

PERSPECTIVES ON MANUFACTURING INDUSTRIES

2016/1

DIGITALIZATION HAS FOUND ITS WAY INTO THE MACHINERY AND PLANT ENGINEERING INDUSTRY AND THE CONCEPT OF “DIGITAL INDUSTRY” HAS BECOME TOP OF MIND.



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and Manufacturing Industries Practice

DEAR READER,

Digitalization has found its way into the machinery and plant engineering industry and the concept of “digital industry” has become top of mind. Only a few companies, however, have a clear idea of what digital industry could do for them. Contrary to common belief, it is not primarily about technology. Technology will enable better decisions, more efficient processes, and new business models. But the greatest value to be had from digital industry lies elsewhere, as discussed in our cover story.

In the “Digital Perspectives” section of the journal, we also discuss how digitalization is leading to new risks – such as industrial cyberattacks – and how manufacturers can tap the power of digitalization in other areas of the business beyond production.

What can manufacturing companies learn from the video gaming industry? How can they increase their project profitability in the long term? And how should activities be allocated to support functions to increase earnings? These and other questions are examined in the “Operations” section, as it is crucial that manufacturers stay on top of operational profit levers as they evolve. Finally, it is essential that manufacturers get and stay involved with young people if they are going to build the highly skilled talent pipeline they will need to meet the industry’s future challenges.

I wish you a thought-provoking read.

Best regards,

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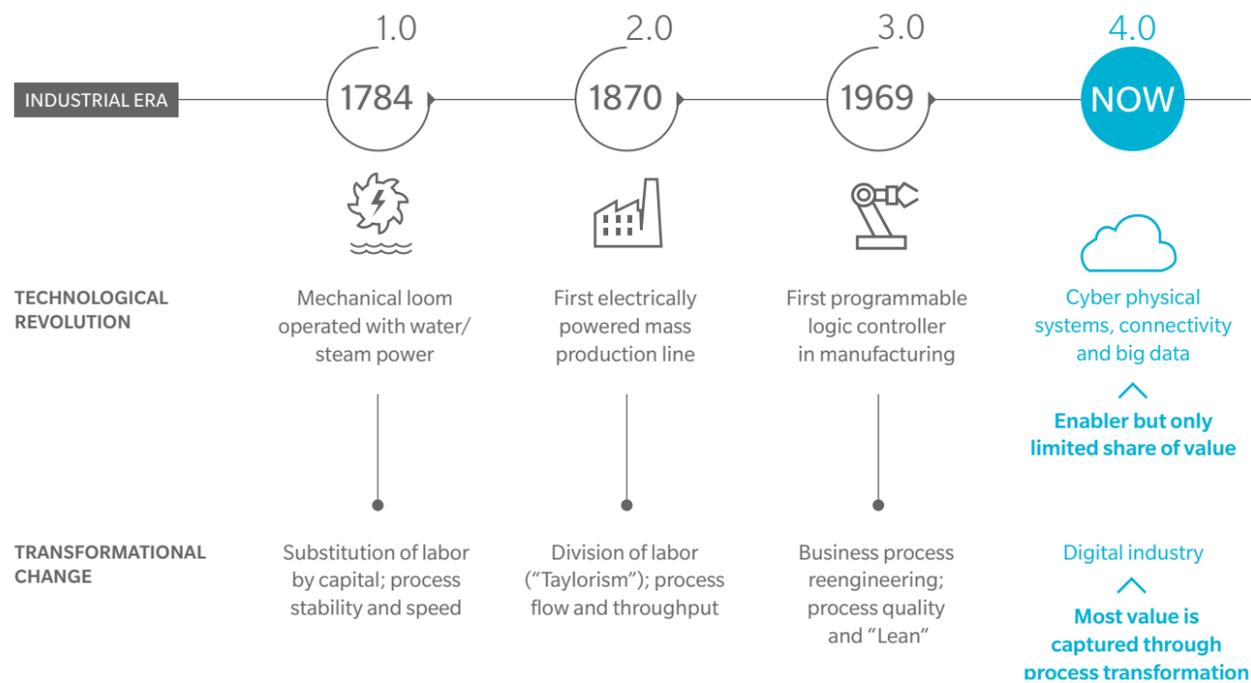


DIGITAL INDUSTRY

THE NEXT INDUSTRIAL REVOLUTION

Contrary to common belief, “digital industry” is not about technology. Technology will be an enabler, but the true value of the next industrial revolution is that it will lead to better decisions, more efficient processes, and new business models. Digital industry will dramatically transform the way industrial companies operate, with results over the next 10-15 years comparable to the introduction of mass production at the beginning of the twentieth century and to lean and reengineering toward its end.

Exhibit 1: The evolution of industry



Source: DFKI (German Research Centre for Artificial Intelligence), Oliver Wyman

The next generation of production technology is just starting to be rolled out: big data analytics, virtual environments/simulation software, broader connectivity, collaborative robots and connected objects, machine-to-machine (M2M) communication, and new manufacturing techniques like 3D printing. This wave of innovation is all part of what is known as “digital industry.” In terms of value generation, however, a recent Oliver Wyman study projects that the hardware and software will matter less than the “application layer” – the business models, processes, analytics, and decision making that this technology will enable. This is not a new pattern: In the three prior modern industrial revolutions, novel technology triggered a fundamental change in the way industrial companies operated (Exhibit 1).

Most of the value of digital industry will be realized outside of the production area. Production will of course be enhanced, but more importantly, digital industry will give rise to a second generation of “lean” over the next 10-15 years and impact processes like planning, pricing, maintenance, research and development (R&D), and product launch. Oliver Wyman predicts that the global annual margin impact of digital industry across

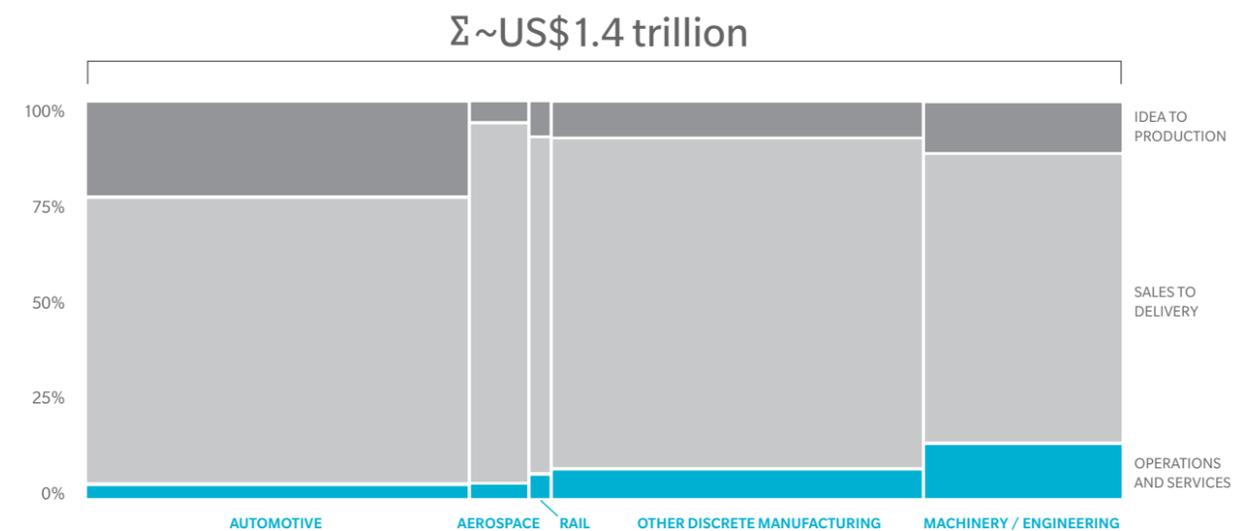
discrete manufacturing in 2030 could be an estimated US\$1.4 trillion (Exhibit 2). The automotive sector could see the highest absolute value impact, while aerospace and rail rolling stock manufacturers could see the largest relative change.

DIGITAL INDUSTRY PROCESS LEVERS

As shown in Exhibit 3, this cumulative value will be unlocked by the wide range of levers that are becoming available to manufacturers as a result of digital industry. Demand forecasting and intelligent pricing is the largest lever, representing margin impact of up to US\$600 billion

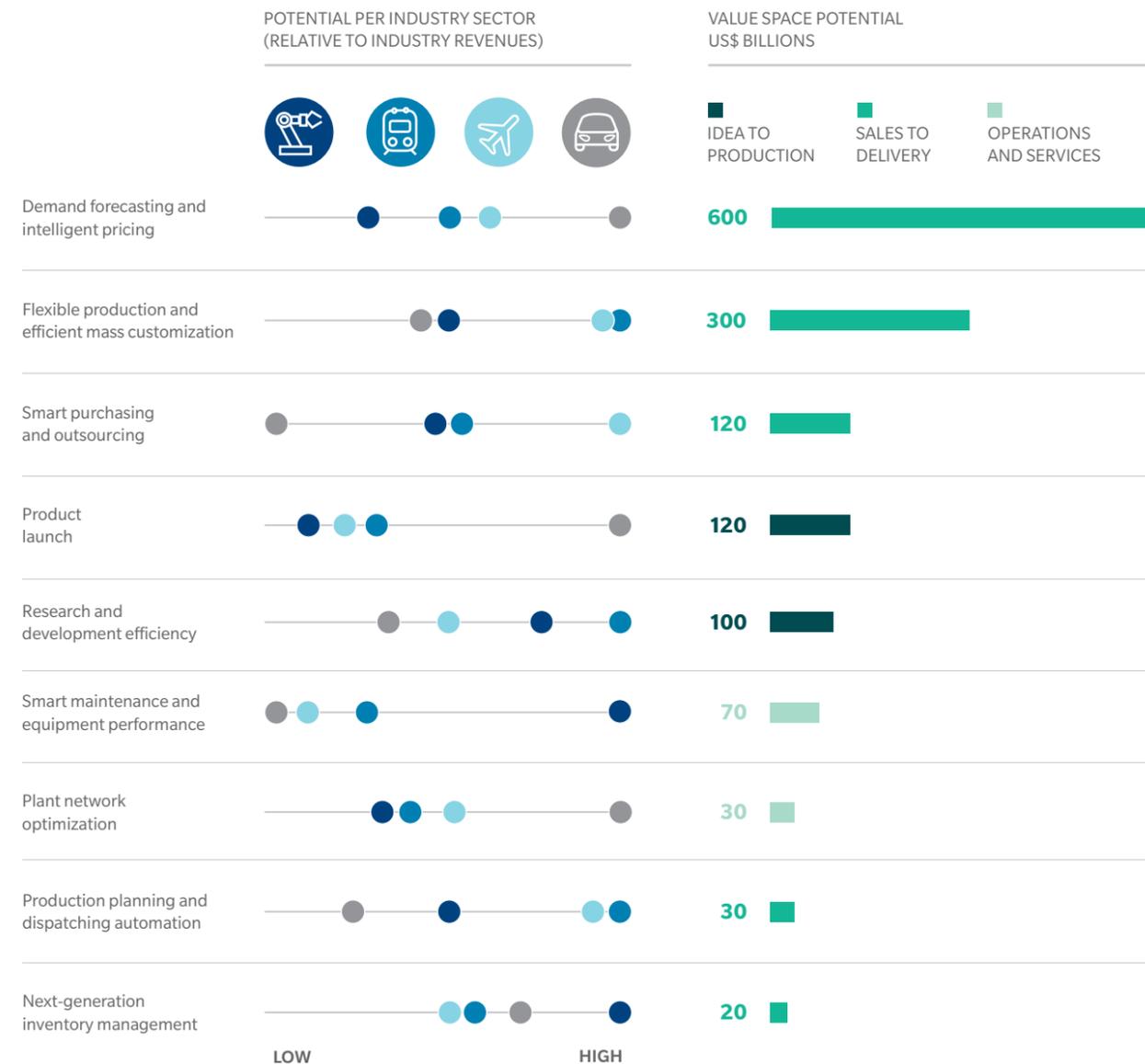
As an example of how this lever could impact industry in a few years, automotive original equipment manufacturers (OEMs) will be able to forecast future demand in real time by analyzing a wide swath of data: online configurations by customers, current and past orders, customer interactions, discussions in online forums and social media, etc. As a consequence, market research, sales planning, production planning, and scheduling will need to be redesigned, with many tasks becoming obsolete. Built-to-stock vehicles will be

Exhibit 2: Potential for digital industry in 2030 (additional annual margin)



Source: Oliver Wyman analysis, OECD, World Bank, United Nations

Exhibit 3: Potential for digital industry in 2030



Source: Oliver Wyman

configured based on real-time data and analytics, not on estimates by individual dealers. OEMs will be able to run yield management based on real-time data, bringing up plant utilization for underutilized plants significantly. A more differentiated pricing model also could be run using real-time data to optimize margin and utilization.

Not surprisingly, more flexible production and mass customization also could deliver some US\$300 billion

in margin impact. In machine engineering, for example, small or individual lot sizes will be handled just like regular series production, based on 3D models, simulation, flexible systems, and fully integrated end-to-end data flows. Integrated rework of non-quality parts within the regular production flow will be enabled based on M2M-communication and embedded product and machining information (e.g., quality and rework data).

In addition, real-time simulation and feedback loops between shop floor and engineering will ensure a seamless production flow and avoid slack.

Improvements in product launch and R&D efficiency could contribute US\$220 billion in margin impact. As an example, in the rail industry, development of product functionality (in terms of mechanical, electrical, and software components) is often a “siloeed” process. Paper-based drawings are still somewhat common and physical prototyping requirements for new tools and products are significant. Digital industry will result in a more effective R&D process, such as structured analysis of train operating data and concurrent mechatronic engineering between manufacturers and suppliers leveraging digital models. Less physical prototyping will need to be performed due to digital modeling and the availability of virtual tooling and testing environments.

IMPACT ON MECHANICAL AND PLANT ENGINEERING COMPANIES

Digital industry also will enable machinery and engineering firms to evolve their business models. In our study, we identified four concrete value spaces around internal processes, after sales, customer value proposition, and optimization software.

Internal processes: Similar to process levers, internal processes can be digitized. While some will argue that this is a more evolutionary process and in line with increasing automation and IT support over the past few decades, the potential to fundamentally redesign processes should not be underestimated. Integrating formerly disjointed processes will be key, rather than optimizing existing processes. In the long run, this will lead to a fundamental transformation of how engineering firms operate.

After sales: Mechanical and plant engineering firms can give a boost to their after sales business models. Many firms currently add product features and services based on their current model of a strong focus on remote service and preventive maintenance. But in the future, failures will be more predictable and avoidable, thanks to full connectivity, real-time condition monitoring, and superior analytics. Technicians will know in advance what needs to be done and can arrive with the right spare parts (possibly 3D printed). And parts can be priced based on real-time price elasticity and market data. Nor will the after

>90%

OF INDUSTRY SENIOR EXECUTIVES CONSIDER DIGITAL INDUSTRY AS AN IMPORTANT STRATEGIC TOPIC; 40 PERCENT SEE IT AS A “TOP THREE” TOPIC ON THEIR STRATEGIC AGENDA.

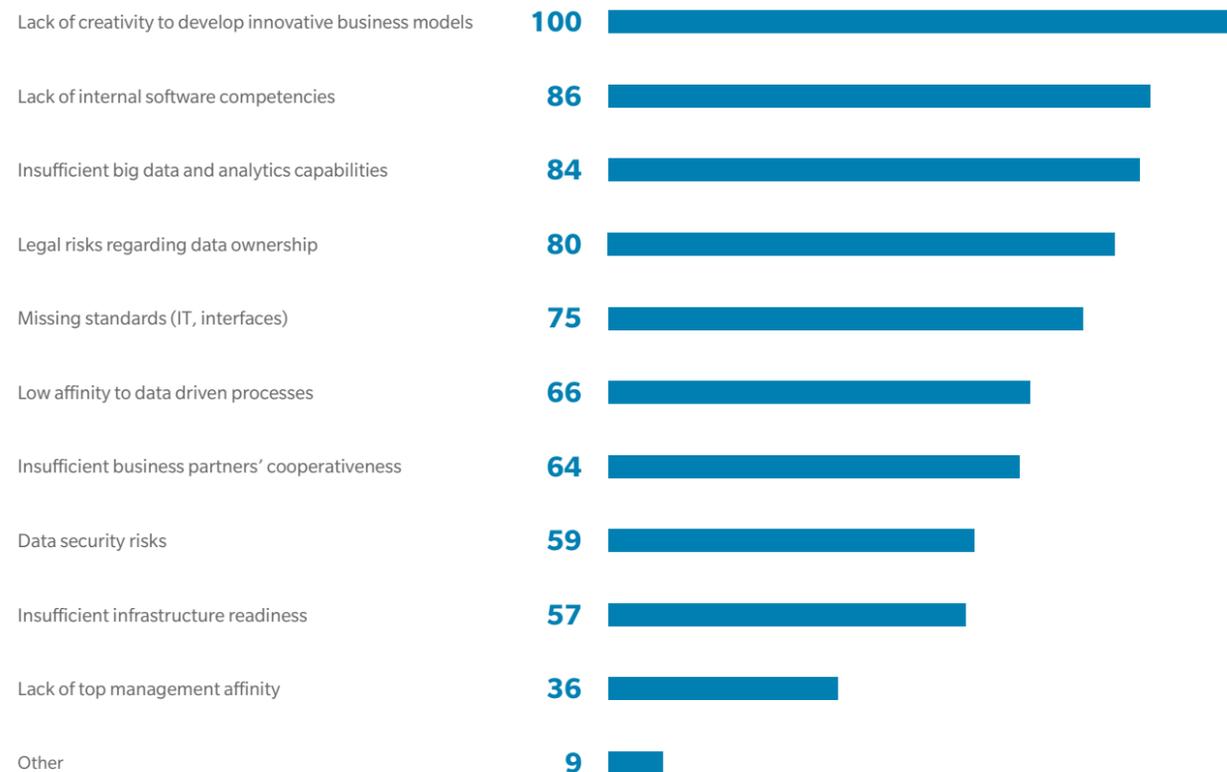


sales business model be constrained to just traditional maintenance, repair, and spare parts. Increasingly, the threshold to actually optimizing how machines are being operated by the customer will be crossed using operational data. This will open the door to new commercial agreements involving uptime/performance guarantees.

Value proposition: Some companies will be able to introduce more comprehensive value propositions to their customers, by leveraging their superior application knowledge to offer a complete “process in a box,” including not only production equipment but also the overlying control system and best-in-class optimization algorithms. This opportunity is particularly large for engineering firms with smaller, less sophisticated customers or customers with many operational facilities. Early examples of this can be observed in the areas of automated mining pits and automated farming.

Another example is a manufacturer of woodworking machinery, which now provides digital industry solutions to its customers in kitchen and furniture manufacturing. The solution’s front end includes a 3D model that a customer and sales representative can use to design a custom kitchen. The order data is then automatically transferred to a “lot size one” production line that manufactures all of the components for the kitchen according to the customer’s specifications.

Exhibit 4: Potential obstacles to digital industry evolution (index)



Source: Oliver Wyman survey of leading German manufacturing companies

Quality control is automated as well, with defective parts repaired or remade. Finally, all parts are automatically packaged and scheduling is automated to optimize delivery costs.

Optimization software: Finally, there is an opportunity for some companies with superior knowledge and data regarding their customer industries to engage in the development of optimization software for customer operations – even independent of and beyond the processes traditionally covered by their machines. Creating such software would of course mean moving into a new role and developing new skills. Thus we anticipate this move will typically involve the acquisition of existing or start-up firms with software experience.

AND THE WINNER IS?

As the above examples demonstrate – contrary to what is often portrayed in the press – incumbent machinery and engineering firms and established software players in product life cycle management (PLM), enterprise resource planning (ERP), and automation are likely to be among the winners as the digital industry evolution takes hold. Industrial applications are too small and fragmented to be relevant to mass consumer market-driven e-commerce/online giants. And so just as Microsoft did not win in “open automation” in the 2000s, Amazon and Google are unlikely to win in the digital industry B2B environment in the 2020s.

To what extent however established mechanical and plant engineering companies can access critical value spaces will depend on many factors. In general, we expect all companies to participate in some way in the first two

value spaces – digitizing internal processes and boosting after sales business models. But the concrete levers to maximize the value realized from these spaces will differ from case to case and depend on factors such as customer structure, product complexity, volume of production, market position, etc. Component manufacturers will have different priorities than machinery companies, which will again have different needs than plant engineering companies.

The third and fourth value spaces – “process-in-a-box” and optimization software – likely will be accessible only in specific circumstances. But where these spaces can be leveraged, they could be game changers for a company’s business model and growth prospects. Of course, exploiting such value spaces requires strategic vision and the readiness to take on substantial risk.

In all cases, definition of a digital industry business strategy will require a deep understanding of the processes and strategic priorities of the customer industries that a mechanical or plant engineering company serves and of the company’s own position, business model, capabilities, and ambitions.

ORGANIZATIONAL IMPACTS AND OBSTACLES

Digital industry will usher in a second wave of leaning out key business processes, likely making entire departments redundant in their current form. Analytics will become more centralized as well as globally transparent (e.g., real-time demand forecasts instead of sales planning), while insight deployment will become more decentralized (e.g., pricing and sales promotion decisions based on centrally run analytics).

The impact on people and jobs will be tremendous. A significant number of planning, analytic, coordination, and managerial jobs will disappear due to leaner, more direct processes that require less planning and coordination. Desired skills and workforce needs will shift toward more analytical capabilities and flexibility; managerial profiles will require more digital affinity and

~US\$1.4 trillion

IN ANNUAL MARGIN IMPACT
COULD BE UNLOCKED GLOBALLY
BY DIGITAL INDUSTRY BY 2030.



openness to transparent, data-based decision making. It is worth noting that the pace of implementation is still somewhat unclear – there are a number of obstacles that still must be resolved. These include an installed base of hardware and software infrastructure that is not fully ready for digital industry, as well as products that might be upgradable but will continue to require “traditional” approaches until they are replaced based on their respective industry’s investment cycle. The need for employees with relevant qualifications and change management as well as unresolved data security and legal issues could also limit the speed of change. Finally, companies will need to consider if they face internal constraints in terms of creativity and out-of-the-box thinking if they are to reinvent their business models for the age of digital industry.

In summary, the impact of digital industry on individual companies and manufacturing industry sectors will be immense. Indeed, this next industrial revolution is already underway. Manufacturers would do well to consider their current situation and begin charting a course in terms of relevant digital industry levers if they hope to unlock the value and opportunities this revolution will bring.

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DIGITAL PERSPECTIVES

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NEW THREATS FOR MANUFACTURERS

THE CHALLENGE OF CYBERSECURITY

In an increasingly digital world, cyberattacks have become an everyday reality. They not only affect machinery and plant engineering companies, but their customers and end users can be indirectly attacked through networked production systems and software-laden products. A holistic approach is needed to fully counter these security threats.

A hacker attack on Sony, data theft from US government agencies, a spy attack on the German federal government: Spectacular cases of cybercrime like these are now a regular feature of news headlines. Indeed, cyberattacks have become a threat to companies around the globe and across all industries. In the past six years alone, annual cyberattacks globally have increased ten times over.

The World Economic Forum's latest Global Risk Report¹ ranks cybercrime as a top ten risk to the global economy. High-tech nations in particular, such as Germany and the United States, are preferred targets for increasingly aggressive, diverse, and sophisticated cyberattacks.

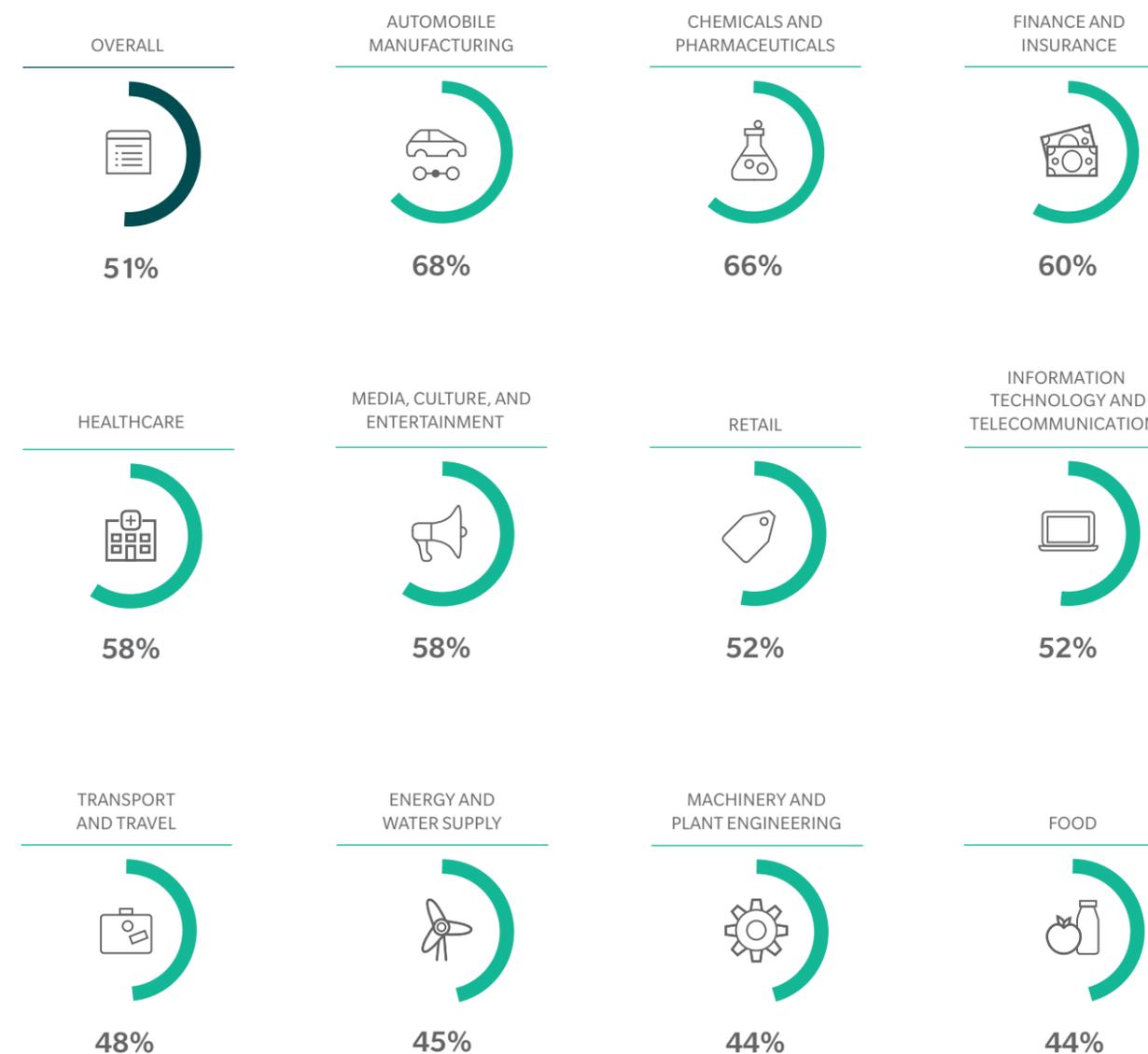
The result is that enterprises now must consider manifold threat scenarios when assessing their cybersecurity. In the past, manufacturers mainly had to worry about cyberattacks as a form of industrial espionage. Today, however, cyberattacks can include attempts to take control of production networks and infrastructure for blackmail purposes, infecting plants and equipment with malware to attack end customers, indirect attacks on critical infrastructure via controllers, etc. Networked manufacturing in the context of Industry 4.0 and the Internet of Things likely will give rise to yet more threats.

PREPARATION MATTERS

Governments are responding to the threat of cyberattacks. In the United States, for example, executive orders this year have authorized sanctions against "cyberspace threats" and created a new Cyber Threat Intelligence Integration Center (CTIIC) to coordinate information sharing. The German government recently passed a law that will require institutions on a list of critical infrastructure to adopt state-of-the-art information security.

Individual companies are a different story. It's alarming how poorly prepared machinery and plant engineering companies are, particularly small and medium-sized companies, which often don't take cyber threats seriously enough and fail to implement appropriate countermeasures. This is partly due to a lack of understanding of the full range of threats and partly to not knowing how to mitigate the risks. In many organizations, the information technology department is still in charge of dealing with cyber risks. This is no longer enough: If a company wants to effectively improve its resilience, it must adopt a mix of measures in the areas of technology, organization, governance, and culture, and integrate them into the company's established risk management processes.

Exhibit 1: Percentage of companies by industry affected by data theft, industrial espionage, or sabotage within the past two years

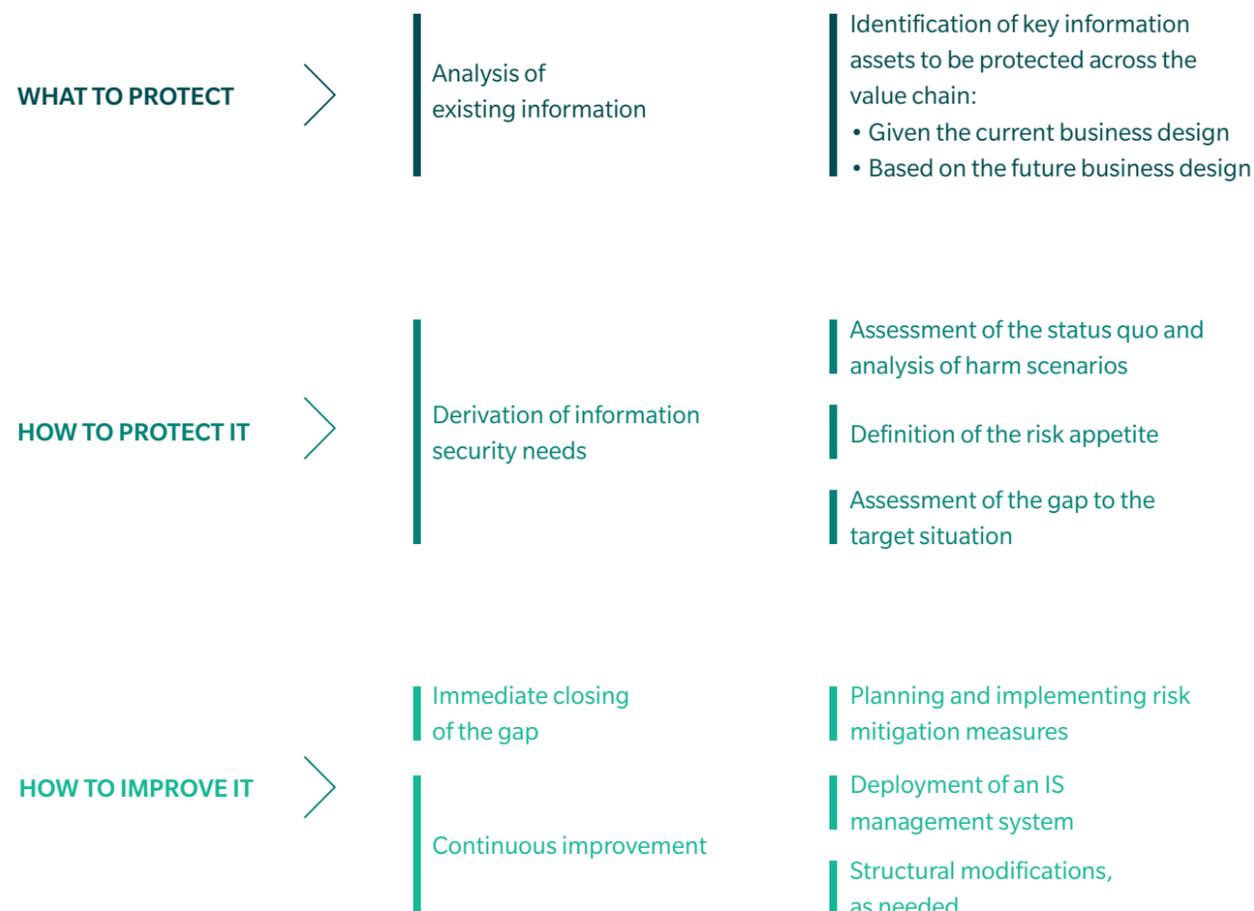


Note: Based on 1,074 surveyed companies. Does not include all industry and service sectors

Source: Bitkom Research GmbH, used with permission

¹ With support from the Marsh & McLennan Companies (parent of Oliver Wyman), and other partners

Exhibit 2: Information protection procedure



Source: Oliver Wyman

TAKING A MORE HOLISTIC APPROACH

A holistic approach starts with making information security an integral part of the agenda for a company's senior management and board of directors, with the goal of developing security measures that will protect the entire organization internally as well as external links to suppliers and customers. On the technical side, for example, companies must make sure that their systems and production equipment cannot be accessed by unauthorized persons. Training for all employees is important – both to ensure that they adhere to good information security “hygiene” and that they do not fall victim to social engineering. It is imperative to establish sustainable leadership structures and mechanisms that ensure cyber risks are assessed iteratively and mitigation plans are regularly updated. And, finally, processes must be designed in such a way that it is impossible for third parties to procure corporate data.

Information protection doesn't happen overnight. While technical improvements often can be quickly implemented, it can take up to a year to make organizational and process changes. As a rule, the most time-consuming step is sensitizing employees to ensure that they consider information security in all that they do. To manage the process, companies should consider appointing a top-level security authority, such as a chief information security officer, a data security representative with extended responsibilities, or a board member with additional responsibilities.

No company can afford to wait on this issue. Last year, a German steel mill lost control of a blast furnace to hackers, resulting in massive damage to the facility. Chilling incidents like these are only the beginning, if companies do not take all possible steps to stop cybercrime in its tracks.

44%

OF MANUFACTURING COMPANIES SURVEYED BY BITKOM HAVE BECOME VICTIMS OF DATA THEFT, INDUSTRIAL ESPIONAGE, OR SABOTAGE.



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GOING AGILE

THE FAST TRACK TO DIGITAL LEADERSHIP

The manufacturing industry has been slow to adopt digital initiatives. A typical concern has been low process/IT maturity, but digital natives and incumbent leaders have discovered a fast track – agile workflows. Using pilots and digital incubators, these companies have become front runners in digitalization, and laggards will need to move quickly to close the gap.

The digitalization of industry will dramatically transform the way industrial companies operate in many areas – from R&D efficiency and faster product launches to supply chain improvements and better operations and services. In the machinery sector alone, the total margin impact potential of “digital industry” initiatives is expected to exceed US\$250 billion by 2030. A process of flexible production and efficient mass customization will be the single most important lever, accounting for more than US\$100 billion. Digital leaders are winning against competitors in this area by achieving “lot size one” production with greater speed and accuracy, fewer manual interventions, and at a lower cost.

TYPICAL DIGITAL IMPLEMENTATION CHALLENGES

To successfully capture digital industry value, companies need to overcome obstacles such as “IT readiness.” If IT infrastructure and software tools do not even meet current requirements, raw data is low quality, ERP platforms are not ready, and Excel is the “tool for everything,” companies may be discouraged from starting digital initiatives.

On top of that, demand for digital solutions has unique characteristics and so is even harder to satisfy with a traditional IT delivery organization: Product innovation must be rapid. Demand may change

continually in the face of an uncertain future. And digital solutions typically are continuously improved through a test and learn process.

In traditional linear models, each creation step completes fully before advancing further. Customers “order” a product and do not see it until the end. It’s not a suitable model for digital product creation – time to market is too slow and the creation process is too abstract. Furthermore, IT is not perceived as an enabler in a linear model, and significant energy is wasted on changes and claim management. The result is a “digital gap.”

AGILE DIGITAL DEVELOPMENT

The key to bridging the digital gap is unifying business and IT through an “agile workflow” methodology. Products are not “ordered,” but instead created collaboratively. The intimate involvement of the business with its customers ensures proximity of the product to changing market needs. Frequent deliveries ensure short feedback cycles, a flexible and educated evolution of requirements, and a shorter time to market. As a methodology, the agile workflow features rapid prototyping, iterative design/delivery cycles, and reusable common modules.

Companies have started creating specific, novel roles to put unified, agile workflows into practice. The “digital product manager,” for example, is the business owner’s advocate and the key enabler for the creation process. The “IT delivery officer” empowers the product manager by driving the process. Design/delivery teams may be internal or outsourced, leading to greater flexibility and better scale and cost efficiency.

The unified, agile workflow approach requires new capabilities. In large corporations, different business units sometimes start a number of digital initiatives in

US\$100 billion

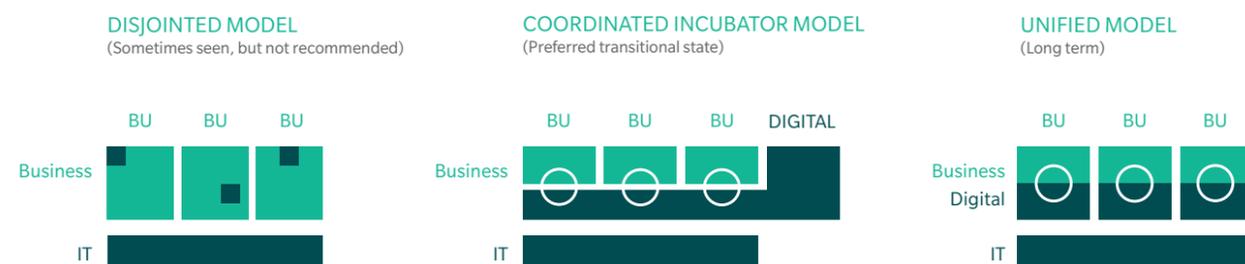
IS THE EXPECTED VALUE POTENTIAL OF FLEXIBLE PRODUCTION AND EFFICIENT MASS CUSTOMIZATION IN MACHINERY BY 2030.



isolation, leading to duplication of effort and sub-scale delivery capabilities. Other firms establish a digital incubator that spearheads “everything digital” in a coordinated and scalable way, pooling digital roles and resources and allocating them to business units as needed. The end game may be a fully unified model with common building blocks as a shared layer and digital product creation driven by the business units. Companies may separate digital incubators from their traditional IT at the creation stage. Still, it is important to join both worlds in a stable operating model with clearly defined services, roles, and interfaces (Exhibit 1).

In some cases, the need for back-end modernization may be just as urgent as the need for innovative services at the front end. The good news: If an architectural decoupling can be achieved, both can happen simultaneously, combining platform renewal (“speed 1”) and digital innovation (“speed 2”). Thus, even manufacturers who are currently lagging behind in the digital industry space have an option to jump-start innovation before their legacy IT is fully optimized.

Exhibit 1: Digital enablement models



Source: Oliver Wyman analysis

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OPERATIONS



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- 32 DISRUPTING THE PRODUCT:
MANUFACTURING’S MOON SHOT?
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SOFTWARE SOURCING

“GAMING” SOFTWARE DEVELOPMENT COSTS

The computer and video gaming industry, which is worth billions of dollars, uses professional software engineering to save time and money. As products become increasingly digital, the industry’s “software factory” approach is one that manufacturers should consider adopting to gain a clear competitive advantage.

The “Internet of Things” will continue to expand for the foreseeable future, driven by demand for more functionality and interconnectedness across a wide range of products – from sports watches and thermostats to bridges and cars. The number of connected objects is expected to grow by 30 percent a year over the next five years, reaching between 50 billion and 100 billion devices by 2020.

As a result, value will increasingly migrate from hardware to software, and manufacturers will have to choose between giving up this value and becoming commoditized, or face skyrocketing software development costs. The prospect of increasing software spend should be all the more worrying for manufacturers whose development approach dates back to when software was just an add-on and not the core of the system.

computer and video gaming (interactive entertainment) industry, which develops more software than any other. Every video game is essentially a highly specialized piece of software. But game makers and advanced manufacturing companies use a completely different development approach, known as the “software factory” (Exhibit 1).

Once a game has been designed (specified) it is broken down into modules, such as character models, player actions, backgrounds, audio, itemization, etc. Then, just as on an assembly line for products, each developer or team “on the line” focuses on just one component of the overall software package. Only once

CHANGING THE GAME

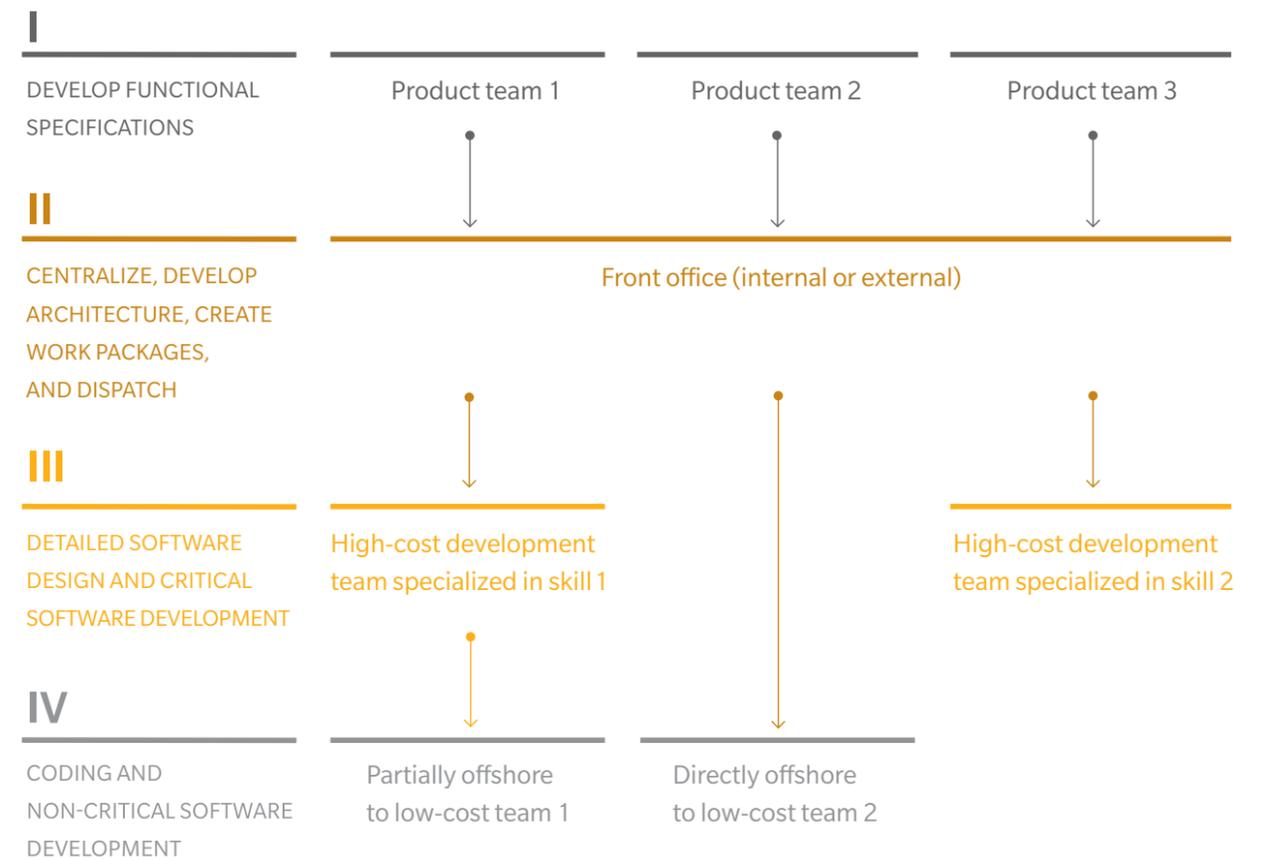
In a traditional software development cycle, functionality, features, and language are specified, then the entire software package is handed off to a team of programmers, often entirely in-house, which codes the software from start to finish. A different product involves the same process, all over again. But there are better practices out there. We recently helped manufacturers improve their software development processes by applying lessons learned from the multibillion dollar

UP TO **80%**

COST REDUCTION CAN BE REALIZED FROM PROFESSIONALIZING SOFTWARE DEVELOPMENT.



Exhibit 1: Typical software factory organization



Source: Oliver Wyman

all of the modules have been completed are they knitted together, tested, and debugged. This approach unlocks unique cost optimization levers:

- **Efficiency from specialization:** Assigning modules by skill allows teams to become highly effective in that specific development step, hence significantly reducing development time. For example, one team only builds backgrounds, another team only works on character models.

- **Reusing building blocks:** Having teams work across multiple games allows them to identify common parts of software that can be reused with no or minimal additional cost.

- **Nearshoring and offshoring:** Breaking down the process into individual building blocks supports a “best shoring” approach. Highly complex “core” elements (like player character animation) are assigned to the most skilled, and thus highest- cost, developers. Less complex elements, like backgrounds

and audio, or coding activities that do not require the same level of programming skills, often can be offshored or nearshored to countries with lower labor costs.

- **Leveraging suppliers' off-the-shelf software:** When outsourced to relevant suppliers, the front office can facilitate the reuse of software already developed by suppliers, reducing overall development costs to the payment of a licensing fee.
- **Sharing resources:** When outsourced to relevant suppliers, the front office can smooth out the workload of teams across several clients, effectively reducing the burden for any one client.

LEARNING THE RULES

Professionalizing software development in manufacturing can lead to breakthrough cost reductions – as high as 80 percent when moving from development to licensing. Adopting a software factory process requires specific organizational changes and skill enhancements to build the right capabilities both in the software and purchasing teams (Exhibit 2). The contribution of purchasing, in particular, is often underplayed, whereas a good understanding of the programming supply market and the characteristics of different types of suppliers, and the ability to challenge developers' specifications are critical in unlocking the full potential of the software factory.

Manufacturers will need to determine their make-or-buy policy for each type of software they need developed. They can simply specify the software and then hand it off to a software integrator, who can oversee

30%

ANNUAL GROWTH IN CONNECTED OBJECTS IS EXPECTED OVER THE NEXT FIVE YEARS.



module development and build the final integrated product. Or, they can choose to break out the modules themselves, outsource them individually, and do the integration in-house. Either choice will require the software and purchasing departments to work together closely to ensure product specifications and vendor capabilities match.

In summary, in terms of software development speed, innovation, and cost control, no other industry outranks computer gaming. By taking advantage of the software factory approach, manufacturers may gain a competitive edge well into the future. Software will increasingly mediate the interface between customers and products. As it takes center stage in the customer experience, the ability to not only create new software but to update and support existing software seamlessly will become an essential differentiating factor for manufacturers.

Exhibit 2: Prerequisites for adopting a software factory approach



SUFFICIENT SOFTWARE VOLUME

A minimum volume threshold is required over time



LONG-TERM COMMITMENT

The company and suppliers must partner up for multiple years



PERTINENT SKILLS

Internal and supplier skills must cover the majority of the software skills needed for development



TECHNICAL COMMONALITIES

The perimeter applicable to the software factory must present some technical common elements, such as recurring language



MATURITY

A clear vision of future volumes and products is needed both internally and from selected suppliers

Source: Oliver Wyman

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SMART MODULARIZATION

BUILDING BLOCKS FOR SUCCESS

For some time now, machinery manufacturers have been focusing not just on fulfilling their customers' every wish, but on developing smart, modular product structures. "Functional configuration" reduces complexity and can help achieve drastic cost reductions. But if companies want to reap the benefits of modularity, they must implement fundamental changes and make efficient use of sophisticated IT systems.

Modularization and standardization strategies can offer machinery manufacturers enormous opportunities to reduce both costs and effort and thereby maintain and increase competitiveness. Even specialist machinery manufacturers are finding it increasingly difficult to differentiate themselves through technology, while dealing with the challenge of lower cost efficiency than that of standard machinery manufacturers. Above all, they must understand that the time has passed when only custom-built machinery could fulfill unique customer requirements. Today, it is possible to massively reduce product complexity and cost without negatively impacting customer value by using standard building block systems, functional configuration, and smart systems.

200 to 1,000 euros, or, in the case of more complex parts such as engines, as much as 60,000 euros. Consequently, the cost savings potential in engineering alone is very large. On top of this, a modular approach makes it possible to scale down order processing costs, which account for 20 to 60 percent of personnel expenses. In purchasing, with its higher level of standardization, manufacturers can cut their procurement costs and realize bundling effects. In production, modularization makes it easier to outsource value added packages, and operations planning is not quite as time and cost consuming. At the same time, because modules are reused more frequently, learning curves are reduced, and setup times become shorter. Overall, manufacturers

THE ART AND BENEFITS OF MODULARIZATION

There is one essential condition for smart modularization: the manufacturer must consider the customer's requirements for the machine. In the context of functional configuration, the relevant workpiece portfolio or materials, for instance, take center stage. A comparison of the functional variants with the technical variants stored in the system today reveals that the latter can often be reduced by a factor of ten or more.

In general, introducing and administering a new variant can generate complexity costs ranging from

15–25%

OF THE COST OF GOODS SOLD CAN BE REDUCED BY ADOPTING A MODULAR PRODUCT STRUCTURE.



can reduce their production costs by 15 to 25 percent by introducing a modular product structure (Exhibit 1). In addition, it may be possible to reduce throughput times and simplify spare parts supply. Ultimately, sales also will benefit when tailoring and explaining solutions to customers.

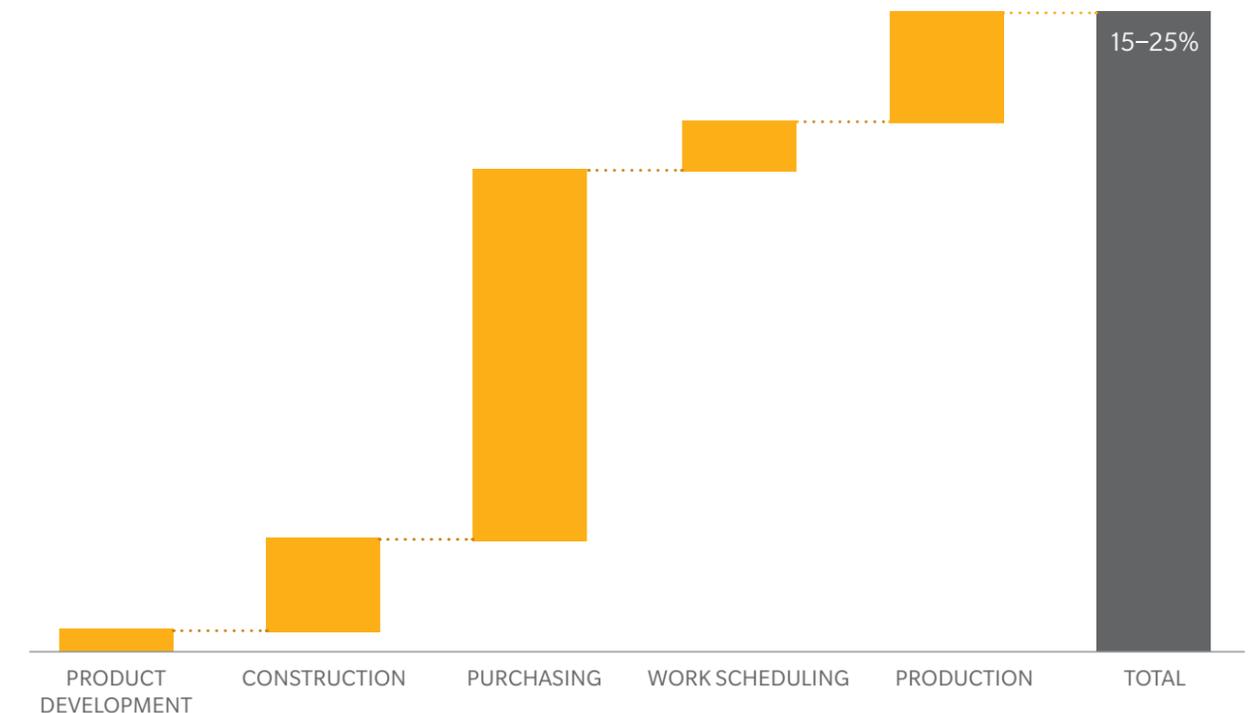
CHALLENGES FOR THE ORGANIZATION, PROCESSES, AND IT

Although machinery manufacturers are already implementing modularization concepts, for many of them the rewards have been slow in coming and are

weaker than expected. This is because successful modularization also requires fundamental reorganization of the company. Construction capacities must be shifted to engineering, automation in production must be stepped up, strategic sourcing must be assigned a more important role, and sales must accept the idea of functional configuration. The ultimate goal is to use highly automated systems to steer an order, from configuration to shipment, through the company's various divisions. This is only possible if all functions are oriented to the process and can easily cross organizational boundaries.

IT systems that efficiently map the entire process are indispensable. The centerpiece is a complex product life cycle management (PLM) system that administers both

Exhibit 1: Average cost reduction potential of modularization in special machinery engineering, as a percentage of a manufacturer's costs



Source: Oliver Wyman analysis

Exhibit 2: Decreasing product complexity reduces costs

FEWER VARIANTS FEWER PARTS LESS EFFORT IN ALL FUNCTIONS



Source: Oliver Wyman

the configuration's functional variants and their technical implementation. Every module must possess features which indicate to which function it contributes, into what part of the machine it is built, and how it is involved in in the machine's control system. Consequently, the PLM system reflects multiple product structures. In addition, the configurator must be connected at the input end, and an enterprise resource planning (ERP) system at the output end.

Such massive changes require not only investments and time. It is also important to reckon with the impact on the company's culture and, consequently, ensure that change management and communication planning are mapped out as well.

★ **CASE STUDY**

MODULARIZATION METHODOLOGY FOR SPECIAL MACHINERY MANUFACTURING

Oliver Wyman designed a product development concept for a modular, mechatronic building block system on behalf of a global machinery manufacturer headquartered in Germany. A complexity cost analysis of today's variants led to the development of a neutral product structure, requirements that needed a PLM system to fulfill, and a new development process (including decision gates, roles, and responsibilities). The methodology was tried and tested in the context of pilot projects. Going forward, it will be used for all of the client's modular product development.

SUCCESS FACTORS FOR IMPLEMENTATION

OLIVER WYMAN HAS IDENTIFIED FOUR SUCCESS FACTORS FOR MODULARIZATION PROJECTS

A CONSISTENT DEVELOPMENT METHODOLOGY

A uniform, company-wide product development methodology is crucial to success. Guidelines for modularized product development should also deal with thinking in terms of mechatronic building block systems, promoting reuse, and a total product cost view.

ORGANIZATIONAL AND PROCESS INTEGRATION

Redesigned, adapted processes and rigorous key performance indicator (KPI) management constitute the foundations of modularization.

HIERARCHY OF BUILDING BLOCK SYSTEMS/SCALING

Companies must distinguish between building block systems geared to applications and those geared to basic functions. Moreover, economically appropriate scaling is key. Building block systems should first and foremost cover performance classes with the highest demand.

A CROSS-FUNCTIONAL, MECHATRONIC APPROACH

All corporate functions and mechatronic disciplines must contribute their expertise. Equally, all areas must participate in success.

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DISRUPTIVE COST INNOVATION

DISRUPTING THE PRODUCT: MANUFACTURING'S MOON SHOT?

Apple, Amazon, and SpaceX have proven that new intellectual approaches can transform entire industry sectors. Manufacturing companies that want to keep up with the frontrunners need to embrace “disruptive cost innovation,” reach for innovative project goals, and earnestly review inconvenient ideas.

If you go back a few hundred years, what we take for granted today would seem like magic. Engineering is the closest thing to magic that exists in the real world – ELON MUSK

There are plenty of signs that a manufactured product has lost its magic and become commoditized: decreasing prices and willingness to pay, standardization, transactional purchasing, and decreasing brand relevance. In this context, incremental innovation becomes difficult and R&D funds tend to dry up, to preserve short-term profitability. Once competitive differentiation becomes impossible, most companies then “put the squeeze on” through incremental cost reduction programs, in an effort to maintain cost leadership for as long as they can.

Our experience is that companies often overlook cost competitiveness as a driving parameter of product design early in the development process, when about 90 percent of future costs are determined – only to later find themselves stuck with trying to optimize a frozen design and leverage existing solutions.

There is another option: disrupting the product from the ground up, and as early as possible in the product development cycle. We call this “disruptive cost innovation” (DCI). The DCI philosophy involves equipping a company with a solid methodology and set up in order to establish a “moonshot”¹ objective, foster teams’ creativity, and funnel the best opportunities into a robust validation mechanism.

The overall process entails three consecutive phases: set-up, generation, and filtering.

SET-UP: PREPARING THE LAUNCH PAD

To lay the groundwork for idea generation, set-up involves four key steps. The first involves breaking the system down into sub-systems and determining where greater competitiveness is needed most. A target can then be defined that is quantifiable, but also challenging – it can’t be reached just by using a classic

90%
OF OVERALL PRODUCT COST
IS DETERMINED IN THE
ENGINEERING PHASE.



¹ Term used by Google X to refer to its most innovative projects.

Exhibit 1: Key principles of the generation phase

STRUCTURE THE PROCESS

with tight planning (hour by hour), precisely defined activities, and a clear timeline for delivery

START FROM BASIC NEEDS

then derive functional specifications. Starting from existing specifications will hinder the success of the process from the start

INVOLVE CLIENTS AND SUPPLIERS

at the beginning of the process as partners. It can be helpful to also involve new suppliers, possibly even from other industries

RESIST THE TEMPTATION

to prioritize and discard unripe opportunities during the idea generation phase

KEEP AN OPEN MIND

about the spectrum of possible solutions, spanning from marginal improvements to completely new concepts

CHALLENGE ALL CURRENT SOLUTIONS

Forbid “sacred cows”

Source: Oliver Wyman

optimization approach. Typically in a commoditizing manufacturing area, the cost reduction target must be above 25 percent.

The project will then need a multifunctional team that can be mobilized full time for the duration of the generation phase. This team must include people with the specialist skills relevant for the selected system or sub-system, as well as purchasing and sales representatives to bring in client perspective and cost sensitivity. Finally, the team needs to be co-located and sequestered for the duration of this phase, to reduce distractions and outside pressures.

GENERATION: BUILDING THE ROCKET

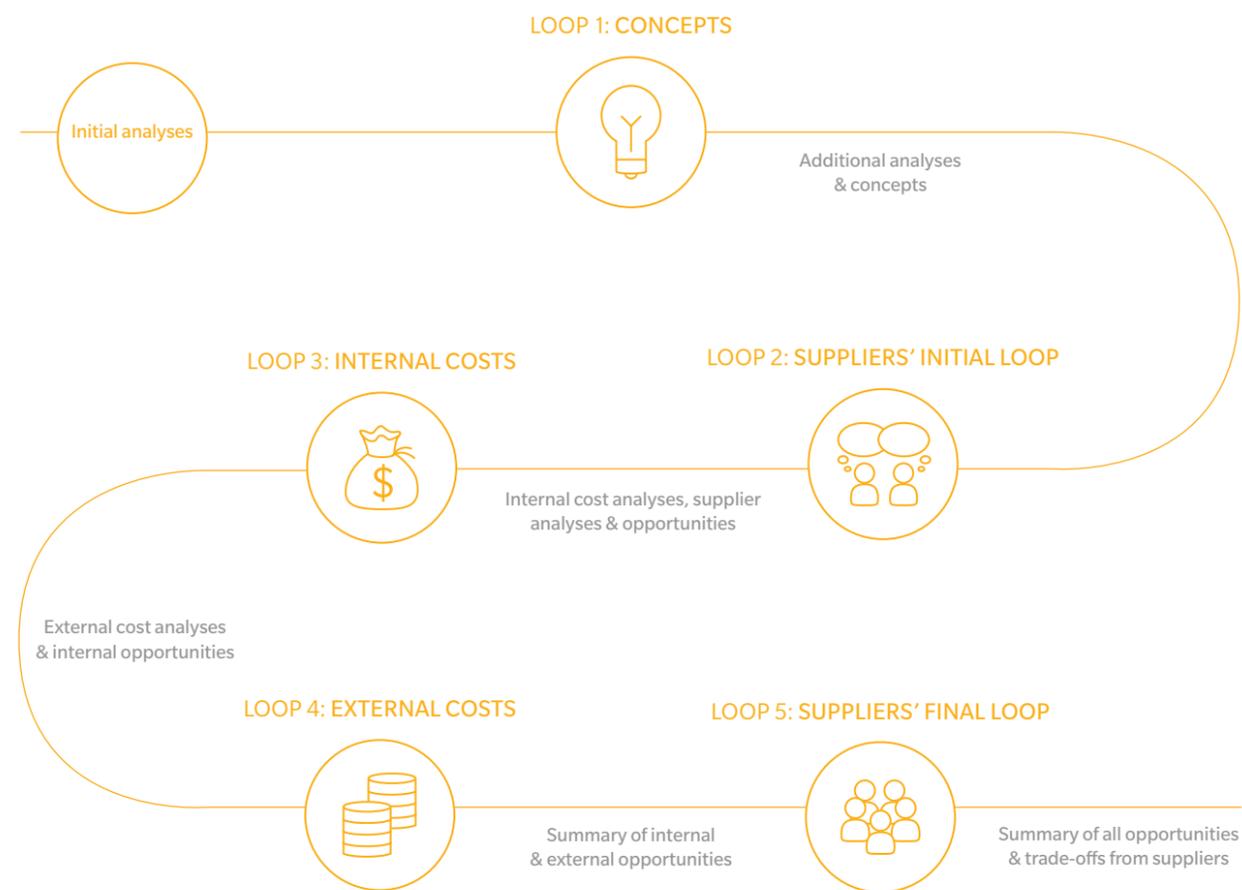
The generation phase is where formal development of the widest range of ideas and opportunities takes place. These ideas can come from the team, as well as suppliers

and clients. But this phase isn’t merely “brainstorming”; rather, it should be a highly structured process, where the functional need for the system is analyzed in depth, research is conducted about how that function is fulfilled in other similar contexts, suppliers are mobilized to propose concepts and quantify costs, and clients are interviewed to ensure efforts are well targeted (Exhibit 1).

Depending on the specificities of the system under review and the target, a number of different analyses can be run to create transparency and foster value generation. Two examples include:

- **Function realization options matrix:** benchmarking how other industries handle a specific function and whether these options are applicable to the system under review. As an example, an innovative solution for air circulation in cars was developed by looking at nasal sprays in the healthcare industry.

Exhibit 2: The five-loop generation process



Source: Oliver Wyman

- System component contribution:** ranking the cost and contribution of each component of a system to basic functionality. As an example, on one project we found that a system structural member contributed little to functional needs, leading the team to find solutions to either remove the structure or use it as a component in other systems.

The initial part of the generation phase is organized as a sequence of five “loops,” to ensure that all cost opportunities are explored and thorough iteration

takes place (Exhibit 2). In each loop, analyses are produced and combined with generated opportunities to feed into the following loop, producing at the end of the process a summary of all available opportunities and tradeoffs. Following this process, high-level cost impacts, investment requirements, and implementation timeframes should be defined for identified opportunities.

FILTERING: LIFT-OFF!

When the generation phase begins to wind down, there is a risk of losing momentum and “opportunity leakage”; that is, unripe opportunities may be discarded prematurely because of the follow-up effort involved. But our project experience has shown that initially deprioritized ideas, when advanced in the process, often can prove to be successful.

Setting up a dedicated project management office (PMO) to filter identified opportunities can mitigate this risk. The PMO first develops trade-offs between overlapping opportunities and combines opportunities into coherent and credible solutions at the system level, to create a set of viable scenarios. These scenarios are then prioritized based on an underlying order preference for:

1. urgent topics (those that impact current program development);
2. independent opportunities (those present in every scenario); and finally
3. dependent opportunities (linked to only one scenario).

The filtering phase also should be a time to look for ways to innovate and disrupt the implementation timeframe for longer-term opportunities, which can be a breakthrough factor in realizing value from the best ideas.

DISRUPTIVE COST FOR FURTHER MISSIONS

DCI takes out costs not by going through barriers, but by simply leapfrogging them – and one’s competitors in the process. And while cost remains the key concern in any commoditizing industry and in manufacturing in general, we believe that there are other areas in manufacturing where breakthrough thinking can produce impactful results. Examples of non-cost-related DCI applications that we are currently exploring include improving lead times, increasing quality/reliability, redesigning processes, and developing new products.

Companies like SpaceX, Apple, and Amazon have shown that disruptive cost innovation can change entire industries overnight. Greater competitiveness is out there – manufacturers just need to believe in the objective, embrace the approach, and make every idea count.

★ CASE STUDY

DCI IN ACTION

To stay competitive, the CEO of a company producing short runs of high-tech, high-value products tasked his engineers and buyers to reduce the cost of the product’s next generation by 40 percent. After working on the project and daily operations in parallel for more than nine months, the teams came back with ideas yielding only 5-10 percent cost reduction – obviously, conventional approaches were not going to deliver on the target.

Working with Oliver Wyman, the company then switched to a tailored disruptive cost innovation approach. Cross-functional teams from engineering, purchasing, quality control, sales, etc. were formed to tackle selected systems, freed-up from daily operational tasks, and brought together at an offsite location.

Utilizing clearly defined work packages, methods, and tools, the teams took an “out-of-the-box” approach. Rather than looking at prior product specifications, they teamed up with potential clients to challenge and streamline functional requirements. The teams also visited companies in a variety of industry sectors working on comparable issues or with similar materials, and studied development approaches in fast moving and quickly innovating sectors. As a result, after six weeks, the team was able to generate ideas that in total surpassed the initial cost savings target twice over. Based on the success of this initial effort, the company decided to extend the approach to further systems as well as to test it in other product lines.

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ADVANTAGED COALITIONS

TAP THE POWER OF COOPERATION FOR INDUSTRY CHALLENGES

An advantaged coalition is the coming together of industry players to create a standalone enterprise to fulfill a specific need with greater success than could be achieved by any individual firm. Companies can use this approach to share risk, overcome competency or technological gaps, create economies of scale, or establish common standards.

The manufacturing industry these days faces a number of challenges that no individual firm can handle, from building infrastructure and prosecuting counterfeiters to meeting environmental regulations.

In such cases, companies can tap the power of cooperation to create an outcome that is greater than the sum of its parts, by forming an advantaged coalition. An advantaged coalition is the coming together of companies in an industry to create a standalone enterprise that meets a specific need more successfully than could any one firm.

Of course, companies cooperate all the time. But in calling out a certain kind of successful cooperation and examining what makes it tick, we aim to create a tool that could be used to solve a spectrum of problems, whether financial, operational, or social.

Advantaged coalitions can help with sharing or disaggregating risk, providing a collective solution to new policies or regulations, overcoming a competency or technological gap, creating economies of scale in the industry, or establishing a common standard. An advantaged coalition is often a more efficient way of solving an industry issue than government intervention.

COALITION EXAMPLES

Oliver Wyman helped form an advantaged coalition when we advised and coordinated an initiative set up to research regional opportunities for aviation biofuels and how to pursue them. The group included airlines, aircraft manufacturers, fuel makers, agricultural scientists,

government agencies, and others with expertise in the biofuels supply chain. This coalition analyzed in depth what would be required to develop a regional biofuels industry, from farm to fuel tank, delineated a detailed pathway for development, and described what the region would need from regulators to develop the industry.

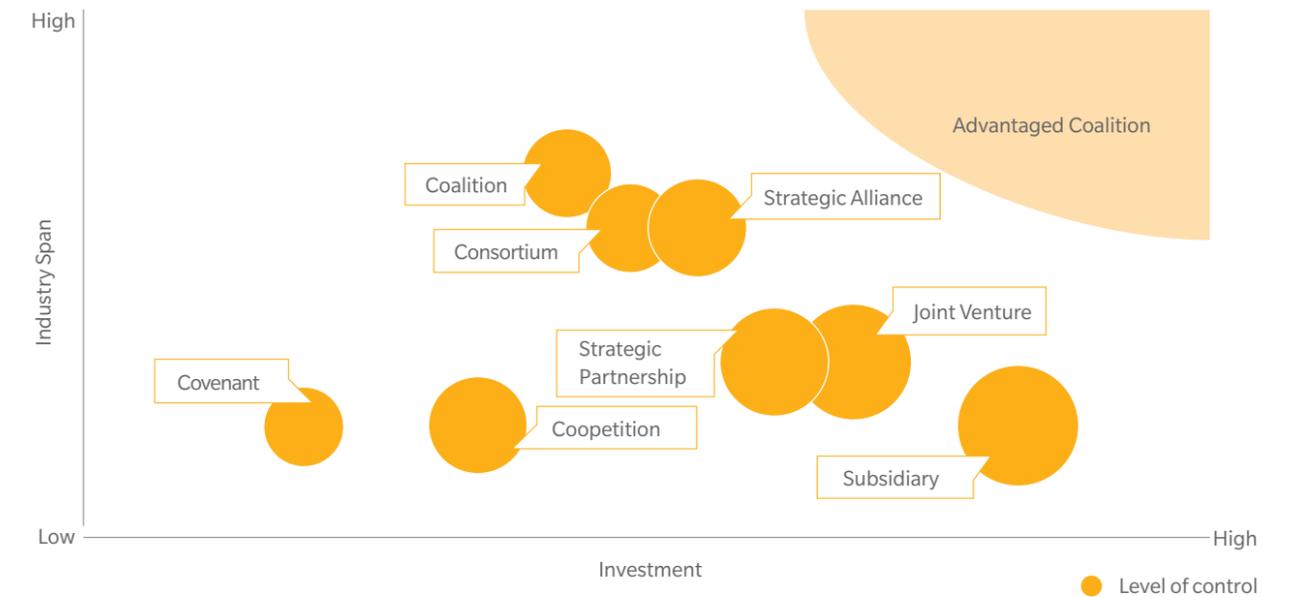
Other examples of advantaged coalitions include electric companies that band together to build interstate transmission lines, consortia comprising construction companies and rail operators that develop high-speed passenger rail, and major oil companies working together to build a pipeline so that they can all get their product to market.

CLARITY AND SPECIFICITY MATTER

The keys to a successful advantaged coalition are clarity and organizational design. Strong coalitions have well-defined boundaries to mitigate the risk of mission creep and cost bloat. The more specific the problem to be solved, the more effective an advantaged coalition can be.

A wide variety of legal structures can be used to establish a coalition and determine its parameters. It can be structured as a buying group, co-op, joint venture, corporation, or any other structure that suits the narrow purposes of the founding members. Coalition members can then use various levers to define boundaries, such as creating a board to actively oversee the group, setting a time limit on the life of the coalition, or working with governments on regulatory oversight to keep the coalition in check.

Exhibit 1: An advantaged coalition requires significant resources but can provide broad industry coverage



Source: Oliver Wyman analysis

It's important for advantaged coalitions to operate within clear and specific bounds or risk losing effectiveness. Consider a trade association that forms to lobby on a specific issue. If the association adds members who are not aligned with the original issue, the interests of the group can diverge and conflict, weakening the group's effectiveness in lobbying on the original issue.

Examples of well-defined coalitions in the manufacturing space are those created by retail goods manufacturers with the specific focus of stopping counterfeiting. The International Anti-Counterfeiting Coalition and the US Golf Manufacturers

Anti-Counterfeiting Working Group are two such groups that have successfully worked with authorities to take action against counterfeiters.

The advantaged coalition approach can be applied to myriad problems that businesses face. In the future, the advantaged coalition could be a powerful tool for companies to apply new technology to everyday problems, from drones to nanotechnology. Further, advantaged coalitions can give businesses a tool to solve their own problems in an efficient manner, rather than requiring governments to step in.

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EXTERNAL SPEND OPTIMIZATION IN CONSTRUCTION

BUY SMARTER, NOT JUST CHEAPER

External spend typically represents 50-70 percent of revenues in the construction industry, so it comes as no surprise that the industry focuses on buying cheaper. And yet, our analysis suggests that construction companies could realize additional savings of 7-12 percent by pulling the right cost levers.

Construction is a distinctive industry and approaches borrowed from other industries have not worked when it comes to reducing external spend, for various reasons:

- **Service provision is not homogeneous:** Core construction (foundations, piping, etc.) demands a different purchasing approach than technical work packages and professional services.
- **Projects vary greatly in terms of complexity:** Low-complexity projects can follow standardized patterns, while high-complexity projects require integrating suppliers early in the process.
- **Reliable benchmarks are hard to come by:** Most purchases are non-recurring and managed locally; detailed quotations are not a standard practice given the low maturity of local suppliers.
- **Specification drives costs:** At least 60 percent of the value at stake is determined by product specifications and not buying levers; this share is closer to 30 percent in other industries.
- **Regulatory requirements limit flexibility but offer opportunity:** Social and environmental impact responsibilities have become critical but energy performance can create a competitive edge.

DEFINING SPEND ELEMENTS

There is a large opportunity in the industry for optimizing design activities, by investing more in up-front analyses of feasibility, quality requirements, total costs, etc.

Winning firms differentiate approaches depending on whether external spending is visible or not visible to the customer. For elements that are not visible, technical resources can be used to challenge suppliers. Engineering offices are not incentivized to optimize costs but only to lower risks: Hiring quantity surveyors is a best practice to bring these costs under control. Where external spend is visible, the priority is to engage marketing and users to identify what is most valued by the customer. Interestingly, this also provides opportunities to impact the top line: In real estate development for instance, increasing total living space using smarter interior design results in increased sales.

Once design and specification activities have been well defined, the rest of the value at stake lies in core buying levers. Our experience shows that key priorities include defining the optimum geographic level at which to address each category, setting up well-defined unit price lists for quotations, thinking through total cost of ownership (TCO), and considering make-or-buy alternatives.

FIVE MEASURES TO UNLOCK VALUE

1. **Set ambitious but realistic cost reduction goals:** Rather than cascading top-down targets, use a bottom-up approach to estimate potential savings through a fact-based diagnostic.
2. **Prioritize the purchasing function:** Top management support is essential to provide the “glue” and maintain momentum.

Exhibit 1: External spend optimization levers

~ 60% OF THE VALUE

~ 40% OF THE VALUE



CONCEPTION/DESIGN

- Engineering firm selection
- Specification optimization
- Design of shared best practices
- Level of fees
- Shared risks and profits



NEGOTIATIONS

- Systematic call for tenders
- Minimal number of quotations
- Detailed quotation analysis
- Unit price repository
- Panel extension

VALUE ENABLERS



IMPLEMENTATION

- Quality control
- Construction work simplification
- After sales services



COST TRACKING

- Budget optimization culture
- Decision support tools
- Saving calculation rules

Source: Oliver Wyman

3. **Ensure cooperation between functions:** Breaking down organizational silos is critical and requires putting in place cross-functional teams early in the process.

4. **Implement dedicated tools:** Building Information Modeling (BIM), used as an information-sharing platform, is a key asset. E-procurement tools also are critical to ensure that local savings are actually delivered.

5. **Secure bottom-line impact:** In construction, savings can be unclear because of the project-by-project nature of the industry. It's thus essential to highlight successes by demonstrating project impact on the bottom line.

Taking a holistic approach to procurement not only offers companies critical advantages in terms of reducing costs, but can be a source of differentiation in a highly competitive environment. In today's economic climate, no construction company can afford to neglect optimizing its spend wherever possible.

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PROJECT RECOVERY IN PLANT ENGINEERING

PULLING THE RIGHT LEVERS FOR SHORT-TERM FINANCIAL IMPROVEMENT

Many machine builders and plant engineering companies experience profitability pressures in their project business. Structural changes are required to address issues sustainably and over the long run – but they cannot deliver quick results. Short-term improvements even in running projects, however, can be achieved through a project recovery approach that helps to detect and mitigate upcoming risks and to identify quickly realizable savings. For a portfolio of projects, the resulting profit improvement impact can be more than ten percentage points.

For many machine builders, increasing competition and more demanding customers are putting pressure on project profitability. Weaknesses in order execution and project management become more visible under such scrutiny. On top of this, manufacturers often struggle with high project complexity, time and technical risks, and contractual challenges. The consequence: a large share of projects incur unsatisfactory or even negative results.

Major loss drivers typically include poorly clarified cost budgets during the proposal phase; no process to “freeze” changes; and incomplete documentation of work incurred due to customer change requirements, leading to a forfeiture of claim management power. Companies can of course systematically change their structures and processes to improve project returns over the long term. But to stop the hemorrhage immediately, a project recovery approach can deliver short-term financial gains across a portfolio of running projects.

SETTING UP THE RECOVERY PROCESS

Project recovery should tackle a portfolio of projects that reflect a significant portion of total sales and is best run as an intensive process for a few months in parallel to structural changes, particularly as the recovery process can provide lessons learned for long-term optimization.

The project recovery process requires a team of dedicated resources, with a balance of commercial and technical understanding, which can act as an engaged project management office (PMO). This team should hold regular meetings involving project managers and line units as the basis for cross-functional recovery discussions. Results should then be regularly reported to senior management in a transparent way to enable pragmatic decision making when necessary. Within 2-3 months, this intensive process should become part of the regular project reporting cycle.

Project recovery starts with building a complete fact book on the projects in scope. This is the basis for root cause analysis on time, quality, and budget deviations as well as critical path assessments. For the most important projects, forecasts on costs by plant sub-section should be developed. In particular, forecasts for engineering hours and on-site hours should be examined due to their typically high impact and likelihood of deviation.

PULLING THE RIGHT LEVERS

In project recovery, potential short-term measures can be identified across all of the delivery phases of a project, from design and engineering to purchasing and on-site installation.

- **Design:** “Design-to-budget” is an important up-front step, supported by clearly communicated cost budgets and additional savings targets. For example, opportunities to change out functionally neutral components should be assessed to exploit cost advantages in purchasing and assembly. Technical “de-risking” can be achieved by (re-) negotiating standard solutions with the customer or through a temporary engineering resource ramp-up if renegotiation is not possible. In addition, change approval processes and layout change tracking during the design phase can help reduce the risk of budget and time deviations in engineering.
- **Engineering:** Engineering (and on-site) hours often overflow due to missing control procedures. Overtime guidelines and weekly tracking and approval rules, however, can keep hours under control. Approval procedures for changes that could impact the budgets of specific project sub-sections must be developed and communicated as well.
- **Purchasing:** Given the many third-party inputs in plant engineering, purchasing typically provides large savings opportunities. Renegotiation and identification of alternative international suppliers can be an effective lever – especially in the early stages. Synergies from bundling should be taken into consideration in the case of a portfolio with several projects running in parallel. Investment in expediting and quality control at suppliers can pay off if cost savings and quality concessions need to be balanced

- **On-site installation:** Ways to leverage local resources should be explored to reduce staff and travel costs. Frequently, delay and penalty risks are rooted in the lack of availability of on-site assembly staff or missing ex-works components/materials. These types of risks can be mitigated by optimizing on-site resource dispatching, as well as closely monitoring engineering time plans prior to the on-site phase.

Across all delivery phases of a project, managing claims both from a customer and supplier perspective is a strong bottom-line lever. This requires reconciled documents that are agreed upon with the customer in the early stages of the project. Finally, savings opportunities and transparency on budget risks must be regularly tracked. For savings opportunities, action plans should be defined and the degree of implementation regularly monitored across the project portfolio.

TANGIBLE RESULTS

Our experience has shown that project recovery can improve profit by ten percentage points or more across a portfolio of projects. In addition, project recovery can help unveil a significant percentage of risks early in the process – enabling mitigation steps to be developed as early as possible as well.

Project recovery does require extra resources over the short run, but the savings it generates provides an immediate return on investment. And there are other benefits worth considering: project managers move up the learning curve faster from participating in an intensive recovery process, while operating departments typically become more reliable once given adequate process and approval guidelines.

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SPARE PARTS

LOGISTICS FOR THE LONG RUN

For many manufacturing companies, the spare parts business is a major source of profit, and manufacturers have done much to expand and enhance it. There's still room for improvement, however: Significant value could be unlocked through an iterative program to professionalize spare parts pricing and optimize spare parts logistics.

For many years, the spare parts business has generated significant profit for manufacturing companies, leading them to expand and improve this business over the past 10-15 years. Key levers they have used to do so have included systemizing pricing, active marketing of spare parts, and improving underlying organizational conditions and management systems. Today, some machinery and plant engineering companies can boast of high contribution margins from spare parts. In many instances, however, there is still considerable room for improvement in spare parts logistics. Not every manufacturing company has perfected the delicate balancing act of delivering customer satisfaction, efficiency, and optimal working capital. But this will be essential in the future, given increasingly global markets, a diversifying competitive landscape, and the growing complexity of spare parts logistics.

THE SPECIAL NEEDS OF SPARE PARTS

The spare parts business is fundamentally different from the new machinery business. As a rule, it involves several thousand product codes, ranging from commodities to proprietary parts; relatively small order volumes, which can be difficult to forecast; and exacting requirements in terms of order turnaround times and delivery dates. Those customers who are increasingly professionalizing their activities are aware of the special characteristics

of this business and are thus often willing to pay a price premium, provided that they are satisfied with the performance of their spare parts provider.

In some cases, premium machinery and plant engineering companies try to meet these requirements by maintaining (too) high of spare parts stocks (tying up working capital) and using comparatively complex and expensive logistics processes. It is true that distinct tools, processes, and structures are needed for spare parts logistics, but often individual processes suffer from being too closely interlinked with the new machinery business; that is, similar mechanisms are used to manage two very different businesses.

ELMINATING OPERATIONAL INEFFICIENCIES AND MARGIN SLIPPAGE

An examination of the performance of selected machinery and plant engineering companies reveals a striking disconnect between the high gross margins and the earnings before interest and taxes (EBIT) of the spare parts business – a sure indicator of process inefficiencies. Too often, parts are sent from one place to another without rhyme or reason, creating more costs if a part is at the wrong place at the wrong time (“spare parts tourism”). Equally, redundant and overly fragmented structures are often still the order of the day.

In these cases, companies need to take the next step in optimizing their spare parts logistics, with the goal of keeping down costs and freeing up working capital, while meeting stringent customer demands. Such a program requires a more strategic and holistic approach to sustainably aligning spare parts logistics, rather than relying on historically grown structures and processes. For example, better segmentation of spare parts can generate better parts-specific strategies. Big data techniques can be used to process and translate relevant information into key performance indicators (KPIs), increase forecasting precision, and better support decision-making through appropriate algorithms and innovative tools.

The end goal of such an optimization process is the elimination of unnecessary redundancies and overstock and the creation of efficient structures and processes at the global level. This should be backed up with training for management to ensure that key learnings and changes are embedded into the DNA of the organization.

DELIVERING CUSTOMER SATISFACTION, IMPROVING EFFICIENCY, AND OPTIMIZING WORKING CAPITAL WILL BE EVEN MORE CHALLENGING IN THE FUTURE FOR THE SPARE PARTS BUSINESS.



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ORGANIZATIONAL EFFECTIVENESS

NEXT-LEVEL CORPORATE SUPPORT: GLOBAL BUSINESS SERVICES

An evolution in corporate support functions is happening apace. Now that shared services centers have become the norm, it's time for them to move to the next level: becoming "global business services" units that are worldwide in scope, with multi-functional integration of processes under a single service management framework.

In the context of continuous pressure to reduce costs and materialize growth opportunities, companies are reconsidering the role and structure of their support functions. CEOs and top management are calling increasingly for support functions to better serve the business – by becoming centers of innovation that are tightly aligned with corporate strategic priorities.

We have recently observed a rising need for functional support to facilitate global expansion, accelerate integration of acquisitions, and stabilize new joint ventures. In addition, the ongoing digitalization of the economy is forcing companies to adapt their offerings and services. All of this means that support functions have a new role to play: that of global, multi-functional business partners. Mature manufacturers are in the process of adopting new models and are fundamentally changing the scope and setup of their shared services centers (SSC's).

DEMAND FOR MORE SOPHISTICATED SERVICES

SSC's have become the norm worldwide, as they can provide standardized services at lower costs than decentralized support functions. Originally, SSC's were designed to deliver recurring high-volume administrative tasks more efficiently. The situation today is different, however: formerly labor-intensive tasks have become digitized, and the former attractiveness of low-labor

cost countries has declined. Enterprises today are reconsidering the role and scope of these platforms: from 2003 to 2013, the percentage of SSC's covering more than one functional division jumped from 24 to 73 percent. Activities are being reinforced or created in markets that represent a growing share of revenues. And the scope of activities is moving up the value chain; e.g., to include business analytics and portions of controlling, due to growing demand for data and intelligence.

To progress to a new level in terms of cost reduction, customer intimacy, and added value, the most mature SSC's are transitioning to a "global business services" (GBS) model, where they are fully aligned with the end-to-end business processes of several functions and have an international footprint. GBS units are structured by the cross-functional services they provide (e.g., customer, supplier, employee, analytics services) instead of being assigned to a single function (e.g., Finance, HR, IT). In addition, they are organized as a single unit, operating through regional and global centers, to overcome the limitations of functional silos and better serve the requirements of their internal customers.

As GBS centers assume a greater role in value creation, holistically managed processes across geographies, managed client relationships, governance frameworks, effective performance management, and clear reporting lines become more important. The head of a GBS unit is more often than not reporting to or part of the C-level.

Exhibit 1: Transformation stages for shared service centers

STAGE I		
COST REDUCTION MODEL	Realize cost savings on administrative tasks through economies of scale and outsourcing to low labor cost countries	<ul style="list-style-type: none"> • Functional focus (single function) • Functional leadership • No or limited standardization • Focus on policies, procedures, compliance • Cost-focused metrics • No or blanket chargeback method
STAGE II		
PRODUCT & SERVICE EXCELLENCE MODEL	Support operations of single functions through standardization and business-related skills and knowledge	<ul style="list-style-type: none"> • Process focus (single function) • Functional regional or local leadership • Some standardization • Focus on business-related/partnering skills • Cost and quality metrics • Chargeback method
STAGE III		
GLOBAL BUSINESS SERVICES (GBS) MODEL – STRATEGIC SUPPORT FOR GROWTH AND VALUE CREATION	Render sophisticated services across functions and geographies through close partnerships and in-depth business insights	<ul style="list-style-type: none"> • Customer focus (multifunctional and global) • GBS cross-functional management • High level of enterprise-wide standards • Focus on business-related service provider skills and behaviors • Negotiated, measured service levels • Tracking of value for business client

Source: Oliver Wyman

In our experience, this type of model can generate recurring savings of about 10 to 30 percent for the support functions within its purview, such as Finance, HR, and IT/IS.

TACKLING THE TRANSFORMATION CHALLENGE

The actions required to evolve to a Stage 3 GBS model are not trivial and will profoundly transform the role of the service center and the functional divisions it serves (Exhibit 1). We consider that one of the leading priorities is defining and establishing a working protocol that treats this evolution as a true transformation project – one that is structured in steps and has a mandate to initiate change.

The challenges are both operational and managerial in nature. Thorough analysis of activity types of

course is needed to decide collaboratively on the right scope of services. But change management, developing a partnering culture, and customer-centric skills and behaviors are components that must not be underestimated. Resistance to moving tasks out of functions should be anticipated and headed off by communicating the vision, case for change, and tangible benefits early in the process.

As a GBS center gains complexity in terms of accountability and reporting lines, talent selection and a focus on service provider behavior will become more critical. Equally vital is putting in place appropriate governance that is aligned with customers' strategic and operational objectives. And finally, senior management must play an active part, both as sponsor and supervisor, to ensure the process delivers on its promise.

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RECRUITING IN MANUFACTURING

HELP WANTED: THE TALENT CHALLENGE

The manufacturing industry in the United States and other industrialized countries is facing an increasingly worrisome issue: A shortage of top talent. Competition is heating up as a result of too few skilled graduates, retiring Baby Boomers, and increasing technology and innovation requirements. Solving the talent shortage will require focusing on long-term strategic talent development and paying more attention to a shifting work culture – both of which are new challenges for manufacturers.

Post-global recession, manufacturers in industrialized countries have been straining to recruit engineers, researchers, and scientists fast enough, and the problem is only likely to get worse: According to a recent survey by the Manufacturing Institute, 33 percent of US manufacturing executives surveyed are reporting high to severe shortages of engineers, and 48 percent expect to face a critical shortage by 2020; the gap for researchers/scientists is not far behind. Similar situations exist in manufacturing centers like Munich and Stuttgart in southern Germany, where unemployment rates for specific types of engineers have dropped below one percent.

A number of forces are coalescing to drive down the availability of talent with advanced skills. These include talent flight from former manufacturing centers, an aging workforce, healthy business growth, an overall decline in STEM (science, technology, engineering, mathematics) graduates, and a greater demand for engineers and researchers overall (and with more diverse skill sets), in response to an increase in high-tech/science components and a push for innovation. Finally, generational changes are having an impact, in terms of what Millennials¹ want from their careers and what industries they are willing to consider.

CHANGING DEMANDS – AND CULTURE

Globally, all manufacturing firms see a need for stronger skill sets in their workforces across all aspects of technology/computer skills, problem solving, math, and technical training. Most critically, the expanding role of technology in manufacturing is putting the sector directly at odds with other high-tech industries that pull from the same talent pool – and that often have greater appeal to Millennials, who want to be at the forefront of innovation.

This group also wants to stay where the “action” is – centers of tech culture – which has led to traditional manufacturing firms setting up and expanding R&D units in Silicon Valley or opening up new international facilities in hot emerging markets, such as India and Brazil, to tap into local talent pools.

Another challenge is that the traditional job security offered by manufacturing is less appealing: 70 percent of Millennials in industrialized countries typically change jobs every two years, according to Kelly Services, a US based staffing agency. And Millennials rate flexibility as a top perk – making contract work more attractive.

EXPANDING THE PIPELINE

As the above trends make clear, traditional manufacturing firms will need to move faster on several different fronts to keep up with an evolving workforce and the ongoing contest to attract top talent. An important initial step is fine-tuning the talent strategy: identifying growth areas and thus where the most critical skill gaps could emerge. Firms can then focus their talent programs on addressing these gaps first, both by casting wider cross-industry and cross-country nets and increasing investment in recruitment and in-house training for specialized skills.

Furthermore, manufacturing firms will need to strategize on how to appeal to Millennials, such as the promise of R&D opportunities and co-location with other tech-focused companies, ideally in towns with high quality-of-life offerings. And with job hopping on the rise, firms may need to develop efficient outsourcing programs, offering more project work on long-term contracts, as well as offering more options for remote work.

The lack of a sufficiently robust talent pipeline, however, starts with not enough young people considering technology-focused careers – and unaware of how trends like Industry 4.0 are changing manufacturing. In response, firms need to reach out and encourage students in their local communities early on to pursue STEM careers. This could include sponsored, interactive programs with schools that highlight innovation and problem-solving in manufacturing, together with visible and broad support for relevant certification and college programs, including graduate-level internships and strong apprenticeship programs.

This last step has been shown to work: Companies in Germany and Sweden, such as AB Volvo, Audi, BASF,

80%

OF SURVEYED MANUFACTURING
EXECUTIVES ARE WILLING TO PAY
MORE THAN MARKET RATE TO
FILL POSITIONS.



and Siemens have had an easier time recruiting precisely because strong ties with universities and graduate-apprenticeship programs have been the norm in these countries for some time.

The other end of the pipeline is redesigning strategies to retain employees and increasing succession planning. There may be a need to develop more flexible options for the most skilled resources as well as for older workers thinking about retirement, with the goal of ensuring that training and know-how get passed on.

In summary, the challenge for manufacturing firms of getting and keeping top talent is unlikely to go away anytime soon, and may get worse. Skyrocketing compensation and poaching may scratch the itch but they are not good long-term solutions. Innovation, flexibility, and investment will be as important to meeting future talent needs as they are to making the products of tomorrow.

Joern Buss

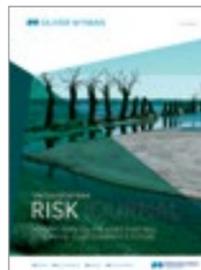
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¹ Millennials are roughly defined as those born in 1980-2004. In the US, they are now the largest generational cohort – about one-third of the population.

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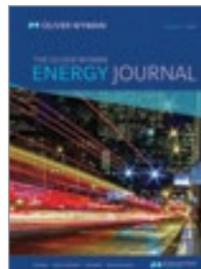
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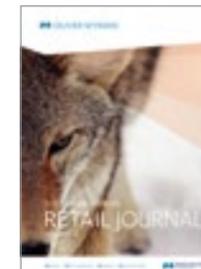
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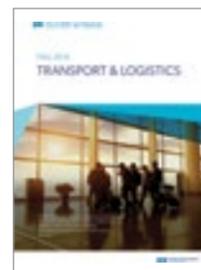
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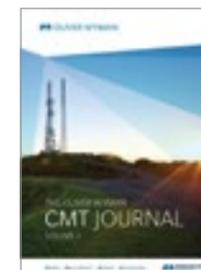
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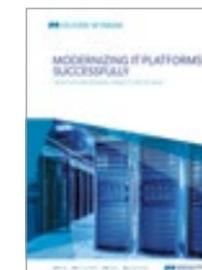
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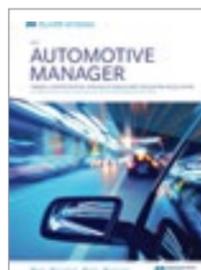
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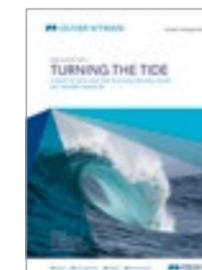
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