying new hardware and software tools without fully understanding the needs of the organization and its partners up and down the development cycle is not the way to make a digital transformation.

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THE BENEFITS OF A DIGITAL TRANSFORMATION
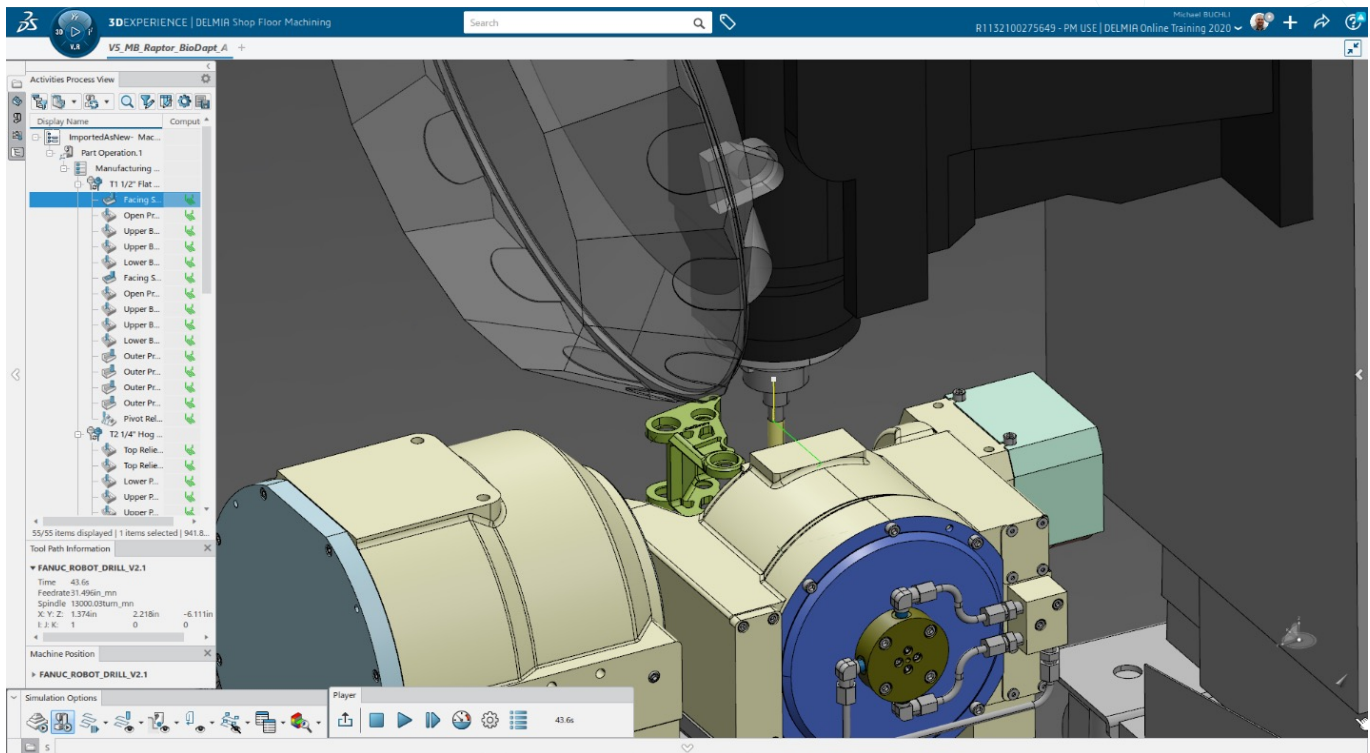
A digital transformation allows a simulation of manufacturing operation.
(Image: Dassault Systèmes.)

No two manufacturing companies are the same. Buchli and Dassault Systèmes' method of helping manufacturers move to data-driven organizations is to help provide a solution. The simplest solution is sometimes just an understanding of what is possible. Every journey is different, but having the best tools possible will help manufacturers to make the best decisions.

Two companies making the same part can have wildly different processes to do what is essentially the same task. "The part is the conduit through which a manufacturer gets paid, but the journey is completely personalized for everyone walking through that conduit," remarked Buchli.

Adopting Industry 4.0 and smart manufacturing first requires the manufacturer to understand where they sit in terms of progress. Are you at the planning and investigating stages, or have you already bought automation equipment and are now trying to figure out how to best use that equipment? Those two different situations will require completely different approaches to make the company more successful.

Data platforms are becoming more popular because all of the data generated by robotic welders can exist in the same place as data coming from CNC turning stations. Ten different problems might be solved by purchasing ten different machines, but if there isn't some direct connection between the data from all the machines, then a manufacturer can't leverage that data to make good decisions. Having your real-time process monitoring and enterprise resource planning (ERP) in the same place as your CNC set-up sheets, robot programming algorithms and CAD files can provide decision-makers with a full comprehensive picture of how the business is run.

Dassault Systèmes SOLIDWORKS sees its place in this transformation space as first listening to its customers. With the 3DEXPERIENCE Works portfolio, the company selected the specific solutions from throughout the DS ecosystem that could help solve problems throughout the businesses of SMB manufacturers.

It all starts with asking the right questions. What is the company's current state, goal state and what are the current obstacles blocking that journey? The second phase is using the experience and knowledge gained from an extensive customer base to help understand what an organization's least painful path can look like.

Even though every company is unique, the problems and obstacles facing one company probably aren't completely isolated. This means that any company can make the leap to digital environments and become more agile and competitive, regardless of the number of employees or the yearly sales revenue.

THE ADVANTAGES TO BEING AN SMB OR STARTUP

Startups and small-scale manufacturers can benefit from a digital transformation and start from a completely clean data position. Before bringing in equipment and employees and different constituents, the data platform can be chosen to start without baggage. A brand-new company can start with the best available technology, and that availability could mean cutting-edge technology or just the equipment that best fits that company's budget at that moment in time. Choosing a CAD tool, a simulation tool and a method for programming equipment can happen at the beginning of a company. When growth opportunities happen, the new machines and factory space can be pulled under that same data platform and incorporated using the same data-driven processes.

This is a huge advantage over larger companies who have decades of processes in place and the artifacts that come with age. Manufacturers started with two dimensional drawings, transitioned at some point to microfilm machines, 2D CAD models and then parametric 3D CAD models. These data sets along with manufacturing set-up sheets, service manuals and financial reporting documents are all sitting in different file formats and waiting to be compiled and digitized. Transforming to Industry 4.0 can be a lot harder for a large company because it will need to decide what data needs to come into the new system and what can be left behind.

The shift to a digital operation for a company can be compared to the shift from 2D to 3D CAD. Three decades ago, product design and development primarily used paper or Mylar drawings to communicate ideas and requirements. As the industry standard for exchanging information, assembly drawings and set-up sheets were drawn, copied and sent to an engineer's team members. The time required to physically send the data could cause issues for different constituents, and errors could be compounded while waiting for a new revision print of a component or assembly.

Email and the Internet made the transmission of ideas and changes much faster, but the advent of 3D parametric CAD brought even larger benefits. Building components and models in the virtual environment is faster for operators with good spatial visualization skills, and newer generations of CAD operators and modelers were much more comfortable interfacing with screens all day instead of paper. The option to use paper drawings to communicate ideas is still available and some manufacturing engineers choose to work primarily from drawings. But overall, parametrically modeled assemblies and layouts are now used to send information to constituents both up and down the design stream.

If Industry 4.0 is that same level of technology jump, then a new company with an injection mold machine and two employees can have the same advantages as a giant electronic parts manufacturer. Even cloud computing can be leveraged to help smaller companies. Many manufacturers look at cloud computing as an efficient way to develop components and processes, but at its core it can be a strong data transmission tool.

Another benefit of cloud computing is security, Buchli says. Small and medium-sized manufacturers can be constantly attacked by ransomware and malware issues; with cloud computing, the security risks can be pushed to the cloud providers where the servers reside. Smaller companies might not have a dedicated IT person because of the associated cost, but that security cost can be easily folded into the cloud service contract. On a data platform, especially a large-scale data platform like the 3DEXPERIENCE platform, customers of any size can operate knowing that a full department of IT professionals is keeping current on hacking techniques, and methods to make the cloud connection safer.

An engineer building a factory layout might require data from several sources. The product being fabricated, the custom-built tools being used by the operators or robots to fabricate the product and the assembly cell manufacturer's components all might come from different CAD formats or file types. Having all of this information in one central location makes the process much easier for the engineer, who no longer has to request files from three different cohorts and go through approval and transmission processes. Another engineer programming that robot can access the factory layout and zoom through to only the part of the layout that is important to the task at hand.

Working through a platform helps more than just the engineering side of the enterprise. When marketing personnel have access to the same visuals as the CAD designers creating the components and assemblies, better images and campaigns are created. Industrial engineers pull the exact part number information from the platform to show operators how the components should be fabricated and assembled. Financial analysts using predictive tools can make better forecasts of part numbers that will be needed for perishable tooling and replacement parts for robots and assembly lines. When the entire enterprise has the same data available in one safe, unified place then errors are lessened, and efficiencies are found.

Another benefit of this data platforming is its portability. The engineer doing the assembly line layout doesn't need to be in the same city or country as the manufacturing plant. The engineer programming the robot might even be in a different time zone.

Small to medium-sized manufacturers are hit with a lot of different challenges today. Inflationary pressures, employee costs, skill gaps and hackers can all cut into the bottom line. Smart companies can partner with companies that have the resources to help when your small to medium-sized company doesn't have the bandwidth to perform those specific functions. Instead of worrying about employees that can act as marketing, payroll, shipping logistics and quality control, a small company that leverages their data wisely can perform these responsibilities with less resources and manpower.

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