



THE OLIVER WYMAN  
**PERSPECTIVES ON  
MANUFACTURING  
INDUSTRIES**

# INTRODUCTION

Dear Reader,

These are turbulent times for manufacturing industries, with manufacturers everywhere around the world confronted with the threat of disruption, profound change, and an emerging recession that has already reached multiple sectors. However, there are measures manufacturing companies can take to not only weather the storm, but to emerge as winners.

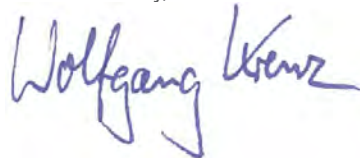
The 14<sup>th</sup> edition of *Perspectives on Manufacturing Industries* examines and analyzes major trends and disruptions facing the industry, including the impact of AI, the growing importance of cybersecurity in a digitalized world, the disruptive effects of tariffs, and the potential benefits of pay-per-use pricing.

In addition to those broader themes, we dive deeply into concrete product cost-reduction levers for preserving profitability and comprehensive means for achieving lasting performance improvement. But a pure focus on cost would be shortsighted: We also look at how the digitalization of the sales function and how leveraging suppliers in the research and development and innovation process can drive profitable growth.

Further, this latest edition takes up sector-specific topics that look not only at new technologies but also at new strategies: How is the construction sector managing its transformation from an industry once driven by hardware to one that is increasingly powered by software? How can defense manufacturers take full advantage of offshoring? Can Europe catch up to China on lithium-ion battery manufacturing or should it concede the race?

The voyage ahead is likely to be choppy and challenging for manufacturers – and will call for all hands on deck and that nothing can be taken for granted. But there are ways to manage the turbulence and navigate safely through the storm.

Yours sincerely,



**WOLFGANG KRENZ**

Sector Leader Manufacturing Industries

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Vol. 14

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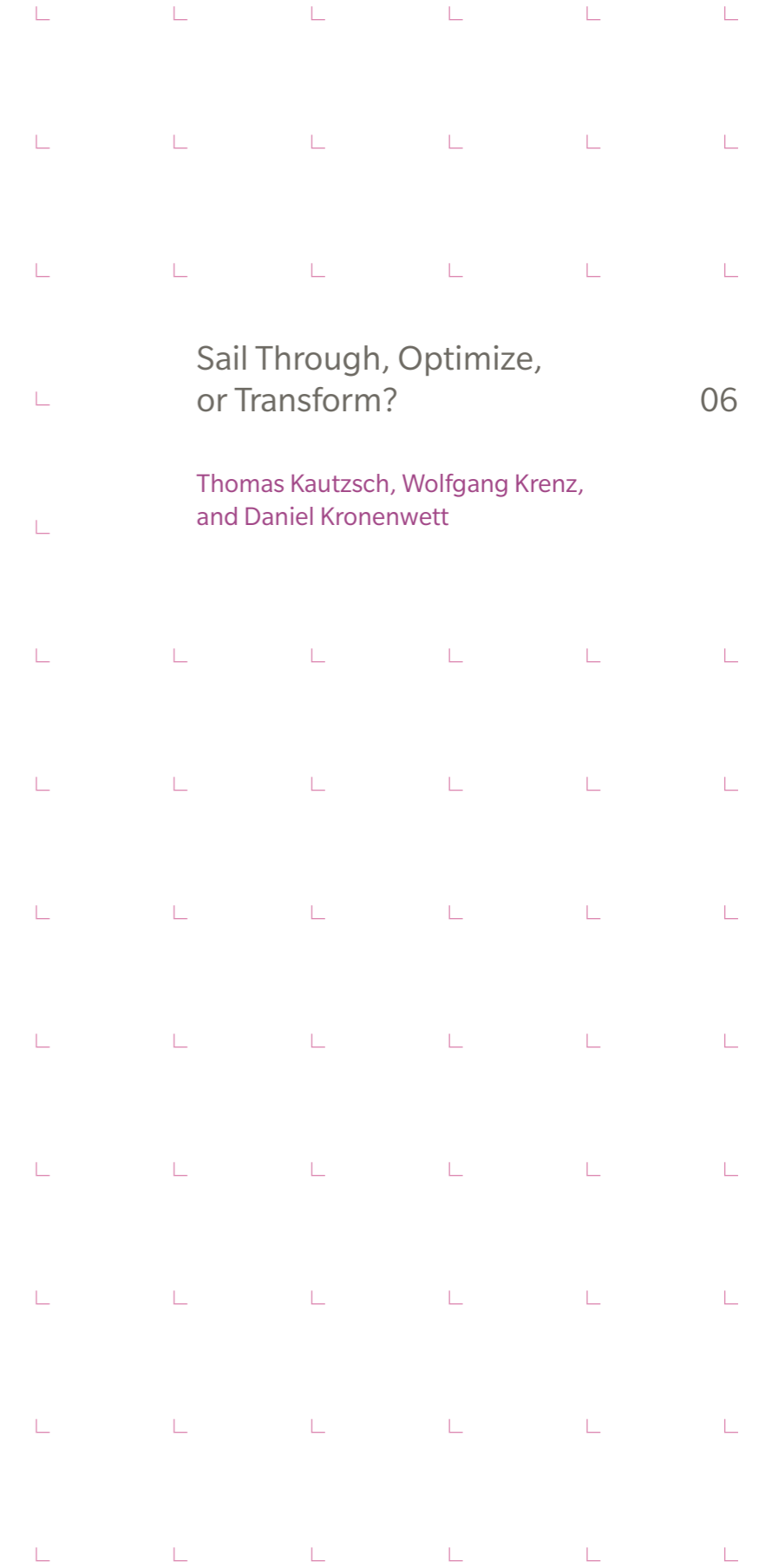
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# COVER STORY



Sail Through, Optimize,  
or Transform?

06

Thomas Kautzsch, Wolfgang Krenz,  
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COVER STORY

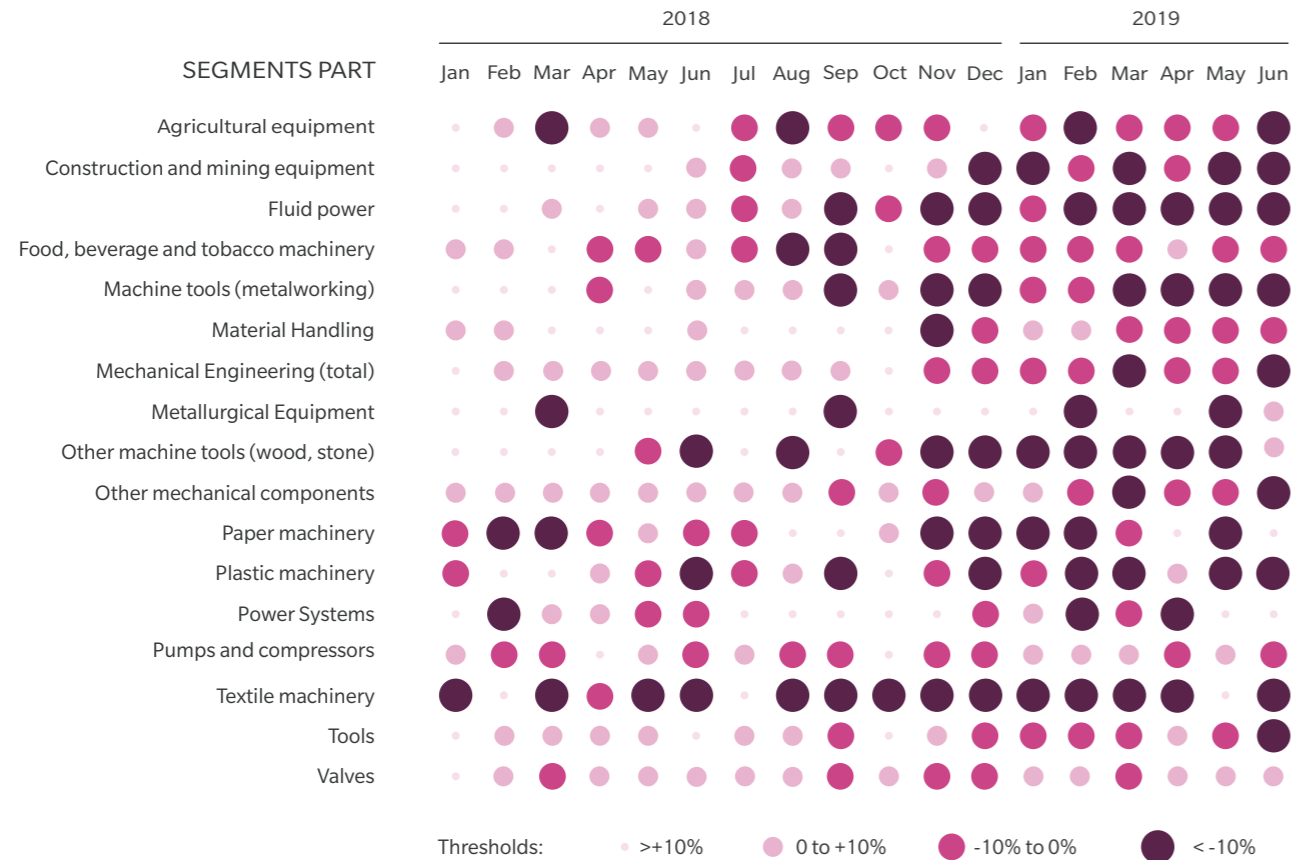
# SAIL THROUGH, OPTIMIZE, OR TRANSFORM?

HOW TO EMERGE AS A WINNER  
FROM THE NEXT RECESSION

Thomas Kautzsch, Wolfgang Krenz, and Daniel Kronenwett

The manufacturing industries market has grown for the past 10 years. Leaders in machinery and engineering firms grew accustomed to volatility and an unprecedented level of uncertainty and risk. But now – for the first time in a decade – lead indicators show an imminent downturn risk. The downturn will be different than previous ones and might hold a cocktail of shocks. However, most firms enter the potential downturn from a position of strength – certainly stronger than it was the case in 2008 – and could emerge as winners if they take the right action.

Exhibit 1: Monthly order intake German mechanical engineering segments (yoy development)



Since the financial crisis in 2008-2009, the market for mechanical engineering firms has grown steadily. With the exception of a few minor dips, the industry has experienced an economic upswing of unprecedented length. Despite all the volatility, uncertainty, and ambiguity, growth in machinery and engineering companies has been relatively steady. But now a potential downturn has become more imminent.

### RECESSION ON THE HORIZON

While macroeconomic indicators are still mixed, they have begun to show a downward trend in the past months: the German IFO index has dropped in June 2019 to the lowest level since November 2018. Europe is up a bit in the second quarter of 2019 but the US purchasing manager index dropped for the third month in a row, to its lowest level in three years.

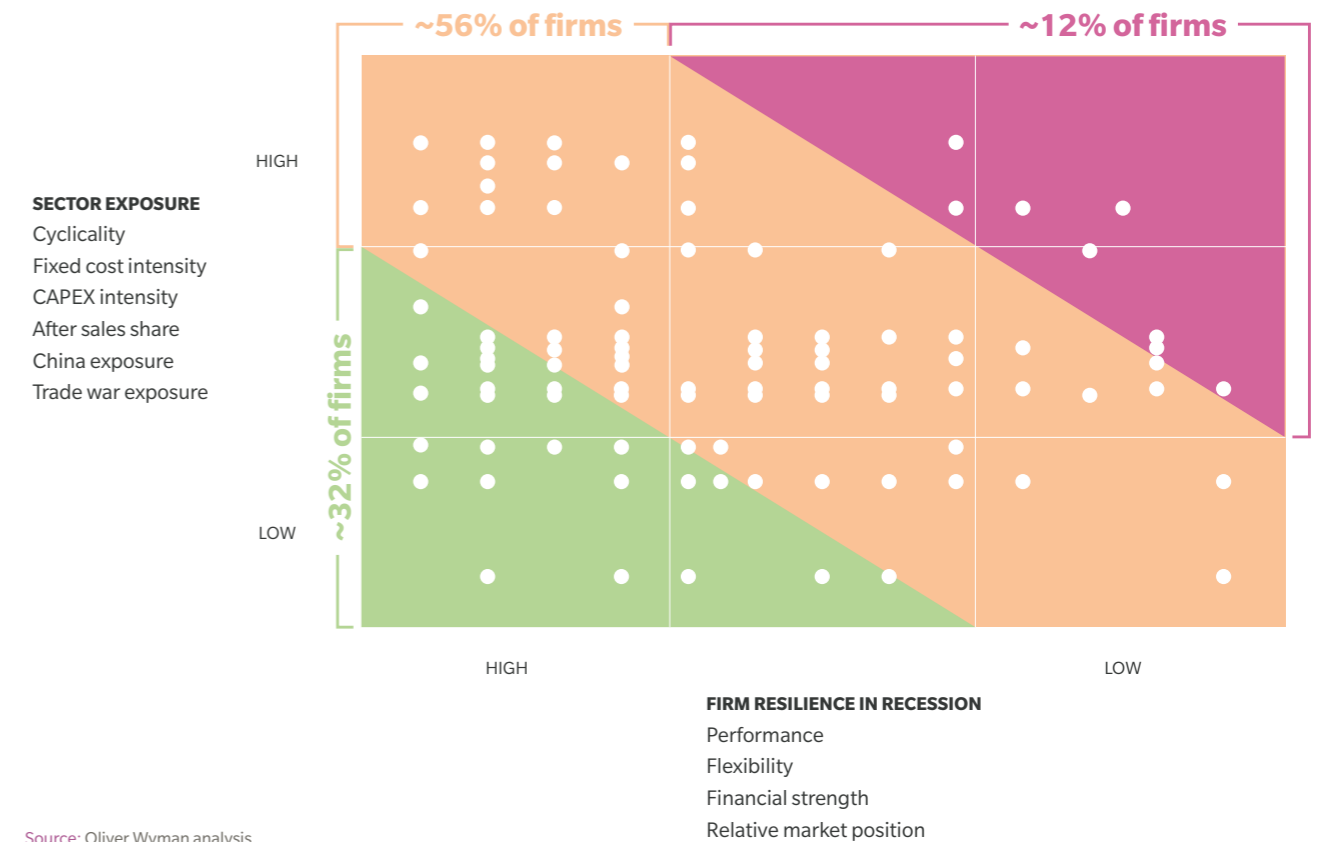
Oliver Wyman has built a lead indicator to predict potential recessions in mechanical engineering. While the

**88%**

**OF MANUFACTURING INDUSTRY FIRMS ARE CURRENTLY IN A GOOD POSITION**

indicator for Germany has been in the neutral-to-“green” range since 2009, it turned “red” in the last quarter of 2018. As the lead-time for this indicator is four quarters, it indicates a downturn for the sector as a whole in the second half of 2019. Some early-cycle subsectors are already experiencing a sharp decline in new orders: for example, plastic machinery,

Exhibit 2: Starting situations differ strongly by manufacturing firm (\*dots represent companies)



textile machinery, and machine tools all saw a drop-in demand in excess of 10 percent. (See Exhibit 1.)

### THE NEXT RECESSION WILL BE DIFFERENT

The downturn in 2008-2009 was harsh but relatively short for most of the industry: the drop-in demand was severe, but governments and central banks acted decisively, and demand rebounded quickly. Companies that did cut their cost in the short term and kept their core group or employees weathered the storm reasonably well.

However, this time the recession will be different for three reasons:

Firstly, a downturn will accelerate the underlying shift in demand that is driven by structural changes like electromobility or digitization in many subsectors. For example, the automotive industry is likely to cut capital expenditures for machinery for conventional combustion engines even further in a downturn to preserve investments in e-mobility.

Manufacturers affected by these accelerated market shifts will suffer disproportionately.

Secondly, trade barriers are likely to rise further in a downturn, disrupting global supply chains and complicating sales for machinery firms, which rely heavily on export sales.

Lastly, the ability of governments and central banks to help in a downturn has decreased significantly as public debt has grown and interest rates have little room to drop further. In an extreme scenario, the stability of the Euro or the global financial system might be tested.

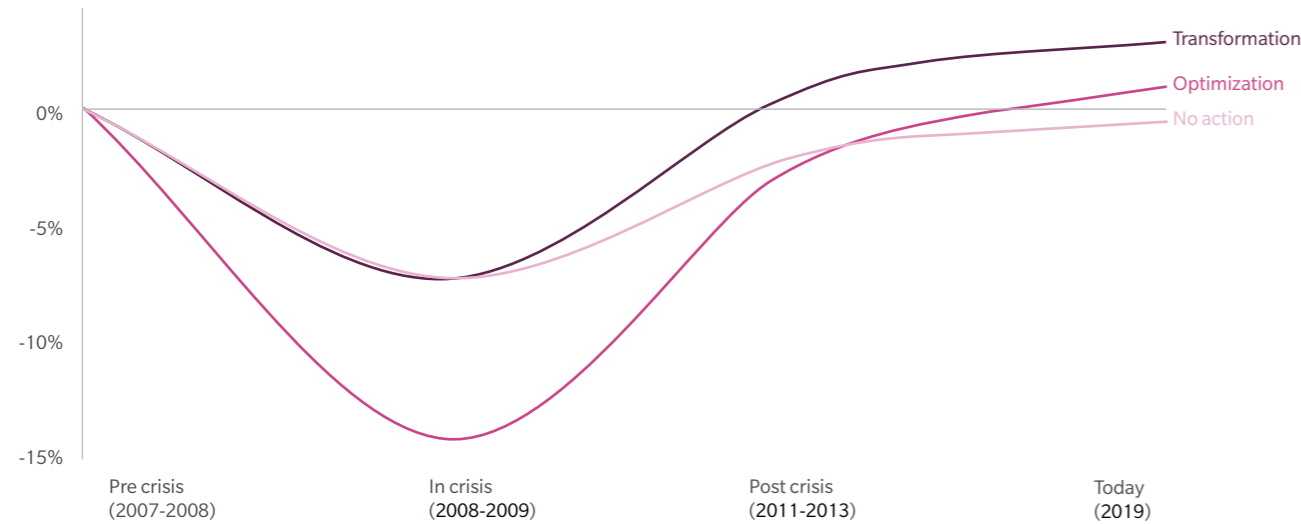
So, anything from a mild wind to the perfect storm seems to be possible.

### COMPANIES ARE STRONG AND HAVE SIGNIFICANT UNTAPPED POTENTIAL

That said, companies currently find themselves in a strong position. Thanks to low interest rates, there is significant financial headroom, equity has been up built over 10 years of growth, and profitability is back to 2007 levels. (See Exhibit 2.)

**Exhibit 3: Action creates a return**

Adj. EBIT-margin development for peer group in the same industry segment  
 Percentage point difference, sample of 100 public manufacturing firms during 2008-2009 recession



Source: Financial Benchmarking, Oliver Wyman analysis

At the same time, there is significant room for reduced complexity, better performance, lower cost and more flexibility. Because many companies have been busy managing growth, structural cost reduction has been postponed in many cases, and the move to low-cost countries and localization of supply chains has not moved along as fast as planned. In many cases, IT platforms date back to the 1990s and digitalization of processes are still in the pilot stage.

**HOW TO EMERGE AS A WINNER**

Industry aspirations are high: A survey by Oliver Wyman indicates that 91 percent of executives aim to emerge stronger from the next downturn.

And for those who act decisively, the returns are likely to be significant. On average, companies that actively undertook a transformation of their business in the 2008-2009 recession saw a 4 percent EBIT gain, as compared to those who took a passive approach. (See Exhibit 3.) Those companies that deployed traditional cost-cutting measures came out in between.

What companies should do in order to prepare for the downturn very much depends on the situation they are in.

“Sail Through”, “Optimize”, and “Transform” are typical archetypes for strategies in a recession. (See infographic for details and case examples.) There are certainly a number of generally good practices such as full transparency, securing financing and cash, having multiple contingency plans ready, and being aware of how recession-proofed your management team is. Having taken those steps, companies should decide on their recession strategy and aim high to emerge as a winner!

**Thomas Kautzsch**

Thomas.Kautzsch@oliverwyman.com  
 +49 89 939 49 460

**Wolfgang Krenz**

Wolfgang.Krenz@oliverwyman.com  
 +49 89 939 49 403

**Daniel Kronenwett**

Daniel.Kronenwett@oliverwyman.com  
 +49 89 939 49 591

**THREE DIFFERENT APPROACHES TO WIN IN A RECESSION**



**EXAMPLE: MANUFACTURER OF COMPRESSORS FOR THE OIL & GAS INDUSTRY.** Sail through meant to temporarily reduce leased labour and refocus on planned internal projects.

**WHEN?**  
 Strong market position  
 Well prepared for future trends  
 Short & shallow downturn expectation  
 Very solid financial position

**WHAT?**  
 No fundamental changes

**HOW TO WIN?**  
 Good judgement  
 Grab opportunities

**SITUATION**  
 Steep decline in demand  
 (from 100 to 6 units per week)

**ACTION**  
 Reduction of leased labour to zero  
 Kept core employees and implemented planned internal projects

**OUTCOME**  
 Emerged from downturn with improved operations  
 Fast ramp up after recession



**EXAMPLE: CONSTRUCTION AND BUILDING MACHINES.** Optimize meant a full restructuring program with short- and long-term measures.

**WHEN?**  
 Greater financial restrictions  
 Short- to mid-term need for action  
 Uncertainty about downturn length

**WHAT?**  
 Traditional cost cutting  
 Some structural changes

**HOW TO WIN?**  
 Early and comprehensive action program  
 Address structural issues

**SITUATION**  
 Market leader  
 Sector strongly hit by financial crisis  
 Weak footprint in China  
 Inefficient operations

**ACTION**  
 Cash generation  
 Capacity reduction  
 Product cost reduction (-30%)  
 Supply chain push -> pull  
 Focus on core value add  
 Implementation faster than competitors

**OUTCOME**  
 Return to profitability  
 Outgrowing competitors  
 Strengthened leadership position



**EXAMPLE: AUTOMOTIVE EQUIPMENT SUPPLIER.** Transform meant to reduce dependency on one customer industry and adapt corporate structure.

**WHEN?**  
 Uncertainty about downturn length & depth  
 Game changer opportunity  
 Solid financial position

**WHAT?**  
 Strategic and structural repositioning  
 Digital transformation  
 M&A

**HOW TO WIN?**  
 Clear strategic target picture and transformation plan  
 Buy-in from management and stakeholders  
 Early and decisive action

**SITUATION**  
 Market leader  
 Stretched after series of acquisitions  
 Strong cyclicalty  
 Slowing OEMs investments  
 Financial stretch

**ACTION**  
 Divestments  
 Redesign of core business  
 Refinancing  
 M&A

**OUTCOME**  
 Widened gap to #2  
 Double digit organic growth  
 3x EBIT

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MANUFACTURING IN A CHANGING WORLD

# DEMYSTIFYING AI: MOVING BEYOND THE HYPE

WHEN ARE WE FINALLY GOING TO SEE  
THOSE „HUMANLESS“ FACTORIES?

Jochen Graff, Cornelius Herzog

For many years now, automakers promised that the first fully autonomous cars would hit the market in 2018. Clearly, that has not happened. Despite an \$8 billion investment in 2018 alone by the global auto-tech industry, some cars now have some autonomous features, but they cannot handle the real-world driving experience without a human onboard. Similarly, manufacturing experts have been predicting for years that machines and robots, simply enabled by artificial intelligence (AI) and machine learning (ML), would lead to fully automated factories with no requirement of any human interaction. But even today's most advanced self-learning AI systems cannot come close to matching the wide array of tasks a human engineer executes, and require professionals to „teach“ AI systems how to „learn.“

Why has AI failed to live up to the hype? In short, it is because people, both so-called experts and the public, have outsized expectations about the potential capabilities of AI. With all the buzz about AI and robots replacing humans, people assume that AI and ML can learn to reason and think abstractly and respond to unforeseen events the way humans do. That is not even close to the truth. In fact, the technological state of AI has the reasoning skills of a 4-year-old child – and therefore clearly unable to independently manage the complex operations that go on inside a factory.

That is not to say that AI has nothing to offer. The current state of AI is capable of addressing many of manufacturing’s much-needed tasks, such as detecting patterns in quality failures and identifying potential efficiencies. But AI cannot respond to unknown environments, such as an unknown processing technique or an entirely new product to manufacture, or figure out how to react to random and out of the ordinary situations, such as a new and previously unknown malfunction or a power outage.

### HOW DOES MANUFACTURING BENEFIT FROM AI?

To unlock the full value of AI, there are two key prerequisites: Present a clear problem that can be solved with an objective truth and amass a large amount of training data – either real-world data or a problem that can be simulated. In short, let AI handle discreet, narrowly focused tasks and let humans handle complex problems with unknown variables. For example, AI is good at optimizing process efficiency in clearly defined process flows, while humans are much better at redesigning and optimizing shopfloor layouts. Similarly, AI is very strong at identifying quality issues in real time, but humans are still superior when it comes to resolving the root causes of these issues.

### PROVEN USE CASES

Yet, there are many areas in manufacturing where AI is successfully being deployed today. In fact, more than 50 percent of large global companies will apply AI-enabled solutions in their supply-chain operations on a broad scale within the next five years! Consequently, worldwide spending is growing at staggering rates of more than 50 percent annually on cognitive and artificial intelligence systems and will surpass \$20 billion in 2019 .

While there is a wide range of use cases being implemented in the supply chain, there are three especially promising use-case examples: Demand forecasting,

production planning and scheduling, and visual pattern recognition. (See Exhibit 1.)

#### 1. Demand forecasting

One of the most challenging aspects of managing a supply chain is predicting the future demand for production. Machine learning is proving to be very effective at correlating hundreds and thousands of factors and deriving results that are much more accurate than can be achieved with traditional statistical methods. As a result, businesses can lower their inventory and operational costs and respond much quicker to customer demands. For example, by using a machine-learning engine in its supply chain, a leading provider of climate control products increased sales by 50 percent and inventory turnover by 25 percent. However, businesses should be aware that AI-based forecasting has its limitations and can only predict future outcomes that are directly correlated to previous events.

### TODAY’S TECHNOLOGICAL STATE OF AI HAS THE REASONING SKILLS OF A 4-YEAR-OLD CHILD.

#### 2. Production planning and scheduling

Machine learning can consider multiple constraints and optimize more effectively for them than traditional enterprise resource planning and production planning solutions. For instance, AI engines can digest machine data (speed, vibrations), environmental data (temperature, humidity), planning parameters (waiting times), forecasting

Exhibit 1: Three promising use-cases where AI is already successfully used today.



Source: Oliver Wyman analysis

data (demand), and more. They then correlate these vast amounts of input data to the output value of key metrics. By uncovering patterns in positive outcomes, they can derive insights for improving business performance. In addition, shop floor operations can be cross-linked with AI-enabled scheduling in real time to improve decision-making at each production run in a feedback loop. As a result, businesses are reducing lead times for components and parts, improving equipment utilization by up to 85 percent.

#### 3. Visual pattern recognition

AI is also proving to be very effective at automating visual quality inspection in factories and throughout logistics hubs isolating damaged products and wear. Modern AI systems can be trained to recognize complex visual patterns using deep neural networks that are able to identify even microscopically small material defects. For example, one of the world’s largest logistics companies leverages a powerful AI engine to determine if a shipping container was damaged

and to recommend the best course of action to repair the assets in real time. Similarly, precision machinery providers can guarantee 100 percent defect-free products by applying fully automated vision inspection systems.

These examples show: while the fully automated, „zero-human“ factory remains more of a science-fiction dream than a reality, there are already many tangible use cases – especially in supply chain – that are boosting business performance today.

**Jochen Graff**  
[Jochen.Graff@oliverwyman.com](mailto:Jochen.Graff@oliverwyman.com)  
 +49 211 8987 637

**Cornelius Herzog**  
[Cornelius.Herzog@oliverwyman.com](mailto:Cornelius.Herzog@oliverwyman.com)  
 +49 89 939 49 593

# BRIDGING THE CYBER GAP IN MANUFACTURING

## HOW TO NAVIGATE THE CYBER JUNGLE

Emmanuel Amiot, Eric Ciampi, Charles de Pommerol

Innovations brought on by technology are rapidly transforming the manufacturing and supply-chain sectors. Digitalization, a game changer, is bringing with it multiple benefits, such as mass customization, dynamic make-to-order products, real-time data-driven operations, and management of the extended supply chain. Increasingly, machinery, products, and delivery vehicles are becoming interlinked.

These changes imply the continued evolution of information systems towards greater modularity, openness, interoperability, and, especially, security. That said, industrial companies face a host of challenges in transforming their IT/OT capabilities: legacy hardware and software, insecure systems, networks with limited encryption proficiency, proprietary connectivity protocols, and a talent shortage.

Additionally, manufacturers are relatively late in addressing their cybersecurity needs. Making it a board-level priority in the industry has proven more difficult than in other sectors, such as financial services or defense.

Still, cybersecurity should be a key priority, as the cost of cybercrime is estimated in 2019 at \$1,000 billion. The recent cyberattacks mounted on industrial companies – NotPetya, Triton, and Stuxnet – revealed the high degree of interconnectivity and vulnerability of industrial systems (such as SCADA, PLC, and Industrial Internet of Things (IIoT) devices) with the non-industrial world. The spread of IIoT has brought with it heightened concerns over what data is captured and how.

The case for change is clear: Cyberattacks in manufacturing industries are on the rise. But how do manufacturers close the cybersecurity gap in the most pragmatic and cost-efficient way?

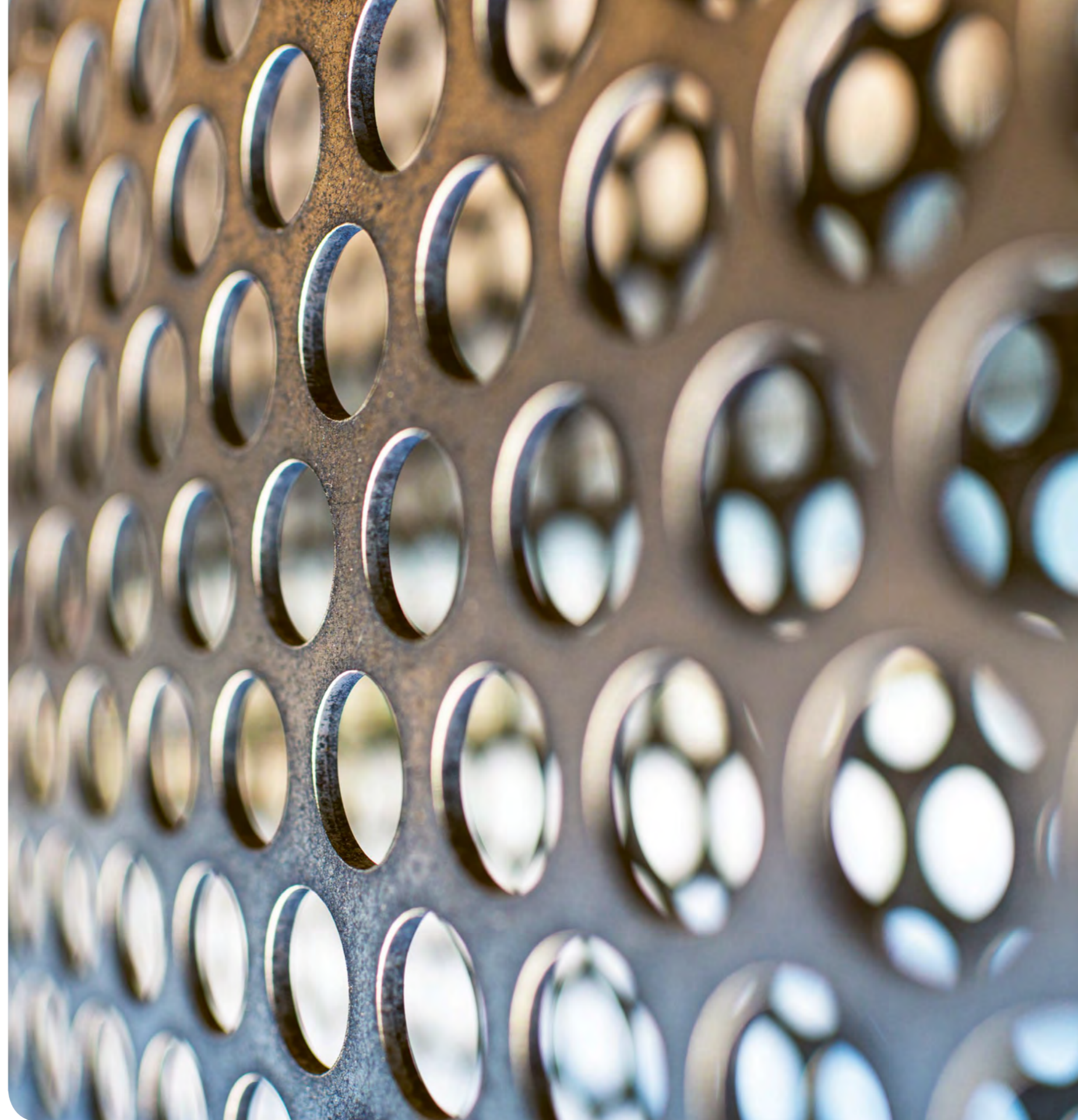
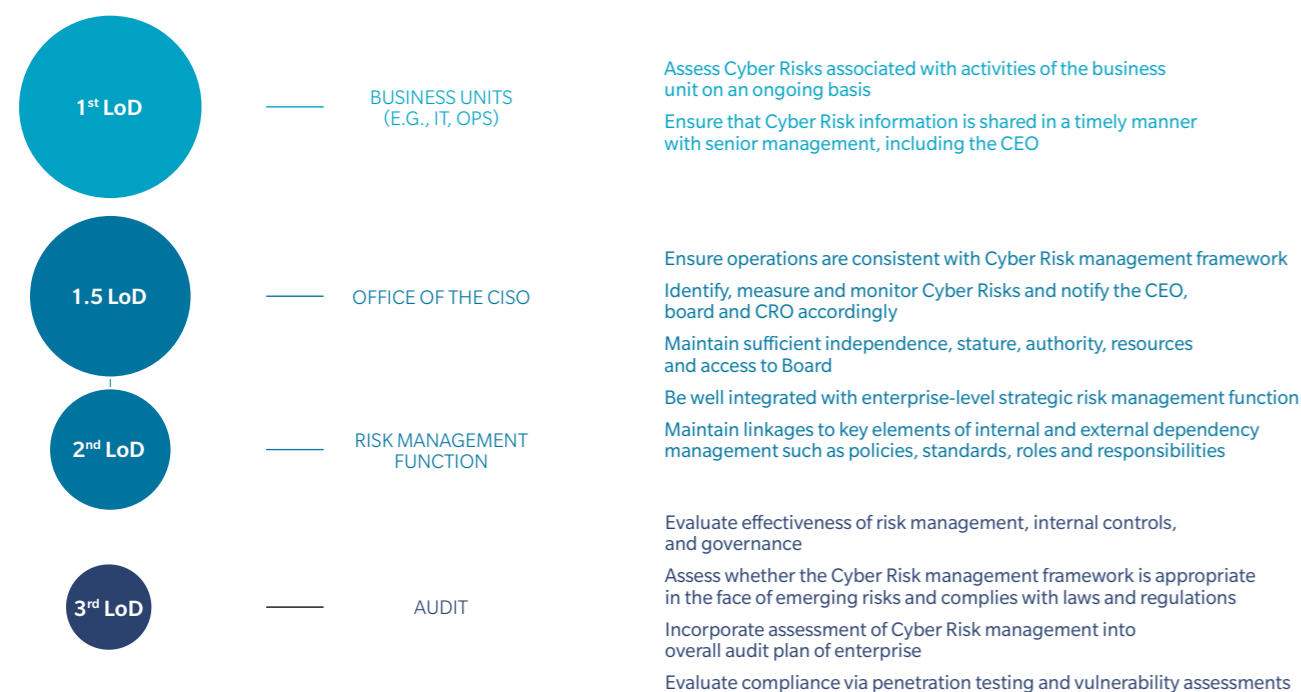


Exhibit 1: Three Lines of Defense concept as applied to cyber



Source: Oliver Wyman analysis

Looking at what the financial-services sector has managed to do may provide an answer. The sector has been a leader in delivering cybersecurity in complex IT ecosystems. Seeing how key financial players defined, launched, and reoriented their cyber transformation offers powerful lessons.

### LESSON #1 – The Chief Information Security Officer needs to be a “serial” tester

Companies need someone in the driving seat to steer cybersecurity initiatives at all its manufacturing sites.

Initially, the common reflex of any company has been to argue, “Cybersecurity is an IT matter.” The Chief Information Security Officer (CISO) thus was conceived as the central owner of all security capabilities. In practice, however, the security setup turns out to be much more fragmented: the plant controls the industrial networks, infrastructure (such as IT production) maintains most of the corporate network security, operations oversee IT risk management controls and business continuity plans, and compliance owns security controls, including cyber fraud.

The positioning of the manufacturing CISO outside the IT function – and implementing a three lines of defense

model – provides a solution to the roles-and-responsibilities puzzle. (See Exhibit 1.) In the model, the first line of defense are the controls on the activities of the business unit; the second line of defense is managed by the CISO and an enterprise-level strategic risk-management team; and the third and final line of defense consists of frequent audits.

This approach ensures that the CISO effectively and firmly defines and owns all IT/OT cybersecurity-related controls. The mandate of the CISO is to:

- Independently define and own the group cyber-risk appetite statement in coordination with the board, creating the right level of adherence from IT, business lines, plants, and support functions
- Define and own cybersecurity policies, standards, and procedures
- Help define the roadmap to implement controls and reach target thresholds
- Continuously test the organization against the defined targets – via penetration testing and red team exercises

### LESSON #2 – A strong foundation is key

Once a manufacturing CISO is positioned and empowered adequately, the next step is to figure out where to start the

transformation. Even in cases in which companies go in this direction, starting with the deployment of security tools rather than setting the basics right is not the way to begin.

Effective cybersecurity is about knowing where the data lies and who should have access to it rather than deploying a solution per se (in fact, that should be the very last step). It is crucial to put the foundations in place so as to avoid unnecessary costs and poor risk mitigation. In practice, this means:

- Defining your cyber-risk appetite and thresholds for controls by type of risk
- Building and maintaining an enterprisewide list of business-critical services
- Instilling a heightened cybersecurity awareness in the different teams
- Stress-testing infrastructure by simulating attacks
- Defining and maintaining incident management processes, including business continuity/disaster recovery plans, for critical processes and systems
- Building dashboards/KPIs for on-going monitoring
- Having two distinct but interconnected networks (industrial and corporate)

### LESSON #3 – How to securely move to the cloud

Now that the lines of defense are in place and a solid foundation has been laid, the manufacturing CISO turns to defining the company’s three-year cybersecurity strategy in coordination with senior leadership. The manufacturer’s public cloud strategy represents the proverbial elephant in the room, given the rise of IIoT and the connected supply chain.

Leading companies have developed best practices in this domain. First, they have established a central, overarching security approach to the cloud and legacy systems made up of three layers of protection:

- Identity and Access Management (IAM): Access rights are managed centrally to ensure that access to systems and data is assigned to administrators and users on a “need-to-have” basis
- Multifactor Authentication (MFA): MFA is used to ensure that administrators and users are authenticated before accessing the cloud or legacy environment
- Encryption and tokenization are employed in cases of particularly sensitive data

Second, leading companies leverage security offerings from cloud providers to prevent common threats, benefit from scale effects, and avoid having to reinvent the wheel.

### A FUNDAMENTAL CULTURAL SHIFT IS NEEDED

Bridging the cybersecurity gap entails a fundamental cultural shift that the head of manufacturing, the CIO, and the board need to demand, support, and nurture. Here is how to trigger the change:

Over the next six months

- Define the business’ cyber risk-appetite statement based on identified exposures – with the goal of putting a dollar figure on potential losses
- Translate the cyber risk-appetite statement to a dashboard that enables management to oversee and steer the transformation
- Appoint a manufacturing CISO and develop your target cybersecurity model
- Conduct advanced, independent penetration tests and red team exercises to identify vulnerabilities

Over the next 12 months

- Bring the most critical manufacturing sites up to speed in terms of cyberthreat detection and response
- Implement a strict access control policy to sensitive systems, supported by best-in-class identity- and access-management tools and advanced encryption to prepare for the transition to the cloud
- Close the most critical findings identified through penetration tests and red team exercises
- Define a cybersecurity organization ramp-up program and talent management strategy

Manufacturing companies have a great deal of work ahead of them in securing their operations, given their vulnerability to cyberattacks. However, there are strategies to mitigate risk and secure key assets. To be ready for the future, manufacturing companies must be prepared to act now.

**Emmanuel Amiot**  
Emmanuel.Amiot@oliverwyman.com  
+33 1 45 02 32 71

**Eric Ciampi**  
Eric.Ciampi@oliverwyman.com  
+33 1 45 02 32 34

**Charles de Pommerol**  
Charles.Depommerol@oliverwyman.com  
+33 1 45 02 36 38



MANUFACTURING IN A CHANGING WORLD

# IS “PAY-PER-USE” THE FUTURE IN MACHINERY PRICING?

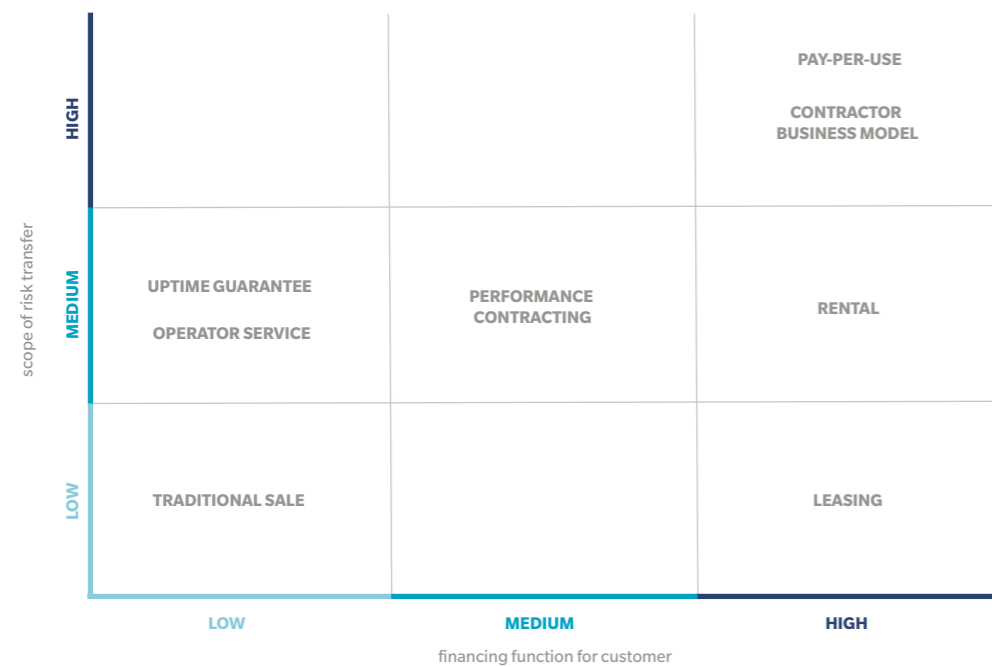
AN INNOVATIVE BUSINESS MODEL MAY  
NOT LIVE UP TO THE EXPECTATIONS

Wolfgang Krenz, Daniel Kronenwett

The proliferation of the Industrial Internet-of-Things (IIoT) has created tailwinds for pay-per-use business models. Many companies have made these models part of their strategic agendas or have started to develop and sell solutions. But, while the level of activity is high and the asserted benefits numerous, one question remains: Does pay-per-use make business sense?

A broad range of manufacturers has begun offering pay-per-use models to customers. One example is a compressed air and vacuum products manufacturer offering customers a fixed price per cubic meter of compressed air; another is that of a printing press manufacturer charging for use of his press by the printed page. Even outside of production equipment, we see the spread of pay-per-use models: An elevator manufacturer has offered to maintain ownership of its elevators and charge the customer a variable annual fee based on usage, promising lower total costs.

Exhibit 1: Classification of pay-per-use and related business models from an equipment manufacturer's point of view



Source: Oliver Wyman analysis

While some equipment manufacturers are employing pay-per-use models as a way to lock in customers – and maximize revenues over the product life cycle and generate steady cash flows – others are focusing on new customer acquisition or in broadening their offering to a new clientele.

### WHAT PAY-PER-USE REALLY IS

In a classic pay-per-use model, the user of a piece of industrial equipment does not purchase and own the product. Instead, customers pay a fee that depends on usage and is measured according to clearly specified consumption, output, or other indicators, which nowadays are more easily controllable through sensors connected to the IIoT.

From an economic standpoint, the industrial equipment pay-per-use model solves two issues users are facing: Firstly, it addresses the issue of financing (equipment users do not invest upfront but pay later, typically from operating cash flows generated by using the equipment); and secondly, it is a risk transfer mechanism from equipment user to equipment maker, especially with regard to operational risk (having the machine available, and running it at performance and at cost) and business risk (the risk of machine under-utilization when orders and demand fall below expectations).

Pay-per-use is not a new concept. Well before the emergence of the Industrial Internet-of-Things, models had arisen to satisfy customer demand for such comprehensive financing and risk transfer. Think of contract manufacturers that have taken over assembly tasks in the electronics industry, or of “bottlers” that are contracted by beverage brands to fill and package their drinks.

Models similar to pay-per-use have also been used in very specific situations, including mission-critical components with a high up-time requirement such as aircraft turbines or valves for petrochemical plants. Lastly, de-facto pay-per-use models also exist for system businesses in which the manufacturer of a machine captures most of the value through the sale of related consumables such as cartons for drinks or paper and ink cartridges for printers.

Also, the offline world has solutions on offer when only elements of a pay-per-use model are required, such as leasing or other vendor financing solutions to meet the need for financing or operator models where equipment makers run the machinery for the owner as a service, as was popular in the automotive industry a few years ago.

### THINK TWICE – OR ELSE IT IS NOT ALL RIGHT

So, when contemplating the entry into IIoT-enabled pay-per-use models, equipment manufacturers need to ask themselves: Is the customer’s problem being solved in a better way than through existing solutions? Is the manufacturer better positioned than the customer to carry the utilization and operational risks? Is the customer ready to share the necessary data and relinquish a measure of control? Is the customer willing to pay a premium for the manufacturer’s assumption of risk? Will the service usage generate enough income for hardware amortization within a reasonable timeframe? (See Exhibit 1.)

Most certainly, utilization risk represents a key concern. Many pay-per-use models seek to exclude or hedge this risk by putting a minimum-order clause in the contract, thus making these models less attractive for customers.

Equally, managing the operational risk can be challenging, as machinery output depends not only on technical performance, but on other input factors such as the quality and availability of materials, the skill-level of the machine operator, and the effectiveness of production planning. This can lead to conflict between the equipment maker and the user, as controlling all these factors by IIoT means is not possible. Therefore, additional efforts of the equipment maker are necessary, such as placing their own machine operators, making the solution costlier and more complex and further blurring the boundary between the equipment maker’s and the user’s business.

These examples show that the answers to the questions we posed are not straightforward and that a detailed analysis is needed to grasp the prerequisites of a successful pay-per-use model.

### NO HOPE FOR PAY-PER-USE?

While we have highlighted the various obstacles to pay-per-use, there are areas where it can yield value. With its low supply cost and high contribution margin, machine software leads the list. Software can be delivered through the internet and has practically no incremental cost associated with each new installation. Once a piece of software has been developed, any new user won through a pay-per-use approach generates additional margin. Another promising model may be to implement pay-per-use models for certain machine features that exhibit software-like characteristics. An example is measuring machines or painting machines, for which the customer can temporarily “unlock” and run special programs on-demand.

Other attractive pay-per-use applications comprise features that the customer needs occasionally or processes that have an auxiliary function and are not part of the business’s core competencies. Moreover, advantages over offline solutions can be sustained where IIoT connectivity truly adds value and helps control more variables than in the offline world (for example through smart sensors on complex tunneling equipment that operates in tough environments, is prone to breakdown, and is difficult to control).

Lastly, pay-per-use models can be useful in bringing innovative machinery to the market because they lower the entry hurdle for customers and essentially represent a “gain-sharing” agreement between equipment makers and users, where the equipment manufacturer is only paid in full if the equipment delivers on the promise of innovation.

In summary, IIoT-enabled pay-per-use models make sense in certain specific circumstances. Often they do not fundamentally change the equipment maker’s ability to take over the associated risks, nor do they alter the underlying economics and business logic of an equipment maker vs. an equipment operator business model. It is likely we will see fewer equipment manufacturers successfully adopting a pay-per-use model than some industry experts currently believe. Is pay-per-use the future in machinery pricing? The short answer is: No.

**Wolfgang Krenz**  
[Wolfgang.Krenz@oliverwyman.com](mailto:Wolfgang.Krenz@oliverwyman.com)  
 +49 89 939 49 403

**Daniel Kronenwett**  
[Daniel.Kronenwett@oliverwyman.com](mailto:Daniel.Kronenwett@oliverwyman.com)  
 + 49 939 49 591

# TARIFF RISK-MITIGATION STRATEGIES FOR MANUFACTURING INDUSTRIES

HOW US IMPORTERS OF  
CHINESE PARTS CAN REACT

Kevin Hauser, Andrew Chien

In July 2018, the US imposed a 25 percent tariff on Chinese imports worth \$34 billion. Shortly afterwards, the US government followed that up with a 25 percent tariff on goods worth \$16 billion and a 10 percent tariff on goods worth \$200 billion. For the latter list, the US raised tariffs to 25 percent in May 2019, imposed additional tariffs on \$112 billion worth of goods in September 2019 and threatened tariffs on \$160 billion worth of goods. Despite a tentative agreement for a “first phase” of a trade deal, tariffs on Chinese goods may remain for a “substantial period” according to both the US government and analysts. (See Exhibit 1.)

Firms have responded. As early as September 2018, a supplier to major multinational computer technology companies said that it was considering relocating its motherboard production line to Taiwan. One of the world’s largest tech companies has shifted substantial smartphone assembly from China to Vietnam. Companies have started to answer questions on the impact of tariffs and mitigation options.

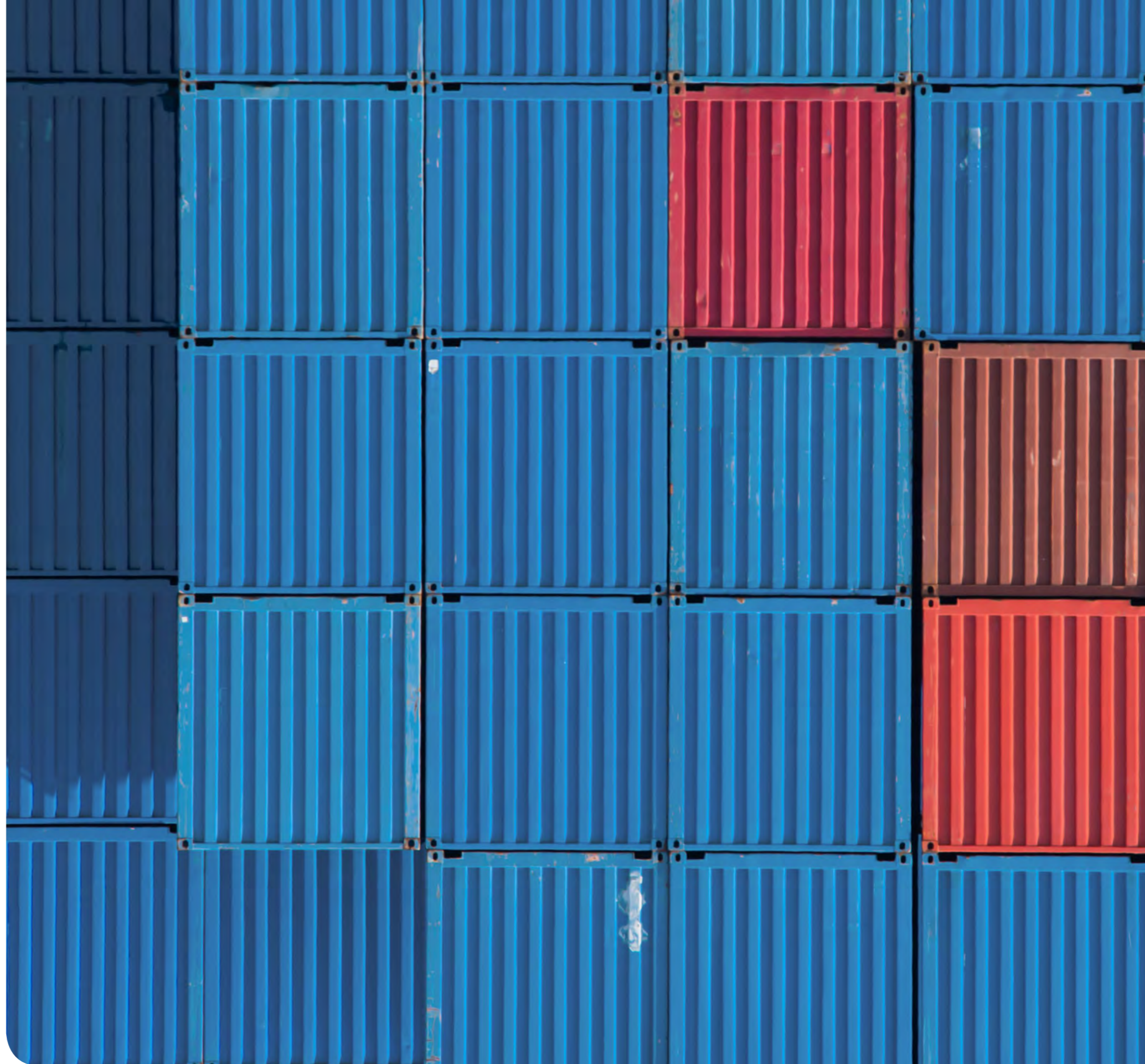
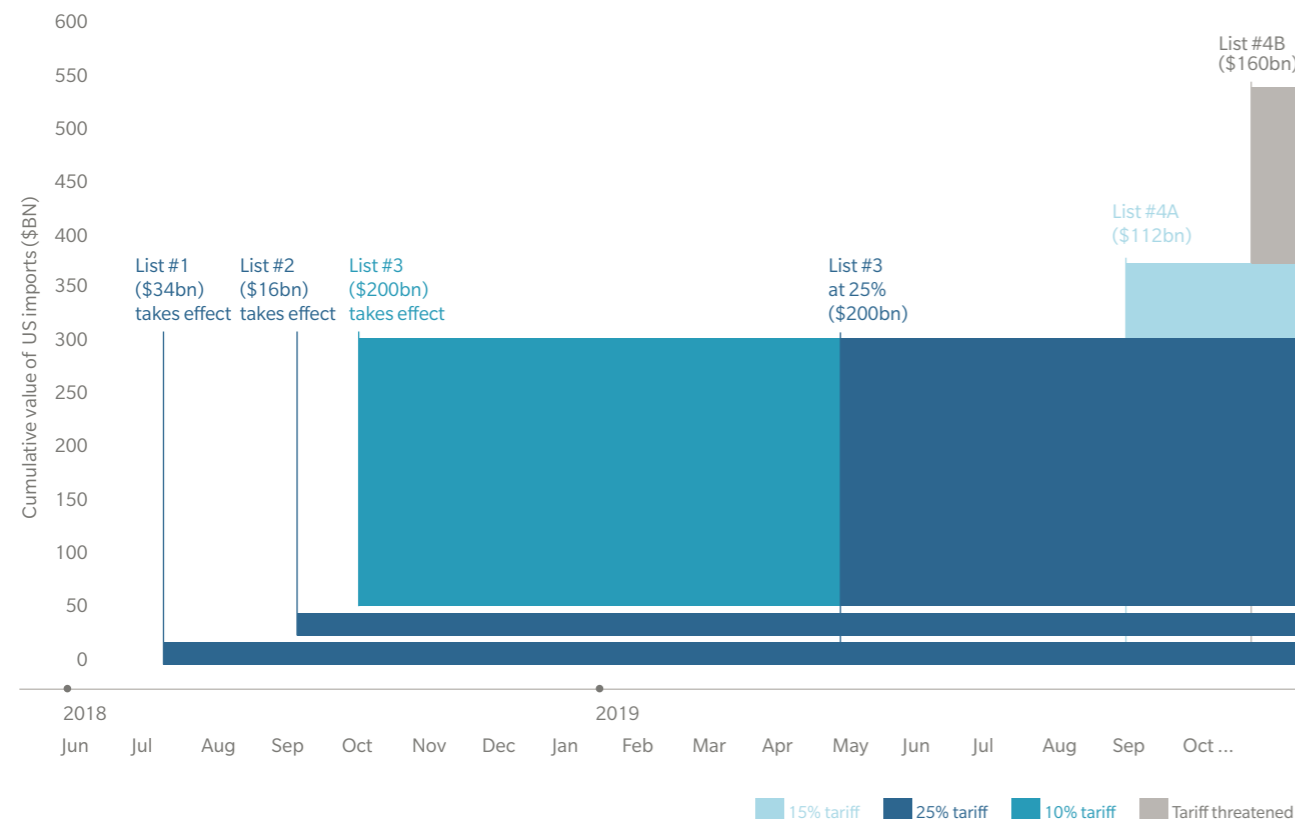


Exhibit 1: Evolution of US 301 tariff actions (incl. threatened tariffs) as of October 28<sup>th</sup>, 2019



Source: Oliver Wyman analysis

### ANY INDUSTRIAL FIRM CAN POTENTIALLY BE IMPACTED

Section 301 of the 1974 US Trade Act provides the United States with the authority to address what it calls “trade practices related to the forced transfer of [American] technology and intellectual property” by imposing tariffs. Specifically, these tariffs are applicable to companies that import products to the US and operate in industries such as aerospace, information and communication technology, robotics, and machinery. More generally, however, the US International Trade Administration targets “products that benefit from China’s industrial plans.” This implies that companies need to have a clear understanding of the origin of their products and components.

Tariffs may be imposed on the full value of a product if one or more of a product’s components have a code or number on one of the tariff lists and where the country of origin is China. Generally, the more parts there are on any

of the lists, the higher the probability that US Customs or a US court will find the product to be Chinese and therefore subject to the tariff.

### SUBSTANTIAL TRANSFORMATION IS THE KEY CRITERION

When assessing a product’s country of origin, the qualitative “substantial transformation” test is used. The test considers, among other criteria, where key components originate and how complex the manufacturing processes are in different countries. It is important to note that there are multiple ways to establish the country of origin. It may be determined by final assembly location, where major components (or the majority of them) are manufactured, or where key transformations occur.

Due to the legal complexity and case-by-case approach of authorities, performing due diligence is highly recommended to assess tariff impact. Any importer needs

### COMPANIES WILL NEED TO ASSESS VALUE-ADD TO US IMPORTS THAT HAVE CHINA CONTENT OR ELSE CAN EXPECT COST INCREASES OF

# 25% ON THESE IMPORTS

to demonstrate “reasonable care” to avoid penalty payments or legal prosecution should it have to revise the country of origin after an investigation. This becomes even more important, as a product’s origin can be challenged each time it is imported. Since the US Customs and Border Protection (CPB) Headquarters Ruling H300226, the CPB has determined that the country of origin for NAFTA and 301 tariff purposes may differ, other or previous rules may not apply, making tariff risk challenging.

### HOW CAN COMPANIES RESPOND?

For companies importing goods with China origin or content as outlined above, we recommend a risk assessment and mitigation strategy. A pragmatic, top-down approach is advised:

**Understand 301 tariffs:** When assessing the manufacturing and supply chain, companies should seek legal counsel, with input from engineering, purchasing, and manufacturing experts.

**Tariff impact determination:** Examine the Bills of Materials for imports and understand the value and character of parts that are on 301 tariff lists or from China. In addition, companies should identify key major manufacturing steps, noting the sophistication of the activities and their locations. The resulting insights will allow them to evaluate the probability of applicable tariffs and quantify the potential impact on costs.

**Operational mitigation option development:** Companies should involve stakeholders across departments to innovate mitigation options. These may be ranked based on success probability, effort, and timeline. Potential actions of competitors should be taken into consideration, both in

terms of market pricing and their commitments to suppliers; likewise, consider suppliers’ potential reactions to both your company’s and your competitors’ actions.

**Evaluation of change:** Depending on the strategy chosen, changes to manufacturing processes, BOM content, and/or suppliers could result. Any business case for change should at least be validated at a 0 percent, 10 percent, and 25 percent tariff level, as these may change quickly.

**Implementation:** Currently irreversible actions to supply chains and operations should be carefully considered. It could still be the case that tariffs are only temporary. However, if a change makes sense at a 0 percent tariff level, it may be undertaken in any case.

### COMBINING LOW-EFFORT MITIGATION STRATEGIES MAY YIELD SUCCESS

While the simplest mitigation strategy may be passing-through tariff-related costs to customers, this is not always the best course in a competitive market. Even in an uncompetitive market, cost-based mitigation strategies should be evaluated to maximize earnings.

Strategies can be examined by department and combined to increase success probabilities. From a legal point of view, companies may choose to lobby, apply for exceptions or identify tariff mitigation options based on product usage. In addition, firms can request duty reclamations. Engaging in a quotation process and potentially changing suppliers to those in countries other than China may be a feasible mitigation strategy, though re-validation costs need to be weighed.

To summarize, companies should start by carrying out a risk assessment, involving a clear understanding of tariffs and their impact. Next, undertake a structured, top-down approach to evaluate the most relevant mitigation strategies. Ultimately, the real challenge is knowing what to do in the period of uncertainty to mitigate risk and to be nimble once the tariff decisions are made.

**Andrew Chien**

[Andrew.Chien@oliverwyman.com](mailto:Andrew.Chien@oliverwyman.com)  
+1 248 455 7259

**Kevin Hauser**

[Kevin.Hauser@oliverwyman.com](mailto:Kevin.Hauser@oliverwyman.com)  
+1 248 455 7260



# BY FUNCTION: NEW SOURCES OF VALUE

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BY FUNCTION: NEW SOURCES OF VALUE

# SUPPLIER INNOVATION AS DRIVER FOR PROFITABLE GROWTH

HOW TO LEVERAGE THE INNOVATION CAPABILITIES  
OF THE SUPPLY BASE TO BOOST PERFORMANCE

Jochen Graff, Kevin Smeets

Innovation is a key driver for future profitable growth. But high development costs can eat up the benefits of sales and profit growth. This is one reason why leading companies are reconsidering their internal capabilities and are moving to integrating suppliers into the development process.

Supplier innovation is about leveraging the innovation power of the supply base in a systematic way to increase one's own innovation performance. If managed successfully, supplier innovation has many benefits including fresh ideas, shorter time-to-market, and higher margins; all of which can lead to profitable growth. Because as much as 70 percent of total lifecycle costs are defined during the design phase, the ability to influence the total cost of ownership decreases rapidly the further out along the development curve you get. But while it seems obvious – the earlier suppliers are integrated, the greater the impact on lifecycle costs can be – managing it is another matter altogether. In a recent study of ours, we found that more than 80 percent of companies struggle with integrating their supplier base into the process and that it often leads to many challenges within the company, ranging from fear about IP issues to lack of transparency about real needs and supplier capabilities to just poor execution. (See Exhibit 1.)

Exhibit 1: Although there are many benefits, it is still not easy to involve suppliers early

**BENEFITS OF EARLY SUPPLIER INTEGRATION**



**NEW IDEAS**

- New and accelerated ideas
- Broader functionality scope



**SHORTER TIME-TO-MARKET**

- Faster ideation
- Faster development



**HIGHER MARGIN**

- Lower COGS
- Higher product differentiation

**MAIN HURDLES FOR EARLY SUPPLIER INTEGRATION**



**FEAR**

- Fear of potential IP issues
- Lack of internal willingness



**IN-TRANSPARENCY**

- No clear view on needs
- Wrongly assessed supplier capabilities



**POOR EXECUTION**

- Late procurement involvement
- Insufficient roadmap alignment

Source: Oliver Wyman analysis

Our study indicates that companies can best address these challenges of integrating suppliers by following three guidelines: clearly prioritize development capabilities for supplier innovation; focus on “profit improvement” instead of pure “cost reduction”; and simplify collaboration with suppliers along the innovation process.

**CLEARLY PRIORITIZE DEVELOPMENT CAPABILITIES**

Pressure to significantly reduce research and development (R&D) costs while concurrently improving innovation performance is almost impossible to achieve. Therefore, it is important to first get your priorities straight: Define core and non-core development capabilities clearly and outsource selected non-core development capabilities to your supply base.

However, simply defining these capabilities is not sufficient. They need to be communicated, both internally to the R&D function and externally to the supply base:

internally, to make transparent where suppliers can add value (and to address concerns over potential IP issues and foster a willingness to involve suppliers), and externally, to inform the supply base about the opportunities, so they can make concrete proposals.

Clear agreements are needed for smooth cooperation. In this context, it is not just legal issues on, for example, intellectual capital that has to be addressed, but also reaching consensus on time and quality management. Applying standard processes for intellectual capital management and program management is an effective way to integrate suppliers early in the development process.

**FOCUS ON “PROFIT IMPROVEMENT”**

The study also reveals that the most important reason for involving suppliers early in the innovation process is “to cover capabilities not available in-house”, closely followed by “shortening time-to-market” and “increasing end-product differentiation”. This clearly underlines, that supplier

innovation is not only about cost reduction but also much more about profit improvement.

Once suppliers become involved in the development process, what needs to take place is a shift in mindset: moving away from focusing solely on reducing cost and shifting towards improving profits. For the shift to be successful, the whole company needs to work in a cross-functional way. Sales, marketing, R&D, production, and procurement need to work closely together to understand real customer needs, develop products and services

requires a common understanding of the company’s innovation goals and the areas where suppliers can add value.

The collaboration with suppliers can be simplified by adopting a unified “language” on innovation topics to facilitate communication. Defining the innovation fields the company is active in – and regularly communicating that to suppliers – along with defining how to cooperate effectively and efficiently, are essential to the success of the innovation process.

Given how fast customer requirements change, it is important that the innovation capabilities of your suppliers not remain static. Companies will need to monitor supplier innovation performance on a continuous basis to ensure that they integrate the right suppliers with the right capabilities early in their innovation process.

**OVER 80%**  
OF COMPANIES STRUGGLE TO INTEGRATE SUPPLIERS EARLY IN THEIR INNOVATION PROCESS

**SUCCESS FACTORS FOR SUPPLIER INNOVATION**

Based on our project work across several industries, we have identified five key success factors for getting the most out of supplier innovation:

- Ensure the organizational and cultural readiness of your company to involve suppliers early in the development process
- Clearly define and communicate capability areas for supplier innovation, so procurement and suppliers can act on them
- Identify and attract the best suppliers for future capability areas based on their innovation performance
- Clearly define supplier innovation objectives upfront and aim for long-term “win-win” partnerships
- Ensure cross-functional collaboration along the innovation process, with a driving role for procurement

If managed successfully, supplier innovation will result in new ideas, shorter time-to-market, and higher margins that will support profitable growth.

accordingly, and identify the right suppliers that can support the company in increasing its innovation performance. This means the role of procurement will have to change, as they will need to be involved much earlier in the process and to be proactive in proposing suppliers that can add value.

An important skill in procurement’s new role will be to evaluate a supplier’s innovation performance. It will be necessary for procurement to know suppliers’ areas of innovation, relevant development capabilities, and innovation competencies so as to judge if, how, and what the supplier can contribute to the company’s innovation performance. Moreover, procurement will need to apply new KPIs on supplier innovation performance that go beyond current supplier-relationship-management KPIs.

**SIMPLIFY COLLABORATION ALONG THE INNOVATION PROCESS**

The tighter suppliers and the company are tied together, the greater the impact of innovation will be. This, however,

**Jochen Graff**

Jochen.Graff@oliverwyman.com  
+49 211 8987 637

**Kevin Smeets**

Kevin.Smeets@oliverwyman.com  
+33 1 45 02 36 53

BY FUNCTION: NEW SOURCES OF VALUE

# DIGITALIZING B2B SALES

COMPREHENSIVE DIGITALIZATION  
OFFERS THE POTENTIAL FOR  
SIGNIFICANT IMPROVEMENT

Wolfgang Weger, Henning Tielker, Andreas Nienhaus

The sales function in manufacturing companies needs to be transformed to meet changing customer preferences and improve sales force effectiveness. Digitalization can enhance sales performance in numerous ways, from creating a new sales channel, to productivity enhancement tools, and on to advanced analytics.



Exhibit 1: There are a few success factors in implementing ideas and new concepts

**CLEARLY DEFINED USE CASES**



Sharp target picture of the use case and purpose of the tool in its future operational environment

**FROM THE FIELD – FOR THE FIELD**



Typical adoption rate after six weeks is 80%

Sales reps' needs at the center of any new concept

**AGILE DEVELOPMENT IN SPRINT**



Rapid iterative process to assure quick results and development close to the users needs

**FROM "BIG IMPACT" TO "BIG DATA"**



Starting from the desired impact, it will then be decided which actions, insights and data will be needed

Source: Oliver Wyman analysis

Over the past decade, companies have begun to upgrade the sales function and have invested in technology to manage the sales force or improve the sales process. Initially, the effort began with the implementation of customer-relationship management (CRM) or management information system (MIS) tools that improved transparency and allowed better management of the sales funnel and overall sales performance. While helpful from a management perspective, these tools consumed the time of the sales force and were perceived as a burden. Consequently, adoption rates were low.

Recently, manufacturing companies have broadened their efforts to digitalize sales. Most initiatives in manufacturing companies have focused on two areas: first, digitalizing customer interaction and the sales process through online shops, portals, and apps; and second, improving sales performance/effectiveness through digitalization/automation and improved tools.

**COMPANIES HAVE YET TO FULLY EMBRACE DIGITAL**

Today, there is not a single meaningful company that has not launched or implemented some digitalization initiatives (such as launching an online store with or without guided selling elements or apps). Nonetheless, there is room for improvement, as companies have yet to embrace digital B2B and online sales fully.

An analysis of the 30 biggest German manufacturing companies found that only a minority of the firms uses at least one product configuration tool, one-third has online shops or portals for customers, and just 40 percent have apps to provide basic information and services for customers. It resembles more a piecemeal than a serious effort to change or re-align the overall go-to-market strategy. Just adding another channel will very likely become too expensive in the long run. The proper setup and commercial model in a multi-channel environment is missing in many cases.

**15-25%**

**IMPROVEMENT OF SALES CONTRIBUTION CAN BE ACHIEVED THROUGH DIGITAL TRANSFORMATION OF SALES**

On a more operational note, many online stores and portals have been developed from the inside out, without taking customer behavior and supplier expectation into the equation. Creating a seamless digital customer journey is critical and essential to create and maintain customer loyalty.

**DIGITALIZATION OF SALES FUNCTION AND PROCESSES IS PIECEMEAL**

Surprisingly, the typical sales representative's use of time has not improved over the past decade, with too little time spent on customer-facing activities. Indeed, more than half of their time is devoted to internal/administrative tasks.

Companies are trying to attack this situation by digitalizing some process steps. But many have lacked a comprehensive approach. Typical areas of digitalization included: 1) reducing administrative tasks by digitalizing existing functions such as e-signatures or integrating information smoothly and swiftly into customer presentations; 2) Improved lead qualification and hit rate via guided online selling; or 3) maximizing the value of the customer interaction through up- or cross-selling.

The focus of solutions is shifting towards the front-line, tablet-based tools that make it much easier for sales representatives. Easy-to-use tablets have seen high rates of adoption.

**ADVANCED ANALYTICS IN SALES IS BEING UNDERUTILIZED**

Our view is that applying advanced analytics to the sales function is an important lever that can contribute significant growth at manufacturers. (See Exhibit 1.) We recognize that advanced analytics and artificial intelligence (AI) are barely

used to improve sales and commercial effectiveness at manufacturing companies. There may be multiple reasons why companies still shy away (such as lack of analytic capabilities or proper data model/data lake). However, we would encourage senior leaders to make use of AI in sales, as we have seen the difference it can make.

Use cases to apply advanced analytics in sales are manifold and company-specific. Examples include:

- A big data-based approach to customer segmentation as the basis for redesigning the sales focus, resulting in 5-to-7 percent revenue increases in key markets
- AI-based churn-prediction modelling that provides better predictions and helped the sales force reduce churn dramatically
- An intelligent cross- and up-selling engine that provides recommendations for the sales force and yielded 60 percent higher revenue

It is the combination of new insights generated through advanced analytics and tools that are designed from the field for the field that increase acceptance. Digitalization has great potential to upgrade the effectiveness and efficiency of sales at many manufacturing companies. The time to take the leap is now.

**Wolfgang Weger**

Wolfgang.Weger@oliverwyman.com  
+49 89 939 49 430

**Henning Tielker**

Henning.Tielker@oliverwyman.com  
+49 211 8987 648

**Andreas Nienhaus**

Andreas.Nienhaus@oliverwyman.com  
+49 69 971 73 527



BY FUNCTION: NEW SOURCES OF VALUE

# TAKING PRODUCT COST OPTIMIZATION TO THE NEXT LEVEL

HOW TO MAKE COST-REDUCTION EFFORTS SUSTAINABLE

Christian Heiss, David Kaufmann, Mark Kiel

Traditional approaches toward reducing the costs of technical products are reaching their limits, at a time when cost efficiency is becoming increasingly critical. To achieve today's targets, a step change in thinking is required, one that takes a fresh look at cost. Companies need to adopt new product cost-down approaches, methods that take a multidimensional view of cost and examine its sources.

# 10-20%

## TOTAL PRODUCT COST REDUCTION POTENTIAL USING A NEXT-GENERATION PRODUCT COST-DOWN APPROACH

Uncertainty surrounding demand and supply is an inescapable condition – and one that is growing. Industries far and wide – from manufacturing to consumer goods, from automotive to telecommunications – are all talking about becoming recession-proof. The desire is to generate free-cash flows and profitability buffers to ensure they can weather whatever the market throws at them. For example, automotive original equipment manufacturers (OEMs) are spending hundreds of billions of dollars on e-mobility transformation over the next five to ten years. That level of investment is not sustainable without fundamentally rethinking how additional efficiencies can be achieved.

After decades of small, incremental improvements, the line of attack is to re-evaluate cost structures to identify step changes in efficiency. The search is on for big wins.

### REACHING THE LIMITS OF PREVIOUS APPROACHES

While some industries are more advanced in cost-reduction methodologies than others, addressing product cost in-depth is a sensitive topic. Companies rightly fear that changes to their products could potentially lead to poor customer reception, thus lowering sales. Past experiences with cost reduction have also left a mark, reinforcing the belief that reducing product costs is a complex and slow business.

The hard truth is that customer product perceptions have little or nothing to do with inherent product cost. Substantial reductions can be achieved by redesigning products to focus on the features that are highly valued by customers, while removing unnecessary complexity and rarely used functionality. This can result in a 10-20 percent reduction of total costs.

All too often, companies have treated product cost reduction primarily as a procurement-focused exercise. Using commercial tools such as structured market tests, costs are reduced either through lifecycle cost-reduction schedules agreed upon by suppliers or through onetime supply-base restructurings.

Even where companies have looked at engineering and design-cost reduction levers, these have largely been used in just a few key product areas. Rarely have companies taken a holistic view of their products, identifying opportunities and cost-reduction impacts across functionalities and product areas.

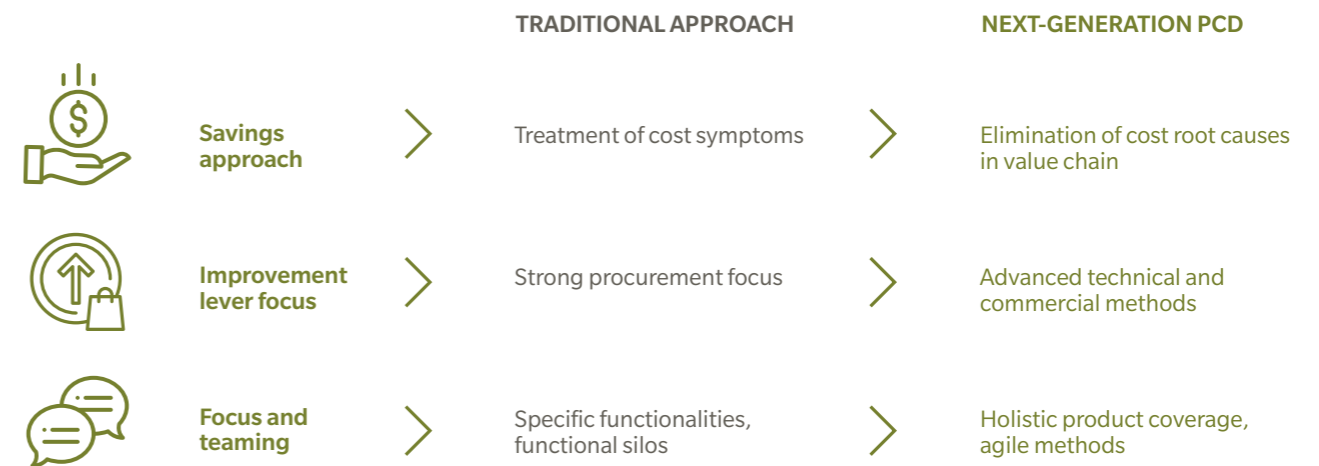
### HOW NEXT-GENERATION APPROACHES DIFFER

Unlike other approaches, the reductions achieved through next-generation approaches are sustainable over the longer term due to the holistic view that encompasses all aspects of the product, from design to manufacture and sales, ensuring that there are no hidden and unforeseen consequences. (See Exhibit 1.) Just as important, the approach tackles the underlying non-optimized elements of the operating model and organization that have led to higher cost levels. For example, an international plant-engineering firm discovered an excessive safety buffer in one of their electric motors. Rather than simply removing the specific buffer, the team traced the issue back to its root cause, which turned out to be an outdated performance guideline introduced years before. Identifying the underlying issue allowed the company to sustainably reduce the cost for the entire product series, rather than optimizing only the specific model.

The second aspect differentiating a next-generation tactic from a purely procurement-focused approach is in how it leverages technical expertise to drive deep into the design and production process. Engineering and design experts work side-by-side with internal experts to challenge existing thinking. The internal experts involved in the process are drawn from multiple sites and/or product lines. Their presence stimulates a robust approach to internal benchmarking, complementing that of the external challenge. This combination of internal and external expertise ensures rigorous testing of existing as well as new designs and specifications. Doing so provides them with a trump card in negotiations, as they no longer have to rely on suppliers for technical input.

The third aspect differentiating a next-generation methodology from traditional approaches is that it relies on agile methods to ensure holistic coverage of the product

Exhibit 1: Next-generation product cost-down



Source: Oliver Wyman analysis

as a whole, rather than focusing on individual aspects of functionality. The agile approach uses clusters of experts to address the two dimensions of root causes (or “cost topics”) and product functionalities. By rotating through the different combinations of topics and functionalities, this approach ensures that the various perspectives, as well as downstream and upstream consequences, are considered when developing new cost-reduction ideas. The ideas are then validated and refined in multiple sprints in the drive towards an implementation-ready business case, with first results placed on the table within weeks of the start date.

### SEIZING THE OPPORTUNITY

These next-generation approaches represent a major opportunity for companies to unlock step-changes in efficiency. To turn it into a success story, companies need to embrace a new mindset that fundamentally challenges the status quo across the value chain. This requires full and continuous leadership involvement and a clear communication of the new paradigm.

Companies need to treat product cost reduction as a proactive opportunity rather than a reactive tool, well before any crisis arises. Additionally, manufacturers should combine quick wins that result in rapid profitability improvements with longer-term measures to create compelling success stories. These efforts inspire the organization and unlock short-term cash to fund more transformative levers. Involving customers and suppliers

in the product cost-reduction efforts represents another success factor to develop win-win opportunities for all stakeholders. Furthermore, it is essential to integrate the methodology and learnings from these new approaches into the organization so they become an inherent part of the company’s cost management approach.

Whether a company is facing a major industry disruption or economic volatility, revisiting the core tenets of their cost structure and value chain should be a key priority on any executive agenda. The next level of product cost optimization lies within reach for any company that seizes the opportunity.

**Christian Heiss**  
[Christian.Heiss@oliverwyman.com](mailto:Christian.Heiss@oliverwyman.com)  
 +41 44 553 3733

**David Kaufmann**  
[David.Kaufmann@oliverwyman.com](mailto:David.Kaufmann@oliverwyman.com)  
 +33 1 450 23716

**Mark Kiel**  
[Mark.Kiel@oliverwyman.com](mailto:Mark.Kiel@oliverwyman.com)  
 +49 69 971 73130

BY FUNCTION: NEW SOURCES OF VALUE

# IMPROVING PROCUREMENT PERFORMANCE FOR BUILD-TO-ORDER MANUFACTURERS

TWO PRACTICAL APPROACHES TO INCREASE LOW-VOLUME STRATEGIC SOURCING EFFECTIVENESS

Andrew Chien, Hendrik Becker, Talon Lloyd

With the economy showing signs of weakening, “build-to-order” (BtO) industrial manufacturers must refocus their strategic sourcing efforts. We propose two methods of procurement optimization to mitigate the complexity and volatility of a build-to-order environment, where traditional mass production strategies are hindered.

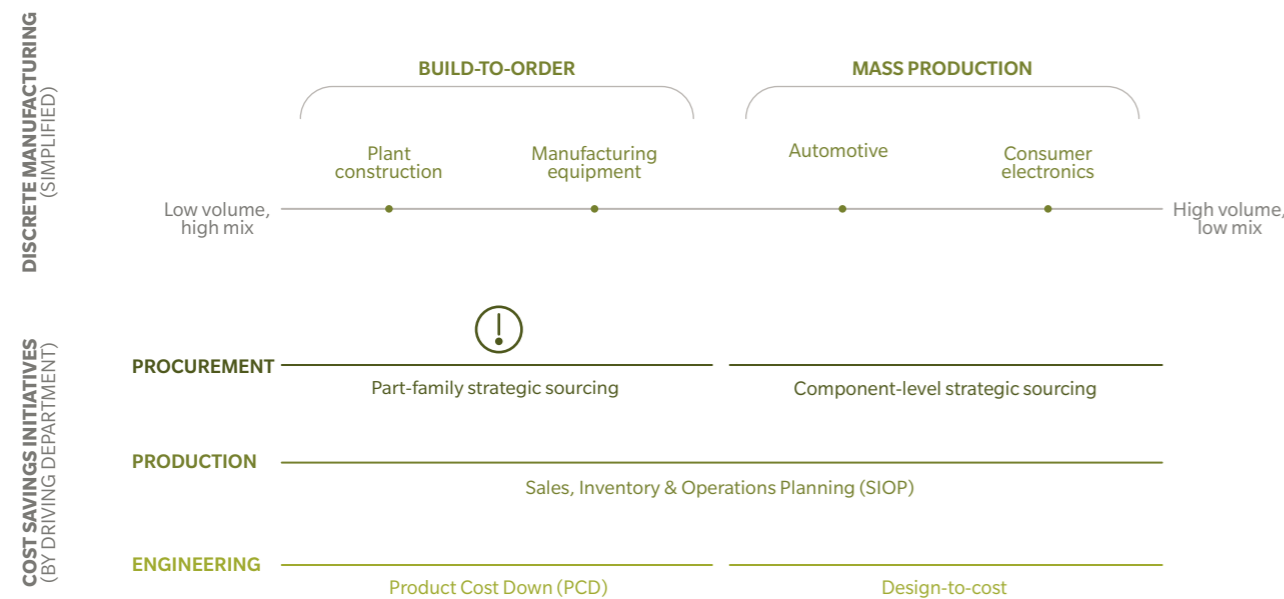
B2B industrial manufacturers have enjoyed a period of significant growth, but the time is ripe for a shift in focus, given the potential for an economic downturn. Where previous strategies would suggest market expansion and greater risk exposure to bolster the top line, rising trade-barrier risks and government financial instability should drive firms to employ strategies to focus on the bottom line and bolster their procurement programs.

The firms likely to be most affected by the downturn will be customized or “build-to-order” manufacturers, where production complexity and volatility make continued growth exponentially more difficult. In light of this, procurement has a substantial role to play in ensuring that these manufacturers emerge as winners through the next recession.





Exhibit 1: Low volume strategic sourcing is often neglected in a BtO environment



Source: Oliver Wyman analysis

## A UNIQUE PROBLEM FOR BUILD-TO-ORDER INDUSTRIAL MANUFACTURERS

Not all industrial manufacturers enjoy the benefits of high volumes in a mass production setting, with clear, minimized demand variability. Such high-volume manufacturers – namely automotive or white-goods makers and suppliers – are generally well-equipped to flex scalability in the face of an economic contraction with traditional cost-reduction activities: e-auctions for components, market testing, as well as deeper design-to-cost activities.

However, firms with limited foresight into demand and highly customized product offerings – build-to-order industrial manufacturers – will not be as well-positioned. The inability to translate revenue forecasts into inventory and operations planning (SIOP) forces the burden of cost-savings strategy onto procurement and engineering teams. Traditional component-level procurement strategies yield limited benefits due to the inability to offer accurate volumes to the market, hindering negotiating leverage in a build-to-order environment. (See Exhibit 1.) Furthermore, product cost down (PCD) and design-to-cost initiatives are undermined by customer-driven specification requirements.

Internal procurement teams and supply-chain organizations note that as a result of demand variability, limited steps can be taken to cut costs. Furthermore, a mentality of “too small – too fragmented – too complex” pervades the sector, further hampering the effort and results from sourcing activities. Our experience with a variety of mid-market BtO industrial manufacturers has enabled us to identify two pragmatic methods of increasing margins by changing sourcing tactics.

## ADDRESSING THE COMPLEXITY OF MATERIAL FORM FACTOR

Traditional procurement programs for high-volume, predictable materials – especially build-to-stock or commoditized items – are able to support a component-level sourcing strategy. For the BtO industrial manufacturer, however, a more aggregate view of volume is required to entice suppliers, and can be achieved through an assessment of “material form factor.” Form factor is a component segmentation strategy that buckets parts of similar size, material, function, or application to aggregate volumes. These aggregated segments can be offered to the market to source by “share of wallet” or demand/supply capacity.

Combining known aggregate demand (comprised of multiple segments of variable demand) helps to overcome the inherent dilemma of part-level forecasting accuracy.

Rather than component-level pricing, suppliers showcase competitiveness through a formulaic costing approach based on volumetric or parametric inputs. They are then awarded part families based on manufacturing expertise, and identification of key cost drivers alleviates the opaqueness of custom or complex part requirements. Other benefits of the approach include strengthened procurement information on material cost pressures, allowing manufacturers to hedge or budget for anticipated increases. Finally, buyers have increased negotiating power for components that deviate from traditional pricing matrices, to ensure rationalization for price premiums on complex or custom parts.

**Case Study 1:** A manufacturer of custom steel molds is able to segment its machined parts into parametric characteristics (cylindrical, multi-cavity, etc.) and thus can negotiate capacity at strategically located and cost-competitive machining shops to meet demand. By aligning on controllable inputs (raw material, labor, and tooling activity by volume), procurement gains greater control over pricing and achieves transparency on leading cost drivers. Furthermore, having multiple suppliers helps to minimize the risk of volatile trade barriers and ensure continuity of supply. Leveraging a capacity sourcing strategy, this manufacturer achieved over six percent cost reduction on segmented components.

## DEALING WITH THE VOLATILITY OF DEMAND

BtO procurement functions typically focus on the easier categories, such as raw materials and components (despite the difficulties described earlier). The more complex categories – for example, contract manufacturing as well as installation and commissioning services – often exhibit a highly fragmented supply base and little or no cost transparency. This is the result of a decision-making process based on short-term availability of capacity, rather than a structured, forward-looking procurement strategy.

The volatility of demand is a key characteristic of BtO manufacturers and will not go away. However, through supplier tiering and disciplined processes, they can smooth some of the volatility: Two or three prequalified and preferred “gold suppliers” receive roughly 80 percent of the business (base demand), while the remaining 20 percent go to prequalified “silver suppliers” (peak demand and special application).

In addition to the general benefit of being assured a certain level of demand, “gold suppliers” can be enticed by potentially increasing their share of wallet – even in the face of a looming recession – and being positioned to take advantage of opportunities once the market picks up again. For this to succeed, however, there need to be processes in place for maintaining competitiveness between gold suppliers.

**Case study 2:** An industrial equipment manufacturer is leveraging external service providers for installing equipment at end-customer plants. The nature of the project-based business has resulted in supply shortages and a high correlation with market pricing: In an up market, capacity is low and prices high, and vice versa. By establishing tiers for suppliers and enforcing strict process discipline, costs can be fixed at down-market levels for the majority of their demand. Additionally, manufacturers can increase cost transparency, improve lead times, and deepen relationships with their “gold suppliers”.

## NOW IS THE TIME TO REFOCUS ON COST

Regardless of a manufacturer’s size or standardization, a recessionary period calls for new thinking and prioritization. While high volume manufacturers may deploy traditional methods to “sail through” the next recession, build-to-order industrial manufacturers need to look at the downturn as an opportunity to optimize or transform their procurement function.

Whether these strategies represent an optimization of procurement practice or full transformation from current practices, shifting to a more equitable and transparent formulaic costing approach allows for effective capacity sourcing and margin bolstering in turbulent times. Furthermore, it is an opportune time for developing a robust supplier-tiering framework to attract vendors and ensure competitiveness for the next economic growth phase.

### Andrew Chien

Andrew.Chien@oliverwyman.com

+1 248 455 7259

### Hendrik Becker

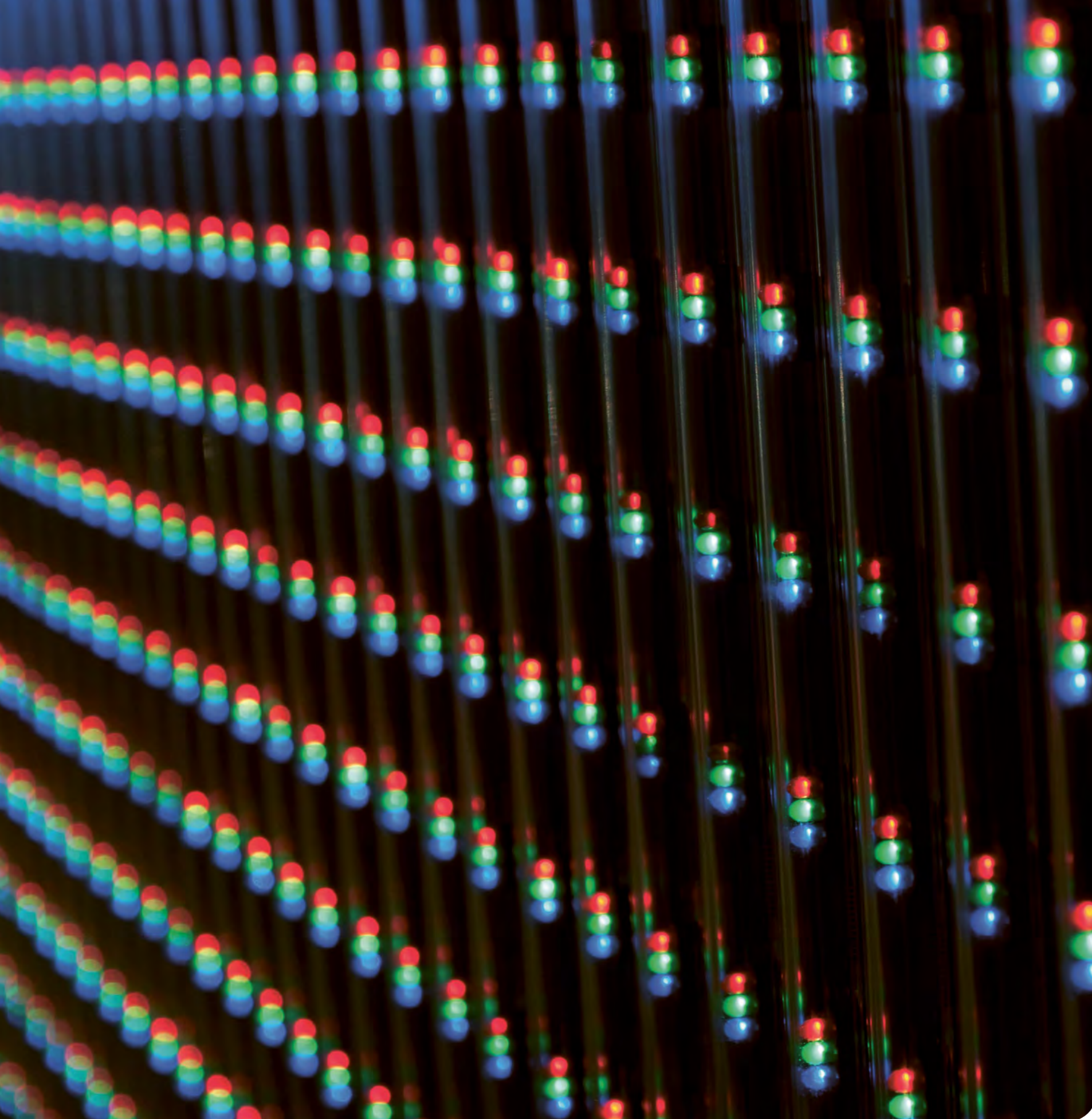
Hendrik.Becker@oliverwyman.com

+1 248 455 7264

### Talon Lloyd

Talon.Lloyd@oliverwyman.com

+1 416 868 8717



BY FUNCTION: NEW SOURCES OF VALUE

# OPERATIONS' NEXT PERFORMANCE DIFFERENTIATOR IS DIGITAL

USING AI TO MAKE SMARTER DECISIONS IN REAL TIME WILL BE A GAME CHANGER

Richard Hell, Hannes Engelstaedter

In a time of rising global economic uncertainty and demand volatility, companies need to make faster and more precise decisions to secure profits. What will differentiate manufacturers in the future and provide them with a competitive advantage? Next-generation operations performance monitoring and AI-based prediction will allow leaders to grasp issues in real time and simulate scenarios to make better decisions.

Discrete manufacturing embarked on the journey to transform traditional factories into factories-of-the-future with the aid of Industry 4.0 solutions years ago. But many companies still have not implemented holistic Industry 4.0 platforms – or else find themselves trapped in “pilot loops,” with little to show for their effort.

Industry 4.0 platforms are often overly broad solutions that require significant upfront investment and are insufficiently linked to solve the most pressing operational problems. Increased business volatility requires manufacturers to be more flexible on production volumes and costs. The benefits of many digital solutions are uncertain, and often do not add value in achieving greater productivity and ensuring a more balanced production, such as a fast product launch, with quick stabilization of output, quality, and cost.

Moreover, there are many unsolved challenges from an IT perspective, including multiple disparate data sources and a weak business logic of interacting key performance indicators (KPIs). Business dashboards, for instance, have been used in manufacturing for many decades, but they focus on simple KPIs reporting such as plant OEE or total production output. Those KPIs, however, are siloed in separate departments and do not provide insights on performance interdependencies; plus, the reporting of operational problems is often delayed.

### THE FOUNDATION FOR SMARTER DECISIONS

Building a powerful, agile and value-adding business intelligence platform requires two main components.

The first consists in building integrated business logic and KPIs between departments to enable transparent business-performance monitoring. Interdependencies between production, quality, logistics, and human resources need to be defined and linked to the plant's operational performance. An integrated business logic enables management to understand the cause and effect of underlying production issues and allows them to solve problems quickly. For instance, how do the changes in line speed, operator experience and rework rate impact required buffers sizes and allow a potential reduction in inventory on hand and thereby working capital.

The second component is having the right data sources in an integrated data lake, to fuel the analytics engine for operations performance monitoring. To achieve the selection of the correct data sources, business KPIs and processes must be clearly and precisely defined and translated into the existing data.

### NEXT-GENERATION DASHBOARDS TO ANALYZE PERFORMANCE ROOT-CAUSES

The next generation of dashboards must come with the flexibility that lets everyone, from executives down to

# 142%

### FASTER PRODUCTION RAMP-UP BASED ON AI PREDICTIONS

operators, perform rapid performance monitoring and root cause analysis, such as receiving alerts on negative quality trends or downtime issues. The capability of top plant managers to have a view of shop-floor KPIs, combined with advanced analytics algorithms that identify patterns and root-causes, provides value in decision-making.

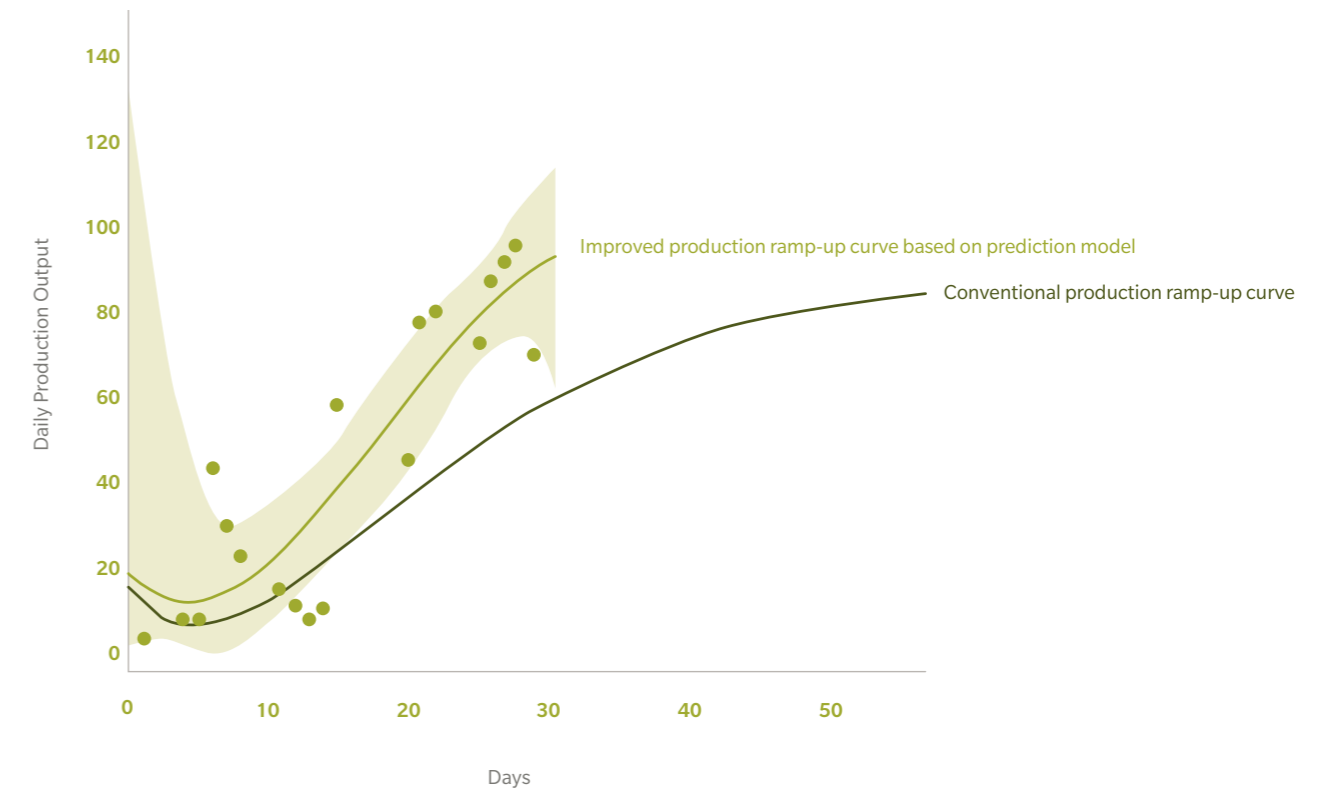
For instance, every 250 milliseconds, a battery production plant stores 10,000 variables of data, not all of them related to production. Thanks to integrated production systems, sensors, and logistics, management requires less than 5 percent of those variables to quickly identify any increase in the scrap rate due to the introduction of new materials designed to improve safety, energy density, and lifetime of the cells.

### FASTER, MORE STABLE PRODUCTION PERFORMANCE WITH AI-BASED PREDICTIONS

High-stress situations in manufacturing often arise during a new product ramp-up, given the uncertainty of logistics delays, material shortages, line imbalances, spikes in defects, increased rework, and so on. Those factors can lead to a poor ramp-up and a struggle to stabilize production.

Based on historic data of the production systems, advanced analytics models are capable of predicting the production performance learning curve during a ramp-up, which then can be simulated and used for more precise production planning. Two factors are critical to the prediction accuracy: First, there needs to be an array of specific data attributes with sufficient causal connection, such as cycle times, machine availability, defect rates, and operator experience. Second, companies need to select the right predictive model, depending on data structure, prediction complexity, and target.

Exhibit 1: Analytics-based prediction of the production ramp-up curve



Source: Oliver Wyman analysis

Being able to predict the production performance based on historical new-product launches is of great value to manufacturers. For example, an automotive Tier-1 supplier used machine learning to optimize output during a new product launch. Using optimized line manning, more precise work-cell balancing, and a production planning per product variant related to historic line performance and product variant complexity, the machine-learning prediction model increased output during the ramp-up by 142 percent, compared to conventional production planning. (See Exhibit 1.)

Digital manufacturing and Industry 4.0 are becoming game changers, both in their business impact and as competitive differentiators. Identifying the levers for improving production, which once required great effort, is something that now can be done in real time. AI and advanced analytics are predicting future performance level and bottlenecks, as well as simulating the results

of potential changes in the production plan, allowing management to make correct decisions faster. AI capabilities are certain to grow even more in the coming years, but we have reached the stage where the impact of AI on a company's performance has become measurable.

**Richard Hell**  
[Richard.Hell@oliverwyman.com](mailto:Richard.Hell@oliverwyman.com)  
 +49 89 939 49 710

**Hannes Engelstaedter**  
[Hannes.Engelstaedter@oliverwyman.com](mailto:Hannes.Engelstaedter@oliverwyman.com)  
 +49 89 939 49 431

BY FUNCTION: NEW SOURCES OF VALUE

# IMPROVING PERFORMANCE IN DISRUPTIVE TIMES

CUTTING COST IS NOT ENOUGH

Romed Kelp, Jochen Graff

Disruption in multiple industries has pressured margins for many companies. The expected economic downturn will bring additional turbulence if changes are not made. To stay competitive in the long-term, companies anticipating or experiencing decreasing margins need an integrated, holistic approach to improve performance.

Companies from almost all sectors and of all sizes are being challenged by disruption. The challenges come from technological innovation, competition, regulation, and customer behavior. For example, large travel companies were hit hard by travel-booking websites that changed the way customers search for, and buy, leisure and business trips. Travel agencies had to redesign their business models and develop new capabilities to survive. Likewise, e-commerce companies are pressuring traditional grocery retailers in a low-margin business. Environmental regulations and testing procedures (WLTP) are pressuring automotive original equipment manufacturers (OEMs) to invest in electric vehicles. Penalties for not meeting CO<sub>2</sub> fleet targets for 2020, or the expense of doing so, can cost automakers billions of Euros. Alongside increasing competition, commoditization, pricing pressure, and the need to provide innovative digital offerings.



A recent Oliver Wyman analysis found that traditional approaches to performance improvement are often not effective or sustainable. Two years after announcement of a given program, more than half of the companies analyzed had improved margins by less than 10 percent and some had even lost ground. There are five major reasons why such performance programs typically fail. First, corporates often start a transformation program too late and, when they do, they do not address the company's real issues. Instead, they give a "haircut" to growth areas that actually slows future development. Second, if corporates focus

protect profit margins before they erode further. Early change can fundamentally impact improvement. (See Exhibit 1.) For example, after many rounds of cost cutting, European telco companies are still confronted with competitive pressure. To achieve significant and sustainable improvements in performance and prepare for future competition, several telcos defined a lean target operating model (TOM). This TOM methodology has delivered savings of 25-40 percent in OPEX costs, representing billions of dollars. It has also served as an impetus to abandon antiquated practices.

To stay in the driver's seat, companies need to consider two broad areas. One, is there disruption ahead? A regular and thorough review of potential changes in the ecosystem, whether driven by regulators, technology or customer behavior, needs to be conducted and potential impact assessed. Two, observe key indicators – such as increasing cost-of-goods-sold (COGS), and declining market share or customer satisfaction – to get a sense of areas where performance needs to improve. For example, for automotive suppliers, a steadily declining EBIT margin – it has been above 7 percent since 2013 – is a clear indication that performance needs to change. A realistic analysis of the expected financial impact of performance changes helps identify the additional gap to target.

TWO YEARS AFTER ANNOUNCEMENT OF A GIVEN PROGRAM, MORE THAN HALF OF THE COMPANIES ANALYZED HAD IMPROVED MARGINS BY LESS THAN

# 10 PERCENT

AND SOME HAD EVEN LOST GROUND.

exclusively on cost measures and not on improving quality of earnings or margin, the scope of programs is often too narrow. Third, these initiatives are often not well aligned with the future strategy and target picture of the firm, and thus measures may contradict the future target picture. Fourth, middle and top managers are often not sufficiently engaged in the program or held accountable for meeting defined improvement targets. Thus, ambitious performance-improvement programs do not have enough "powder" to make major improvements. Finally, many programs are not well managed, resulting in inefficiencies and missed opportunities.

### HOLISTIC APPROACH TO PERFORMANCE IMPROVEMENT

A holistic, forward-looking approach to performance improvement should address the issues above to

### ACHIEVING SIGNIFICANT PERFORMANCE LEAPS

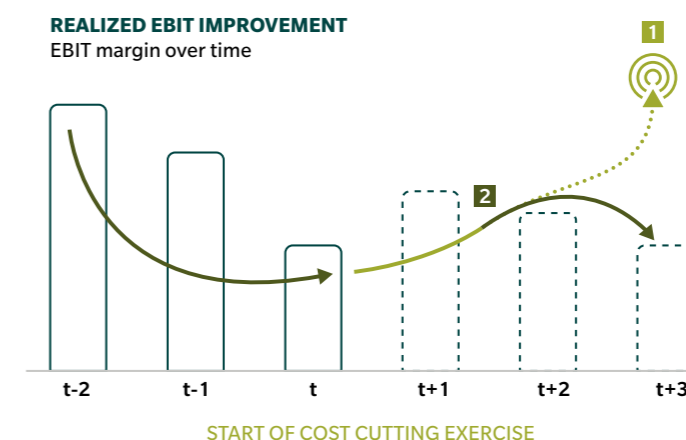
Performance-improvement initiatives should not only focus on bottom-line impact, through product or cost initiatives, but also look to improve the top-line, considering, for example, product and service pricing.

A pragmatic and thorough diagnostic of the current cost position, organization structure, or key operative KPIs, provides an improved understanding of the company's current situation and helps to identify its key problems. The complementary target operating model (TOM), defined through key principles, provides clarity about future requirements and helps identify more radical levers for achieving significant profitability improvements. Combining the diagnostics with an outlook of future operational needs provides input on measures that yield profit potential beyond top-down defined targets.

### EFFECTIVE AND SUSTAINABLE REALIZATION

To realize performance gains, ensuring top-management buy-in and accountability is key. Therefore, integrate savings

Exhibit 1: Failures of traditional cost reduction exercises to sustainably improve EBIT



#### 1 FAILURE TO ACHIEVE MORE AMBITIOUS TARGETS

- Many bottom-up efficiency targets
- Focus on short-term measures, no "outside the box" thinking
- No accountability for performance
- No consideration of functional interfaces
- Potential from commercial improvements left aside

#### 2 FAILURES TO ACHIEVE SUSTAINABLE IMPROVEMENT

- No change in day-to-day behaviors, leadership style, and established structure
- Cost returns due to strategic changes not considered
- Targets not transferred into budgets
- No continuous or standardized tracking of measures and achievements

Source: Oliver Wyman analysis

targets into budgets that top management approves, to ensure their clear traceability. With senior leadership "speaking with one voice," leading the initiative and making clear decisions, employees will also buy into and engage in the transformation.

An underestimated but key ingredient is governance. This focuses on functional and procedural issues, manages main stakeholders, continuously aligns with other corporate initiatives, and keeps a close eye on meeting measurable goals to avoid falling behind. For example, setting up an effective change program will strengthen the organization's cost readiness by raising awareness of the issue. With leadership calling attention to day-to-day cost behaviors, successful programs will hit ambitious improvement targets and avoid new costs that would hinder P&L impact.

Companies need to continually review and challenge their profitability situation, the impact of industry disruption,

and of the expected downturn. Proactively setting up a performance-transformation program before margins are badly affected will help to maintain competitiveness and prepare the company for future growth.

#### Romed Kelp

Romed.Kelp@oliverwyman.com  
+49 89 939 49 485

#### Jochen Graff

Jochen.Graff@oliverwyman.com  
+49 211 8987 637



BY SECTOR: NEW TECH, NEW STRATEGIES

# CONSTRUCTION EQUIPMENT: FROM HARDWARE TO SOLUTIONS

WHAT MARKET PLAYERS SHOULD  
DO TO WIN IN AN INDUSTRIALIZING  
BUILDING INDUSTRY

Romed Kelp, David Kaufmann

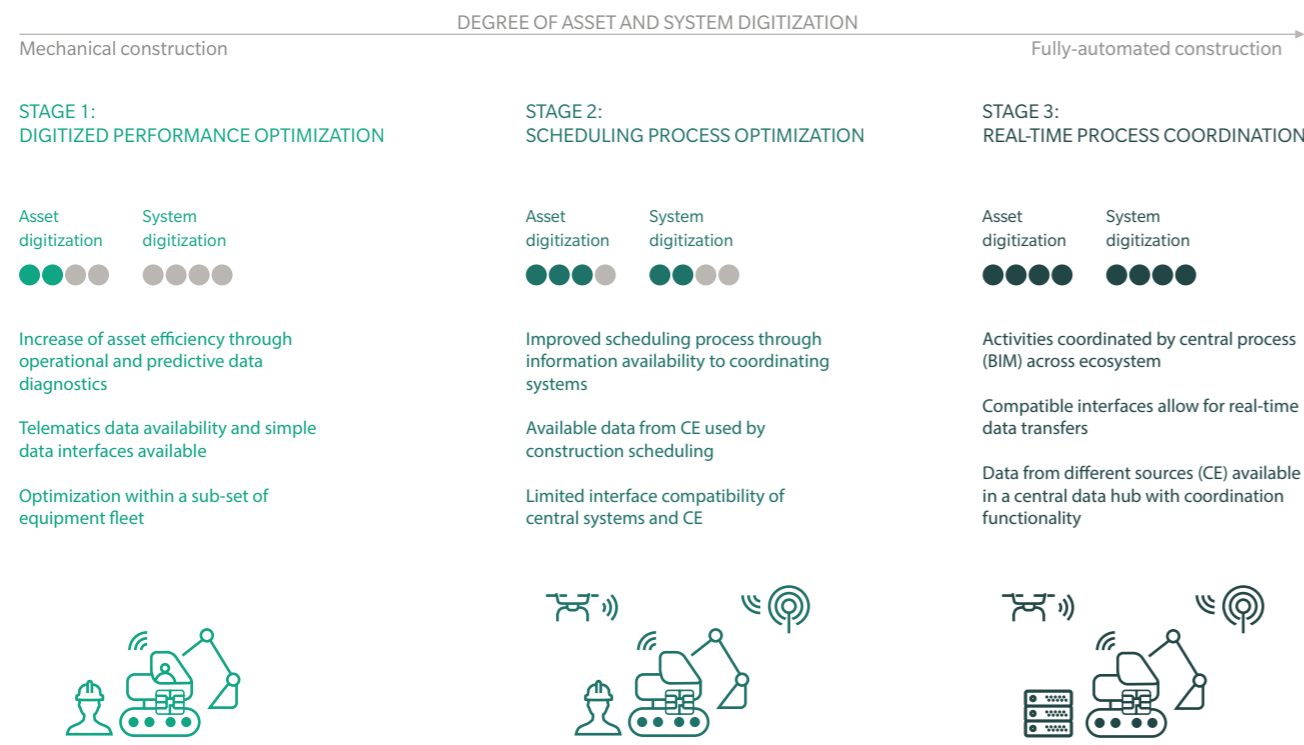
The global construction equipment industry is recovering from years of continuous decline. At the same time, however, OEMs face multiple challenges, including digitization and the entry of new competitors. Established market players should prepare for the future by shifting their business models and securing necessary capabilities and talent.

## AN INDUSTRY TAKING A BREATH

The global construction equipment (CE) industry has recently experienced a recovery. After having lost almost 30 percent in sales value between 2011 and 2016, the industry has grown by over 20 percent from 2016 to 2017, regaining a market volume of \$88 billion. Similarly, the top players are moving back towards long-term sector profitability rates, with an average EBIT margin of around 7.5 percent, almost double that of 2015. While the possibility, especially in Europe, of a recession hitting the broader engineered-products space is not unlikely, the medium-term business outlook for the global construction equipment sector indicates a continuing upward trend, according to Off-Highway Research. The research firm projects average expected annual unit growth rate at between 2 percent and 3 percent until 2022, mainly driven by sales in North America.



Exhibit 1: Five archetypes of IIoT platform offerings



Source: Oliver Wyman analysis

However, fundamental opportunities and challenges lie ahead. Despite the more “traditional” challenges, such as environmental regulation compliance, safety, product reliability, or total cost of ownership (TCO) optimization, construction equipment OEMs need to work on a broad digital agenda to secure their future competitiveness. While multiple developments – including automated equipment, integration of new tools such as drones, and the digitization of the construction industry itself via Building Information Modeling (BIM) – drive the disruption of the business models, OEMs need to further build capabilities and talent to exploit the opportunities provided by digitization.

## PREPARING FOR BUSINESS MODEL EVOLUTION

The construction equipment industry has been a “hardware sector” for decades, and to this day, the focus remains on the core hardware business. This becomes evident when looking at the M&A investments of the leading 50 players. Out of 160 deals over the past five years, approximately

two-thirds have been focused on their traditional hardware segment. In contrast, only 10 percent of deals were related to digital targets, such as software or drone companies. CE companies are starting to digitize their products to enhance efficiencies. Autonomous vehicles have been used for example in mining sites for many years. Likewise, other competitors are currently experimenting with semi-autonomous and remote-controlled bulldozers and excavators. Some market players are betting on autonomous construction vehicles, developing a broad product range. Others are aiming at automating parts of the construction process itself, for instance working on a brick-laying construction robot, which is expected to reach the market in the next few years. This will be a first step towards reducing TCO and overcoming shortages of skilled operators.

However, all these activities remain centered around the traditional business model. Going forward, market participants must ask themselves the strategic question on how to embark on the journey of business model

# ONLY 10%

## OF M&A TRANSACTIONS OF THE LEADING 50 CONSTRUCTION EQUIPMENT PLAYERS ARE FOCUSED ON DIGITAL TARGETS OVER THE PAST FIVE YEARS

evolution. In this context, three stages can be identified. (See Exhibit 1.) Stage 1 named digitized performance optimization, is focused on the improvement of a single piece of equipment “with digital means” as described above. Stage 2, scheduling process optimization, will show a much more integrated approach, connecting various machines in a “systemic” way, to substantially increase construction site efficiency. Finally, stage 3, real-time process coordination, will be using the BIM-environment to allow automated, real-time coordination of assets and processes. While stage 1 is a fairly medium-term target picture, the system integration of stage 2 lies within reach.

There is a fundamental difference between the first two stages. While in the first stage the USP is still close to the single asset, with technical performance, uptime, TCO, and spare part availability in focus, the USP will significantly move towards the solution in the second stage. Providing an integrated, coordinated, systemic offering that orchestrates various physical assets, from excavators, via loaders to drones and data to move to a more industrialized way of building. As creating and exploiting these kinds of offerings requires specific skills, the challenge for CE OEMs is twofold. On the one hand, non-traditional players increasingly push into the new element of the value chain, to capture value from customer access and system integration. As these companies operate differently compared to traditional OEM competitors in that field, OEMs need to adapt to the “rules of the game.” On the other hand, the new game requires new skills and talent that OEMs need to build quickly, to help drive the new business model. On the mission to create the workforce for the future, firms must strengthen their workforce strategies to not only create staying power through a clear purpose proposition, but also to access critical skills through targeted hiring, partnerships, or talent crowdsourcing.

## DOUBLE-DOWN ON EFFORTS TO DIGITIZE AND INNOVATE

Construction equipment OEMs need to double-down on efforts to embark on this journey. They must define or refine a clear vision on where and how to play in the medium-term, how to safeguard their current position, and how to exploit new value pools. Based on that, they have to determine what the company should look like to successfully deliver against this picture: what kind of competencies, structures, and processes are needed and whether these competencies can be created in-house or have to come via acquisitions or partnerships. Finally, the transformation from a more “hardware-oriented DNA” to a “solution-oriented DNA, with a strong hardware component” needs to be initiated from a structural, cultural, and talent point-of-view. Regardless of whether the industry faces a rougher economic environment in the near term or continues to enjoy a recovery, the time to address these strategic challenges is now, to be prepared for the future.

### Romed Kelp

Romed.Kelp@oliverwyman.com  
+49 89 939 49 485

### David Kaufmann

David.Kaufmann@oliverwyman.com  
+33 1 450 23 716





BY SECTOR: NEW TECH, NEW STRATEGIES

# BATTERY MANUFACTURING IN EUROPE

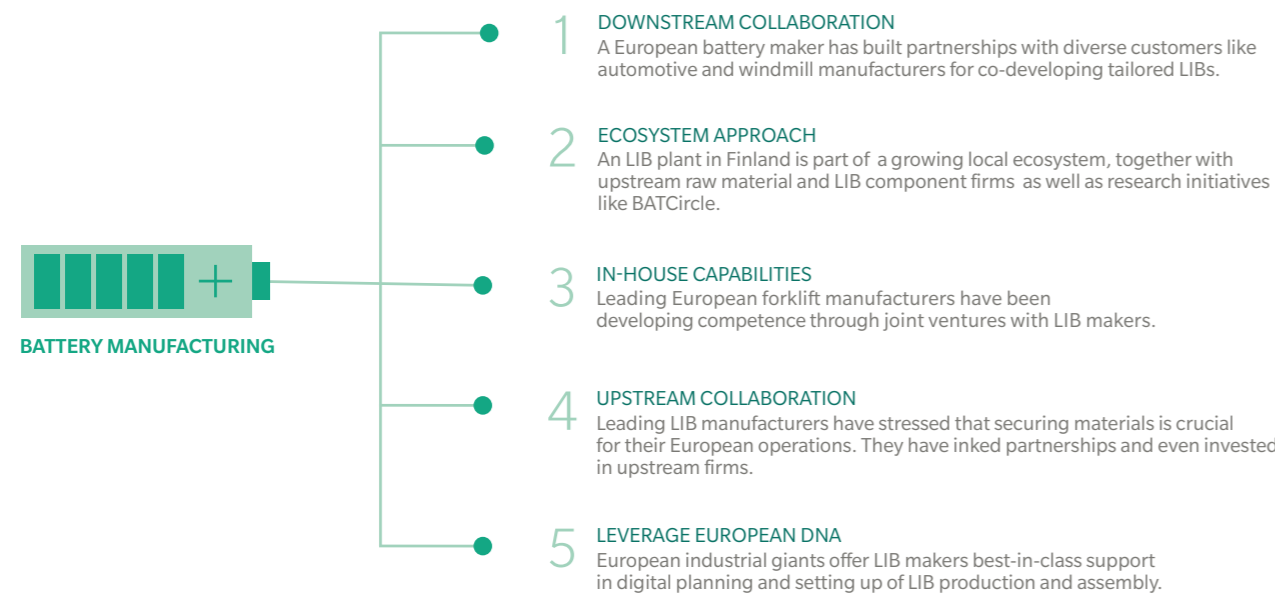
IS THERE A SECOND CHANCE?

Simon Schnurrer, Srinath Rengarajan, Markus Drews

Europe is aggressively moving to establish a lithium-ion battery (LIB) industry. Despite the chasm separating European companies from the leading industry incumbents, there are strong grounds for European players to establish themselves in the sector. To be successful, however, they must consider five strategic levers – and act now.

A global shift away from fossil fuels is leading to a boom in lithium-ion battery applications, ranging from electric vehicles to energy storage systems. The market is projected to have a value of €250 billion in Europe by 2025. To secure local value creation and jobs, there is now a concerted push to achieve European sovereignty in LIBs, including the European Battery Alliance to promote manufacturing, and research and innovation initiatives like “Horizon 2020” and “Battery 2030+”. The institutions involved have announced multi-million euro grants to foster LIB ventures, secure resources, and build mega-factories.

Exhibit 1: Strategic levers in battery manufacturing



Source: Oliver Wyman analysis

However, European firms face a challenging industry environment, with significant barriers. The landscape for lithium-ion battery manufacturing is dominated by Asian players, which account for 89 percent of global manufacturing capacity. In contrast, European firms hold a paltry 3 percent share. The Asian giants are entering Europe to meet local demand. In addition to competing against their scale and cost advantages, new entrants must reckon with a fast-paced and dynamic landscape. The question is: Do European firms still have a chance to participate in a local LIB value chain, or is it already too late?

### WHY EUROPEAN PLAYERS SHOULD ACT

The rapid evolution of LIB technology and industry also offers opportunities. There are four strategic reasons why a second chance for European LIB players and equipment manufacturers is beginning to emerge.

Firstly, European manufacturers not only have access to funding, but also can benefit from favorable economics. In comparison to Asian imports, local production offers about ten percent cost savings from shorter logistics to end customers. Moreover, recent investments in developing local raw material resources like lithium and nickel help cut costs. Combining these factors with elements such as the factory-of-the-future and digitalization can provide an additional ten percent in savings.

Secondly, the growing pace of automotive electrification represents a source of unmet LIB capacity demand. For example, electric-vehicle adoption rate forecasts are being revised upwards, with more than 300 models expected to be launched by 2025. Automakers have been scrambling to secure LIBs. This offers an opportunity for firms that can meet quality, performance, and sustainability requirements. It should be noted that it can take up to five years from a greenfield LIB plant to full operational capacity. It is critical for firms to align their production ramp-up with electric vehicle (EV) sales in this period.

An evolving application space offers a third reason. LIB technologies are not monolithic. Cost considerations and product requirements dictate their suitability for each application. For example, nickel-cobalt-manganese and lithium-iron phosphate cathode chemistries are respectively preferred in electric cars and buses. The same applies to future applications such as robotics, aerospace, medical devices, and industrial applications, representing a blue ocean for firms to provide tailored offerings. Engineering a shift away from standardized mass-produced LIBs to customized batteries offers Europe's firms an opportunity to stand out from the crowd – a strategy that has proven successful by European players in other industries. Concurrently, coexistence of LIB technologies in the foreseeable future ensures that investments will continue to

### SETTING UP A GREENFIELD BATTERY PLANT CAN TAKE UP TO

# 5 YEARS

generate returns – even in case of future fuel-cell-powered transportation solutions.

Finally, entering the space allows firms to prepare for the future LIB landscape. New entrants will naturally start as laggards, trailing the incumbents' resources access, scale, and competence in today's LIB technology. However, advanced LIBs are already under development to address the limitations of this generation. For example, solid-state batteries are expected to be commercialized in four to five years, with technologies like metal-air on the horizon. These require significant tacit knowledge in battery design, chemical and thermal properties, interaction processes, cell manufacturing, automation, and assembly. If Europe is to become a player in commercializing the technologies of the future, the experience gained in catching up to today's LIB leaders is essential.

### LEVERS TO ACT

The industry dynamics and technology development offer European firms the chance to secure future value creation. But in their pursuit, they must keep five important strategic levers in mind. (See Exhibit 1.)

Firstly, they must identify end applications and collaborate with customers to derive performance specifications and lower costs. Being customer oriented will help to develop and commercialize the LIB technology best suited to those requirements. It also ensures a dynamic view on demand, minimizing the risk of overinvestments and oversupply.

Secondly, they must proactively build ecosystems spanning the complex value chains. This allows firms to tailor R&D efforts and stay abreast of technology developments and breakthroughs. Orchestrating the ecosystem will enable them to commercialize the LIB solution quickly.

Thirdly, they must build their own in-house capabilities in LIB technologies. Successful LIB solutions not only

require developing new active materials, but also need innovations in passive materials, solutions for battery and thermal management, process design, and equipment. To this end, they must invest in talent and equipment to build competence in design, development, and production.

The fourth lever is upstream partnerships to manage investments and costs. Firms must build strong relationships to ensure access to resources necessary for scaling production and controlling material costs. For this, they will need to cooperate with miners and processors to mitigate supply-chain risk.

Finally, they must leverage their European roots. Industrial firms in Europe have historically established and built brand value and industry relationships. They also have a track record of meeting tough sustainability standards, which is especially important given the environmental concerns that are driving vehicle electrification. Crucially, they have exposure to innovative production technologies and manufacturing process efficiencies, which offer a cost-savings potential second only to material optimization. European firms would strongly benefit by exploiting these advantages.

### TIME TO ACT

The advantages of a localized LIB ecosystem are clear. Given the growing demand in Europe – and more electrification applications on the horizon – the absence of a local LIB industry will mean significant value migration and painful structural changes. While playing catch-up with the current industry leaders will be difficult, waiting will only widen the gap and make it that much harder for European firms. As demonstrated by Chinese LIB makers who capitalized on tailwinds to catch up with Japanese and Korean players, European firms with the right strategy have a chance to become industry leaders in the future LIB landscape.

#### Simon Schnurrer

[Simon.Schnurrer@oliverwyman.com](mailto:Simon.Schnurrer@oliverwyman.com)

+49 69 971 73 036

#### Srinath Rengarajan

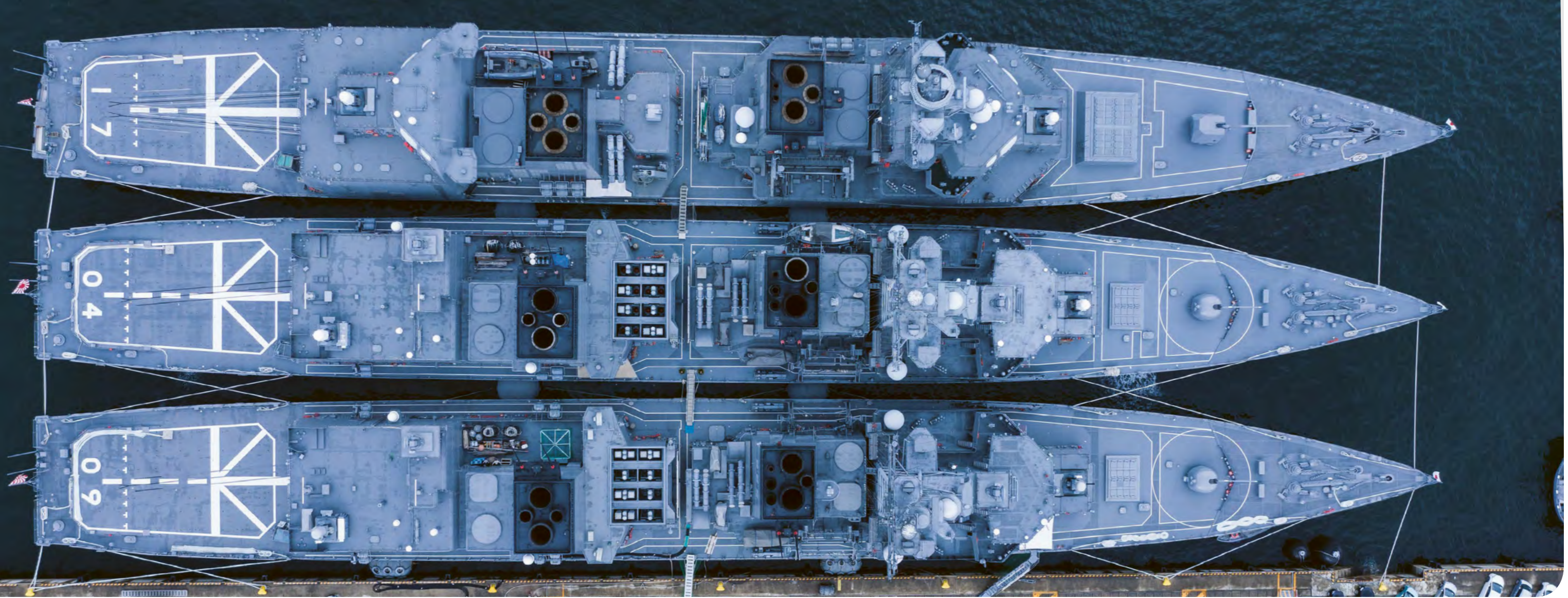
[Srinath.Rengarajan@oliverwyman.com](mailto:Srinath.Rengarajan@oliverwyman.com)

+49 89 939 49 480

#### Markus Drews

[Markus.Drews@oliverwyman.com](mailto:Markus.Drews@oliverwyman.com)

+49 89 939 49 296



BY SECTOR: NEW TECH, NEW STRATEGIES

# ENGINEERING OFFSHORING IN THE DEFENSE INDUSTRY

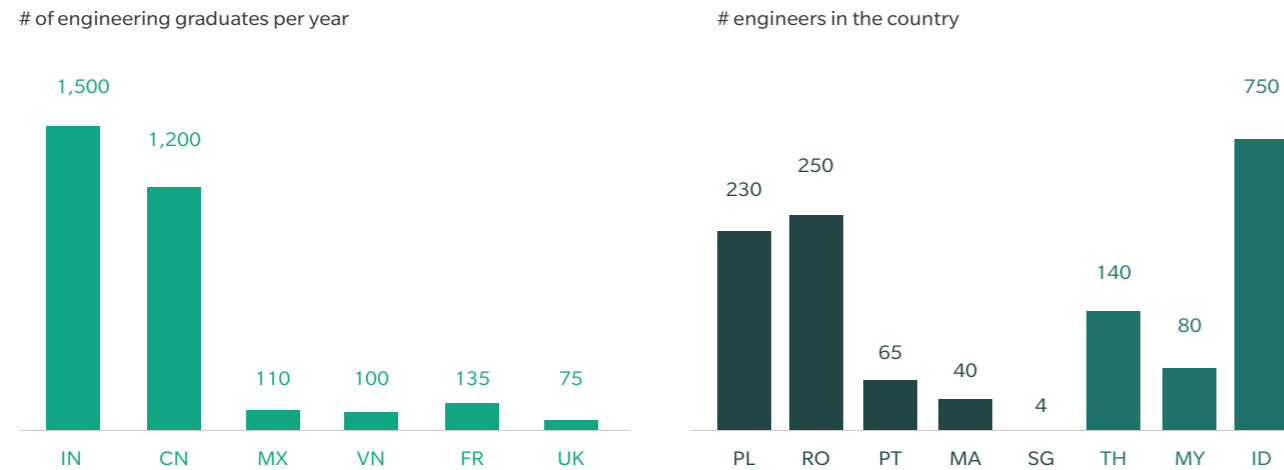
MOVING STRATEGICALLY BEYOND  
SIMPLE LABOR COST-CUTTING

Eric Ciampi, Marc Boilard, Archag Touloumian

Traditionally, offshoring has been employed as a means of increasing competitiveness by reducing labor costs. Companies in the defense industry have used this lever over the years, for the most part by moving production capabilities offshore. Now, however, the trend is becoming accelerated as firms move toward offshoring engineering activities as well. Indeed, the impact on competitiveness is likely to be significant: Industrywide, engineering labor costs account for 30 to 50 percent of total costs and are 75 percent to 90 percent lower in countries such as India, China, or Eastern Europe. Two other benefits have gained importance in line with companies current challenges: It provides an opportunity to penetrate the biggest and fastest-growing markets such as Southeast Asia or Latin America, and it allows companies access to a large pool of highly skilled resources that are growing scarcer in Western countries.

Exhibit 1: India and China are training massive number of engineers, while Poland and Romania have already quite a large pool of engineering skills.

#### INSIGHT ON COUNTRY ENGINEERING POOLS (IN '000 OF ENGINEERS)



Note 1: Software Engineering = Data scientist, software developer and web developer | PT: Portugal, PL: Poland, RO: Romania, IN: India, MA: Morocco, AE: United Arab Emirates, SG: Singapore, TH: Thailand, MY: Malaysia, PH: Philippines, ID: Indonesia, FR: France, VN: Vietnam  
Source: Press review, Oliver Wyman analysis

### TAKING ADVANTAGE OF MARKET PROXIMITY

The intensification of geopolitical tensions is leading countries such as China, India, and the Middle Eastern nations to boost their defense industry investments, with expected growth rates between 5 percent and 8 percent per year over the next five years. To penetrate these new markets, international defense companies need to have a local presence.

The most pressing incentive to moving work offshore is associated with contractual offsets. The value of these offsets has doubled in 10 years, outpacing market growth and highlighting their importance in negotiations. Some countries, such as India, require offsets of 30 percent, but others can be more demanding, such as the United Arab Emirates (UAE) that require 60 percent. In these cases, companies are pushed to offshore higher value activities, such as engineering.

Another important offshoring factor is tied to geopolitical and commercial spheres of influence that gravitate around the United States, Europe, Russia, and China. Export control laws can limit trading options when a product is sold to two different spheres of influence and orientate development and supply-chain options.

### ACCESSING LARGE POOLS OF EXPERTISE

The complexity of defense equipment, the ever-increasing software integration of their parts and components, and the digital services associated with such innovations have led to new demands and requirements in engineering skills, such as data analytics, cybersecurity, systems architects, and more. Over the past years, this need has resulted in a competitive environment for attracting talent in Western nations, contributing to a talent shortage. Offshoring offers a sustainable solution to this problem, as emerging countries have millions of engineers, each regional pool having its own specialty. (See Exhibit 1.) An engineering center begun in India in 2017 by a leading aircraft manufacturer succeeded in finding needed talent with cutting-edge skills; the center now constitutes more than 1,000 highly specialized Indian engineers.

Talent retention is challenging in these emerging nations, given their high turnover rates. To build a solid relationship early on and to make sure graduates meet the requisite level of expertise, leaders in the defense industry have initiated partnerships with universities in the UAE and in India. Governments are also involved in these efforts, as

# <15%

### OF ENGINEERING WORKFORCE OFFSHORED, FOR MOST WESTERN DEFENSE PLAYERS IN 2018

demonstrated in initiatives by Thailand and the Philippines. While Thailand has made significant investments in digital learning and engineering capabilities, the Philippines has developed a “Cyber Corridor” to create interconnected centers of technology services.

### INCREASED COMPETITION

Beyond lower labor costs, emerging countries have launched tax-reduction programs to tip the balance of development costs even more in their favor and attract foreign investment in research and development (R&D). For instance, India offers a 150 percent tax deduction for in-house R&D expenditures while China offers a 50 percent allowance on machinery, equipment, land, and buildings through its R&D tax incentive program.

### SUCCESS FACTORS OF ENGINEERING OFFSHORING

The defense sector is a unique industry, standing at the intersection of cutting-edge technologies, innovation, national ambition, military strategy and secrets, and the highest technical standards and oversight. The combination of factors adds to the costs and demands placed on the engineering function at companies. To overcome these challenges and stay in the race, Oliver Wyman has identified eight key actions to accelerate and succeed in engineering offshoring:

First, define and establish clear guidelines to ensure collaborators adhere fully to the transfer of activities. Stressing positive motivations – such as additional growth through market proximity, competitiveness, and access to new expertise – is likely to get a better and more constructive reception than an emphasis on competitiveness.

Second, screen your R&D activities to identify which ones to transfer. Build a long-term roadmap: Initially, focus on discrete, non-core engineering activities, such as unit testing or software code development, to build trust. Gradually, however, bigger chunks of development work should be moved offshore, to promote competitiveness and motivate local teams.

Third, create specifications for transferring work early in the process, and make offshore-supplier-management training a must.

Fourth, design a robust local organization and operating model to guarantee quality control of local development. Early on, recruit a local technical leader and a human resource manager.

Fifth, set up strategic partnerships in the target country with engineering services providers to rapidly access trained resources for a quick ramp-up.

Sixth, define the IT architecture that will support the development between the different countries, either through a shared workplace and engineering environment or through data transfers. Cybersecurity and export-control restrictions need to be embedded in the IT architecture.

Seventh, manage cultural differences and domain onboarding by organizing training sessions in Western countries for key local people. Prepare future local managers by pairing them with expatriate managers.

Finally, address the issue of export control licenses early on by involving the Ministry of Defense and sharing the activity transfer roadmap.

Offshoring engineering activities is an opportunity for defense players to benefit from flourishing export markets and take the lead in the talent war. It is also an opportunity for a step change in the engineering processes. The eight key success factors aim at ensuring the sustainability of an outsourcing project and achieving impact in defense projects.

#### Eric Ciampi

[Eric.Ciampi@oliverwyman.com](mailto:Eric.Ciampi@oliverwyman.com)

+33 1 45 02 32 34

#### Marc Boilard

[Marc.Boilard@oliverwyman.com](mailto:Marc.Boilard@oliverwyman.com)

+33 1 45 02 32 19

#### Archag Touloumian

[Archag.Touloumian@oliverwyman.com](mailto:Archag.Touloumian@oliverwyman.com)

+33 1 45 02 32 58

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# OUR AUTHORS

**EMMANUEL AMIOT**

PARTNER, PARIS OFFICE

Emmanuel.Amiot@oliverwyman.com  
+33 1 45 02 32 71

**HENDRIK BECKER**

PRINCIPAL, DETROIT OFFICE

Hendrik.Becker@oliverwyman.com  
+1 248 455 7264

**MARC BOILARD**

PARTNER, PARIS OFFICE

Marc.Boilard@oliverwyman.com  
+33 1 45 02 32 19

**ERIC CIAMPI**

PARTNER, PARIS OFFICE

Eric.Ciampi@oliverwyman.com  
+33 1 45 02 32 34

**ANDREW CHIEN**

PARTNER, DETROIT OFFICE

Andrew.Chien@oliverwyman.com  
+1 248 455 7259

**CHARLES DE POMMEROL**

PRINCIPAL, PARIS OFFICE

Charles.Depommerol@oliverwyman.com  
+33 1 45 02 36 38

**MARKUS DREWS**

RESEARCH ANALYST, MUNICH OFFICE

Markus.Drews@oliverwyman.com  
+49 89 939 49 296

**HANNES ENGELSTAEDTER**

DIRECTOR, MUNICH OFFICE

Hannes.Engelstaedter@oliverwyman.com  
+49 89 939 49 431

**KEVIN HAUSER**

PARTNER, DETROIT OFFICE

Kevin.Hauser@oliverwyman.com  
+1 248 455 7260

**CHRISTIAN HEISS**

PARTNER, ZURICH OFFICE

Christian.Heiss@oliverwyman.com  
+41 44 553 3733

**RICHARD HELL**

SENIOR VICE PRESIDENT, MUNICH OFFICE

Richard.Hell@oliverwyman.com  
+49 89 939 49 710

**CORNELIUS HERZOG**

PRINCIPAL, MUNICH OFFICE

Cornelius.Herzog@oliverwyman.com  
+49 89 939 49 593

**DAVID KAUFMANN**

PARTNER, PARIS OFFICE

David.Kaufmann@oliverwyman.com  
+33 1 450 23 716

**THOMAS KAUTZSCH**

PARTNER, MUNICH OFFICE

Thomas.Kautzsch@oliverwyman.com  
+49 89 939 49 460

**JOCHEN GRAFF**

PARTNER, DUSSELDORF OFFICE

Jochen.Graff@oliverwyman.com  
+49 211 8987 637

**ROMED KELP**

PARTNER, MUNICH OFFICE

Romed.Kelp@oliverwyman.com  
+49 939 49 485

**MARK KIEL**

PRINCIPAL, FRANKFURT OFFICE

Mark.Kiel@oliverwyman.com  
+49 69 971 73 130

**WOLFGANG KRENZ**

PARTNER, MUNICH OFFICE

Wolfgang.Krenz@oliverwyman.com  
+49 89 939 49 403

**DANIEL KRONENWETT**

PARTNER, MUNICH OFFICE

Daniel.Kronenwett@oliverwyman.com  
+49 89 939 49 591

**TALON LLOYD**

ENGAGEMENT MANAGER, TORONTO OFFICE

Talon.Lloyd@oliverwyman.com  
+1 416 868 87 17

**ANDREAS NIENHAUS**

PRINCIPAL, FRANKFURT OFFICE

Andreas.Nienhaus@oliverwyman.com  
+49 69 971 73 527

**SRINATH RENGARAJAN**

SENIOR RESEARCH ANALYST, MUNICH OFFICE

Srinath.Rengarajan@oliverwyman.com  
+49 89 939 49 296

**SIMON SCHNURRER**

PARTNER, FRANKFURT OFFICE

Simon.Schnurrer@oliverwyman.com  
+49 69 971 73 036

**KEVIN SMEETS**

PARTNER, PARIS OFFICE

Kevin.Smeets@oliverwyman.com  
+33 1 45 02 36 53

**HENNING TIELKER**

PRINCIPAL, DUSSELDORF OFFICE

Henning.Tielker@oliverwyman.com  
+49 211 8987 648

**ARCHAG TOULOUMIAN**

PRINCIPAL, PARIS OFFICE

Archag.Touloumian@oliverwyman.com  
+33 1 45 02 32 58

**WOLFGANG WEGER**

PARTNER, MUNICH OFFICE

Wolfgang.Weger@oliverwyman.com  
+49 89 939 49 430

# PUBLISHER'S INFORMATION

## EDITORIAL BOARD

### WOLFGANG KRENZ

PARTNER

Wolfgang.Krenz@oliverwyman.com  
+49 89 939 49 403

### SUSANN SCHEICH

MARKETING ASSOCIATE

Susann.Scheich@oliverwyman.com  
+49 69 971 73 433

### MAXIMILIAN SCHNEIDER

ENGAGEMENT MANAGER

Maximilian.Schneider@oliverwyman.com  
+49 211 8987 695

## DESIGN & DIGITAL PRODUCTION

### AGATA GUMÓŁKA

SENIOR DESIGNER

Agata.Gumolka@oliverwyman.com  
+48 22 376 63 71

### KATHARINA VAUBEL

SENIOR PHOTO EDITOR

Katharina.Vaubel@oliverwyman.com  
+44 20 7852 7152

### TIMOTHY FADEK

SENIOR PHOTO EDITOR

Timothy.Fadek@oliverwyman.com  
+1 646 364 82 85

## CONTRIBUTORS

These people contributed research and insights to this journal.

### DOMINIK BETZ

ASSOCIATE

Dominik.Betz@oliverwyman.com  
+49 89 939 49 244

### RAOUL BOYA

ASSOCIATE

Raoul.Boya@oliverwyman.com  
+49 69 971 73 598

### CARSTEN KRETSCHMANN


ASSOCIATE

Carsten.Kretschmann@oliverwyman.com  
+49 89 939 49 708

### FLORENT LIETO

ASSOCIATE

Florent.Lieto@oliverwyman.com  
+33 1 45 02 30 00



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