DIGITAL TRANSFORMATION IN MANUFACTURING INDUSTRIES

MANUFACTURERS URGENTLY NEED TO EMBRACE THE DIGITAL AGE

A key to excellence for manufacturers has been their focus on reliability, incremental improvements, and close relationships with customers. However, the next era of competition will be digital, and that will entail change in everything from sales team management to designing products. Manufacturers will sell solutions, as well as metal. Development will be carried out by agile, risk-taking teams. And managers will have to trust data and analytics, where once they relied on people.

To succeed in the new age, manufacturers will need to step out of their comfort zones to learn new habits, acquire new talent, and build out a set of digital capabilities to implement organizational transformation (see Exhibit 1). Effective digitization will not take hold with piecemeal change, like when a robot speeds up a particular factory operation. Instead, the benefits of the transformation will come from new connections between disparate parts of an organization, ending silos, and facilitating real-time collaboration. The rewards could be big: Oliver Wyman estimates digitization could yield $1.4 trillion in margin gains for manufacturers by 2030.

One way for manufacturers to get there is by pushing digital methods at strategic pressure points. These can range from a central team giving digital advice to business units, to placing digital experts in each unit in order to push change faster (See box on page 8). The right model will depend on the individual manufacturer: How effectively they implement change will determine whether or not they thrive – or even survive – as manufacturing goes digital. In particular, there are four critical areas that company leaders must pay attention to.

ANALYTICS EXPERTS NEEDED

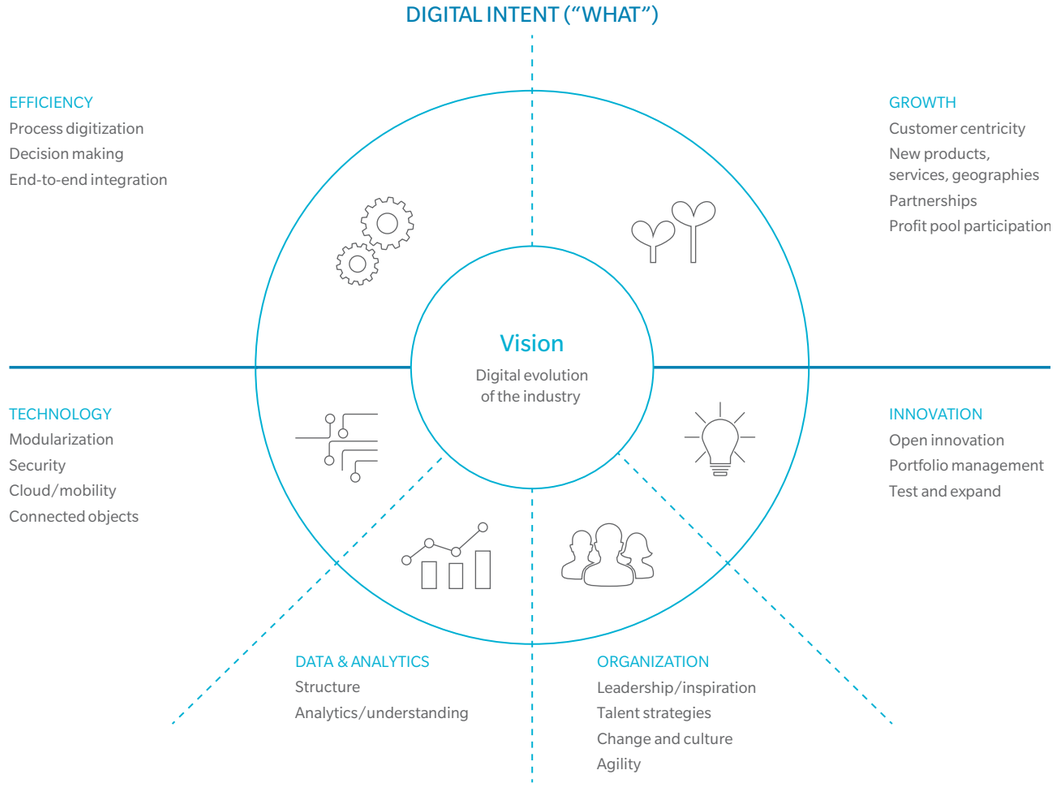
One of the big digital contributions to manufacturing will come from new ways of using data. But many industrial companies, especially those selling to other businesses, have made little use of data analytics, which applies most naturally to the large-volume transactions of the consumer world. Instead, they rely more on experience and human judgment. In the digital era, they need to acquire the skills to manage highly connected machines and the data these produce. For example, data analytics can interpret the gigabytes of data generated each hour by sensors on a jet engine fuel pump, and compare its performance with data models and other pumps in the fleet. An alert can then indicate that a specific pump might need to be replaced sooner than usual to avoid potential malfunction.

To take advantage of these capabilities, manufacturers will have to recruit new types of employee with the relevant skills. These staff members will understand the content and value of existing data pools, and will be able to handle large amounts of data. They must also be able

MANUFACTURERS WILL NEED TO STEP OUT OF THEIR COMFORT ZONES

Exhibit 1: The digital wheel
How digital plans and digital capabilities interact

DIGITAL CAPABILITIES NEED TO BE BUILT OUT TO EFFECTIVELY TRANSFORM THE COMPANY IN ORDER TO ACHIEVE DIGITAL GOALS



Source: Oliver Wyman

to apply sophisticated analytical techniques to data, including making full use of off-the-shelf analytics software. Management must develop the confidence to trust these insights and act on them. Firms will also have to train existing staff. Manufacturers are often located far from wired-in big cities, and many employees have spent long careers in the same company. Both factors will make the digital transformation that much harder. But eventually, the whole company needs to be on board and get used to working in new ways.

NEW THINKING, NEW PRODUCTS

The digital age will revolutionize products and how they are made, so staff will have to think differently about every aspect of their work. Currently, makers of machinery – say, equipment that packages products in a factory – often sell those machines along with post-sales services such as maintenance. In future, using digital tools, they will sell solutions for their customers' businesses, such as an improvement in packaging speed or quality.

THE CHIEF DIGITAL OFFICER – A NEW ROLE FOR A NEW ERA

Industrial corporations need a dedicated chief digital officer (CDO), a senior-level executive charged with the planning and execution of digital change. The CDO is in a better position than the chief information officer (CIO) to evaluate the organization's status: He is able to look at an organization from the outside. Given this perspective, the CDO can produce a vision for radical transformation and come up with a plan for implementing organizational change, including establishing new roles and allocating resources differently. The CDO needs to understand the company's various businesses, as well as its functions and how they interact. Also essential to the role are strong relationships within the organization, in the wider industry, and with external visionaries. This person must have a proven track record at implementing large-scale change – and being capable of thinking outside the box and in several dimensions. At the same time, the role demands mastery of digital trends and disruptions, mixed with creativity and startup skills. The CDO must promote digital leadership throughout the organization to generate momentum for cultural change. Moreover, the role is likely to be a temporary and come with an expiration date: If the CDO has done his job right and managers are thinking more digitally, then it is probable the CDO will no longer be needed.

One characteristic of the digital world is that agile development processes run on the test-and-learn principle. In a sprint cycle, for example, a development team is presented with a list of product improvements to achieve in a set time – often between one and four weeks. The updated prototype is then presented to the project manager, who provides feedback to start another sprint cycle (see Exhibit 2). This is a completely different attitude to what prevails in physical-world engineering, where less-than-perfect products can lead to critical failure, and flaws "in the metal" require lengthy reworking and testing.

Eventually, the test-and-learn process may turn out to be applicable to physical products too – not by simply imitating digital procedures, but by adapting aspects of this technique. But for now, manufacturers must house both traditional processes – linear, slow, risk-averse, and in-house – and projects where pace is more important than perfection. Another way to appropriate more digital thinking is to hold external competitions for ideas and solutions: crowdsourcing techniques maximize the number of brains at work on a problem; hackathons, with a prize for the best solution after a day, can also yield solutions quickly.

THE DIGITAL PLATFORM

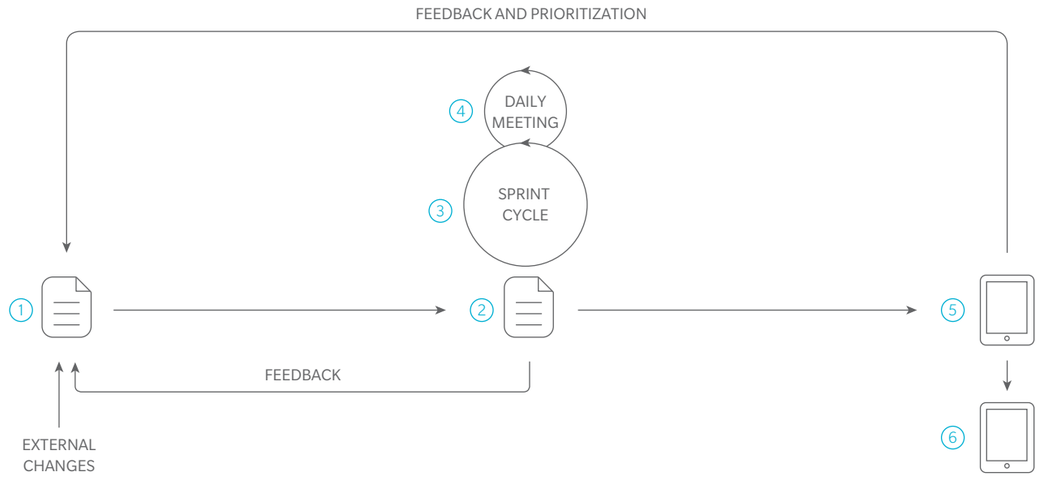
Innovation and digital solutions will rest on new, agile IT systems whose primary tasks include providing insights. This digital platform will need to work alongside legacy IT systems, which will be tasked with creating records, as retooling these would take too long.

The new system will handle vast quantities of complex data, which will be scalable and accessed via the cloud. Manufacturers will want to share information with other corporations, such as their customers. This can be done by integrating application programming interfaces (APIs) that open up a company's digital services. The data will often be unstructured: it will be gathered from plants and machines, describing physical phenomena such as how a machine is operating; or from social media, where customers might leave verbal comments. That means the volume and degree of complexity of the data will be far greater than in the past. The information and automated reactions will fundamentally change manufacturers' relationships with their customers, bringing them direct, real-time links via connected devices and sensors that report specific needs.

Exhibit 2: Agile product development
Digital products can be engineered through new, faster processes

AS PRODUCTS ARE INCREASINGLY "DIGITAL", AGILE ENGINEERING IS EMERGING AS PREDOMINANT ENGINEERING PHILOSOPHY, SUPPORTED BY PDM/PLM

ITERATIVE DEVELOPMENT PROCESS



1. **PRODUCT BACKLOG**
   List of prioritized product requirements which can be updated or changed at any time during the development process
2. **SPRINT BACKLOG**
   Derived from the product backlog the sprint backlog is a list of tasks that must be addressed during the next sprint
3. **SPRINT CYCLE**
   A time period (typically 1– 4 weeks) in which the development team works on the current task contained in the sprint backlog
4. **DAILY MEETING**
   Time boxed meeting (usually 15 min) that allows the team to discuss their work focusing on current progress, planning and challenges
5. **PROTOTYPE**
   At the end of a sprint cycle the functioning of the prototype is presented to the stakeholders
6. **FINAL PRODUCT**
   The process is repeated until the final product meets all requirements of the product backlog

ADVANTAGES

- Frequent evaluation of current progress allows for timely changes
- Details and product requirements can be changed without any significant time delays in the next cycle
- Sufficient transparency of current requirements and tasks through the product and sprint backlog
- Documentation is kept to a necessary minimum

Impact:

Lower development costs

Earlier testing and integration

Better quality products

Source: Oliver Wyman

Another capability of the new IT system will be to support simulation techniques such as digital mock-ups and digital twins. These are the digital equivalent of architectural scale models, and enable tests and trial runs to be carried out on a ship, car, or factory before they have been built. Only when a nearly flawless version has been developed through test-and-rebuild cycles will the product be constructed in the real world. In cases such as a manufacturing plant, the digital twin can be updated throughout the plant's lifetime, so that all changes made – servicing and the addition of spare parts for example – are documented, and the twin is always up to date. This approach is already revolutionizing the construction industry, where it is known as building information management (BIM).

However, a large firm with an established corporate culture cannot change its working methods overnight. The new digital capabilities will need to be built separately from legacy systems in a parallel organization, and the company will have to operate a dual system, with digital technology kept separate from the legacy system, at least initially.

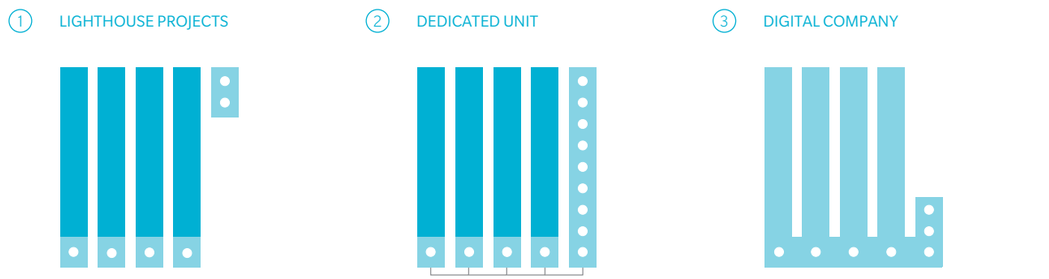
PUTTING IT ALL TOGETHER

Managing an organization with one foot in traditional manufacturing and the other in the digital world will require new roles, such as "content authorities" – experienced managers who can quickly make judgment calls about the feasibility of new ideas. "Tweeners", who understand both business and the uses of digital technology, will act as mediators between these initially separate worlds. Once the digital world has gained critical mass, it can be integrated with the legacy business – or absorb it.

In the end, all parts of an organization will be connected to a common digital backbone that drives faster data exchange and decision making. It will be possible to do some of the work remotely or virtually, presenting an opportunity to attract talent in regions far from the physical headquarters. Work and resource allocation will center on nimble project groups instead of organizational charts and job descriptions. These pods will be able to react to external changes and deliver new innovations much faster than traditional structures. Digital culture and skills will be imported through partnerships with specialized firms or institutes – though the fragmented nature of manufacturing means that it tends not to attract as many digital startups as consumer industries do. Other agents of change may be as mundane as a casual dress code or a new office layout incorporating table soccer.

Exhibit 3: Turning an organization digital
A number of different structures can help introduce digital change

A PROGRESSIVE APPROACH USUALLY STARTING WITH SPECIFIC PROJECTS



Source: Oliver Wyman

MANUFACTURERS SHOULD PLANT DIGITAL SEEDS IN STRATEGIC PLACES IN THEIR ORGANIZATIONS

THE JOURNEY

To get things moving in these four areas, manufacturers should plant digital seeds in strategic places in their organizations. There are at least three models for this (see Exhibit 3). First come lighthouse projects. A small, central digital team defines the company's strategic direction and provides groups of digital experts to guide each business unit. The projects themselves are staffed by the business units, making them narrower in scope – but their relative lack of complexity means higher odds for an earlier success.

A more ambitious approach is the digital hub, where a larger-scale digital organization inside the corporation sends more formal groups of digital experts to the business units. They form part of the staffing for projects, and have a correspondingly greater impact on the digital transformation.

A third approach is the digital corporation. Like the digital hub model, this has a large central digital organization. But far more digital experts are placed in the business units, switching the whole corporation into digital mode as fast as possible. The magnitude of the change means that this will require greater internal effort and have a greater chance of failure – but also the greatest potential for impact.

These methods have helped large firms in other sectors, which arrive in the digital age carrying their own, unique legacy baggage. A number of big European banks, for example, have picked versions of these models as they try to fight back against new, high-tech entrants trying to grab some of their business.

What transpires will depend on the archetype for digital transition that the company chooses – lighthouse project, digital hub, or digital organization. To drive this transformation, leadership needs to set the tone for a culture that values speed, responsiveness, and change. Leaders need to be open to new ideas, adapt quickly, and encourage different cultures in different parts of the organization. They need to move from command-and-control mode to principle-based leadership, where they set principles and objectives – and let the new teams find the paths to reach these.

Digital disruption has kept its distance from manufacturing till now, but it wasn't just being polite: applying digital techniques to the physical processes and sales methods of engineered products was complicated. But the technology is finally ready – and manufacturers need to be ready, too.

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