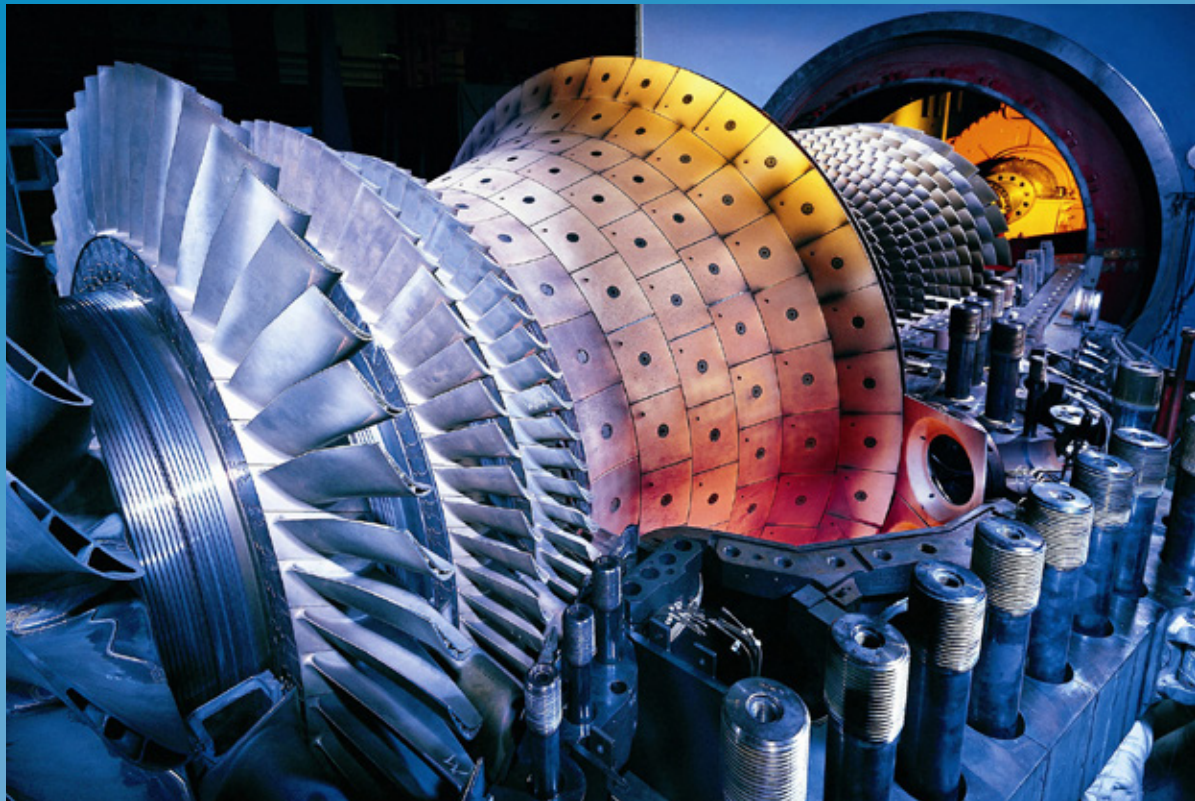


# How to succeed: Strategic options for European machinery

Shifting growth patterns, increasing pace of digitization, and organizational change





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# WELCOME

## Machinery industry in Europe – a basis for employment, growth, and wealth

Export-oriented and competitive the world over, Europe's mechanical engineering sector employs 2.9 million people. In 2015, European companies generated aggregated revenues of EUR 644 billion, of which EUR 240 billion stemmed from sales outside the EU. Europe's industrial sector is tightly interwoven within the single market. For instance, exports out of Germany contain 27 percent foreign value added, of which 51 percent stems from other EU countries – these percentages are even higher in smaller economies. Mechanical engineering in Europe lives from innovation and its technological edge. European companies spent roughly EUR 13 billion on research and development.<sup>1</sup>

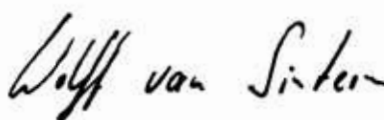
The backbone of the European industrial sector, mechanical engineering is a basis for employment, growth, and wealth. But these achievements cannot be taken for granted: they have been the product of relentless effort, time after time – with groundbreaking innovations and competitive products. However, some regions have seen creeping deindustrialization over the past few years. And the global competition doesn't sleep: China is by far the world's largest producer of machines and, with ever improving products, it is tapping many export markets – as far afield as Europe. The United States too has managed to halt the erosion of its industrial sector over the last few years; and other competitors worldwide are ready to make their move.

Collaborating regularly since 2013, McKinsey & Company and the VDMA have sought to analyze the challenges currently facing mechanical engineering and help guide the sector's advancement into the future. 2014 saw the publication of the first joint study, "The future of German mechanical engineering," which proposed specific actions at an operational level. The present, second joint study has a broader strategic scope: it focuses on European mechanical engineering and its future strategic alignment. Within the three thematic areas – shifting growth patterns, increasing pace of digitization, and organizational change – the present study identifies patterns that have proven successful and describes the requisite fields of action – for each individual company, but also for Europe at large as an economic hub.

We are certain: if Europe's mechanical engineering companies stay in touch with the pulse of the times, this European success story will continue. We trust that you will enjoy reading our study.



**Dr. Reinhold Festge**  
President of the VDMA



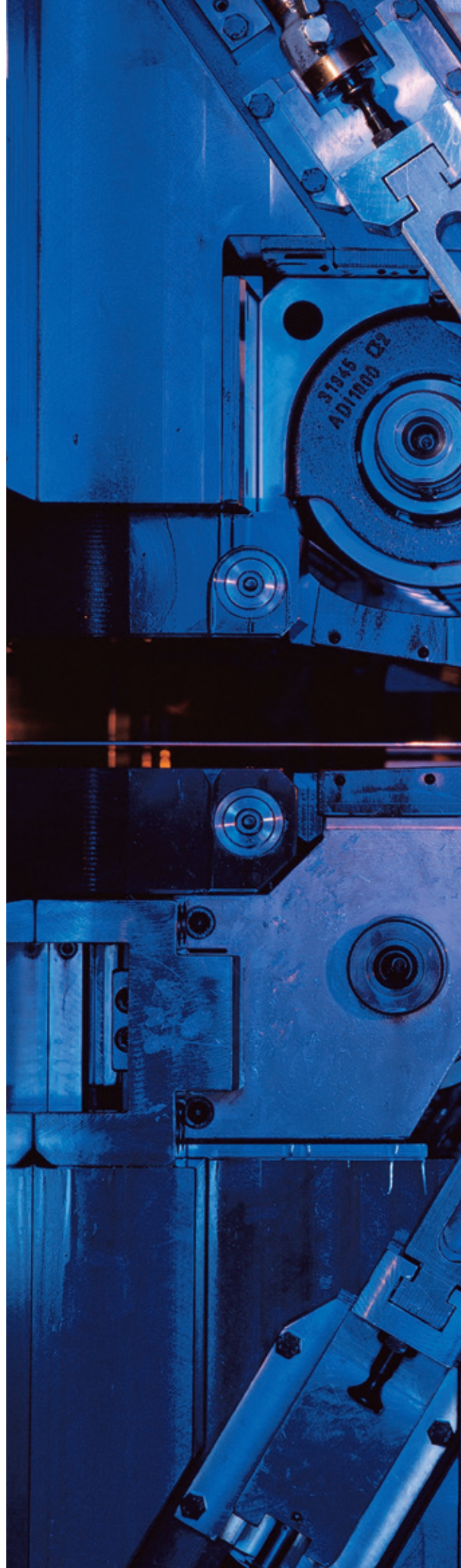
**Wolff van Sintern**  
Director, McKinsey & Company

<sup>1</sup> Eurostat, VDMA estimates (revenues: 2015, foreign value added: 2013, spend on research and development: 2011)

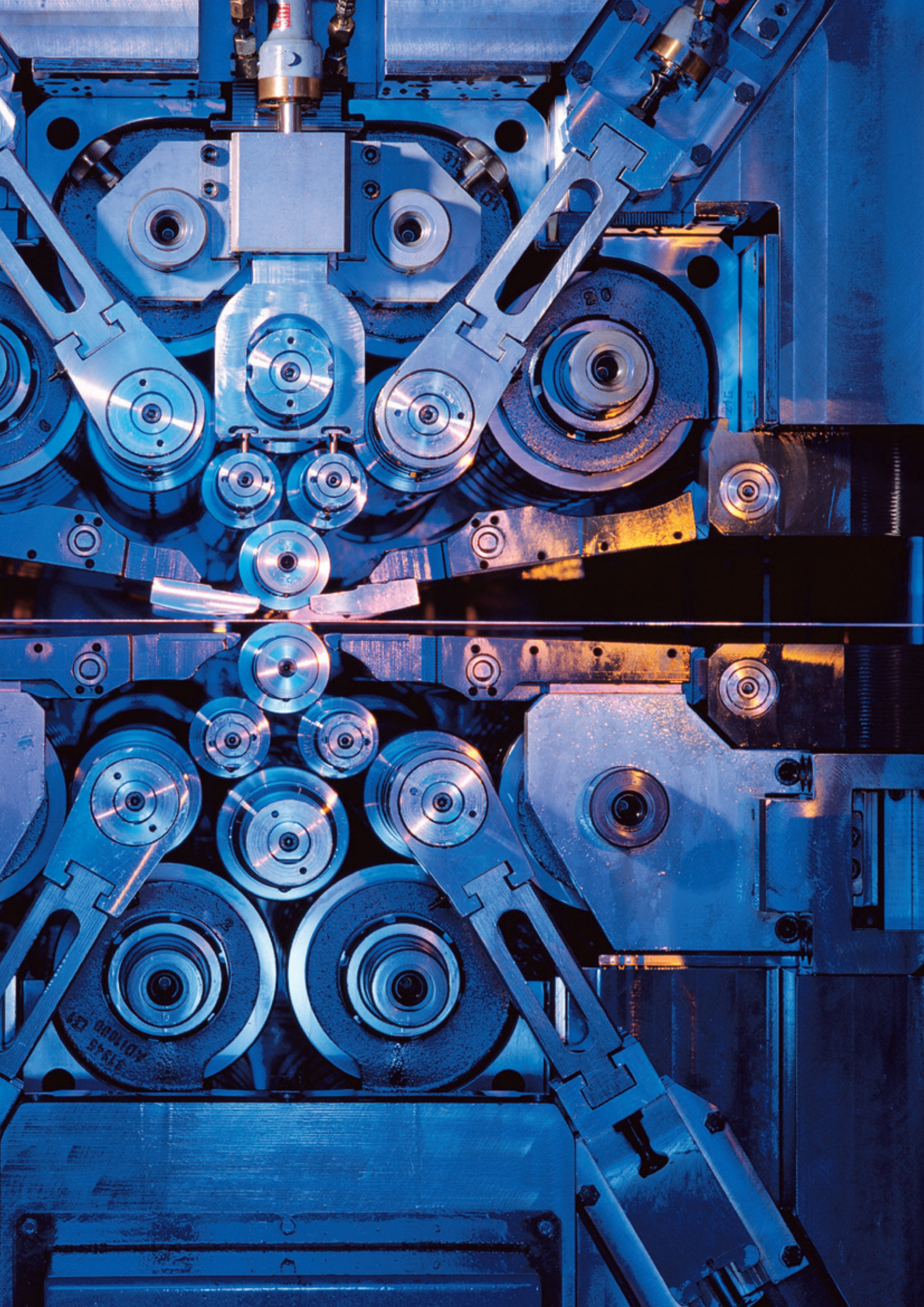


# INTRODUCTION

The European machinery industry has experienced impressive growth and profitability over the last several years. Macroeconomic and technological shifts, however, are on the horizon, and players in this space risk losing their competitive advantages if they are unable to develop appropriate growth strategies or build adaptive organizations.









The European machinery industry is foundational to the European economy representing 12 percent of the European industry and employing about 2.9 million people.<sup>2</sup> So far, the European machinery industry is a success story both in terms of growth and profitability. Official statistics show impressive performance with about 5 percent revenue growth p.a. between 2010 and 2014 and an average EBIT of 7 to 9 percent. This study, which was jointly conducted by the German Engineering Federation (VDMA) and McKinsey & Company and is based on a survey of 215 European machinery companies, reveals an even brighter picture: the average respondent reports about 7 percent annual revenue growth for 2010 to 2014 and about 10 percent EBIT margin.

European machinery companies are extremely successful internationally holding a share of 26 percent of worldwide machinery production, followed by the US (around 14 percent) and only surpassed by China (around 38 percent).<sup>3</sup> However, the business environment is changing: in a volatile macroeconomic market environment, the planning of future growth strategies is becoming more and more difficult. Digitization is increasingly casting doubt on the sustainability of traditional business models. Higher complexity of the offered products and solutions in combination with ever-shorter product cycles is imposing stronger pressure on returns and demands more agility in production and product development. While traditional engineering capabilities retain their fundamental importance, shifting growth sources and digitization require new capabilities and talent. Locating qualified personnel is already a barrier to growth, and the war for talent is intensifying. More and more companies are asking themselves whether they have the right organizational setup to keep pace with these developments. Competitors, especially from China, are attacking the industry with competitive pricing and better time to market, while the US machinery industry picks up its pace with new and creative business models.

In this context, it is crucial to identify not only the challenges but also the opportunities and to actively participate in changes. These strategically provocative and exploratory questions apply equally to every individual enterprise and to the industry as a whole (Exhibit 1):

- How can shifting growth patterns be captured – both geographically and along the value chain (e.g., from products to services)?
- What impact will digitization have on industrial business models and operations? And how can companies design their own digitization strategies?
- How should enterprises adapt the inner workings of their organizations to address these opportunities and challenges?

This publication intends to add insight to the ongoing discussion of how to shape the future of the European machinery industry. Chapter 1 gives an overview of the industry and introduces typical business model archetypes of companies. Chapter 2 analyzes the most important strategic themes for the coming years and the associated opportunities

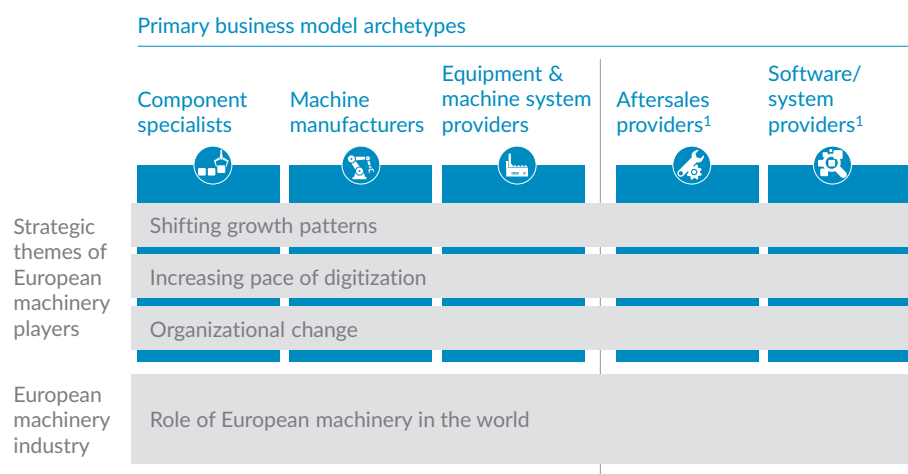
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<sup>2</sup> Eurostat 2016 (EU-28 + Switzerland + Norway, excluding the building sector)

<sup>3</sup> VDMA April 2016, based on national statistics, Eurostat, UN, CMIF, and VDMA estimates, EU-28

and challenges. Chapter 3 discusses the role of the European machinery industry in a global competitive context. Building on these findings, Chapter 4 derives concrete measures and actions for European machinery companies.

**The survey was structured and has been analyzed along strategic themes of the European machinery industry and primary business model archetypes**



<sup>1</sup> Companies can be part of other archetypes as well

EXHIBIT 1

The participating 215 machinery companies represent all sectors of the industry and have been grouped into five geographical clusters:

- Germany (63 percent)
- Switzerland and Liechtenstein (13 percent)
- Other Western & Northern Europe (Austria, Belgium, Denmark, Finland, France, Netherlands, Sweden, UK) (13 percent)
- Southern Europe (Greece, Italy, Spain) (9 percent)
- Eastern Europe (Czech Republic, Russia, Ukraine) (2 percent).

Participants represent the diversity of the industry. The set of respondents covered a broad range of company size, ownership structure, and industry sectors (Exhibit 2). The average participating company has revenues of EUR 476 million p.a. and 2,530 employees. The study therefore has an above-average proportion of medium and large companies compared to the overall industry. In terms of ownership, almost two-thirds of the participants are family owned, around 20 percent are publicly listed, and around 15 percent are run by a private equity fund or others.

The survey explored key performance indicators (KPIs), such as profitability, identified business models, and assessed future trends and challenges of the industry. In addition to the survey, interviews with more than 20 industry leaders were conducted to expand on the survey results, and external data (especially macroeconomic data) was used to validate the survey’s findings.

The survey participants represented a broad range of industry sectors

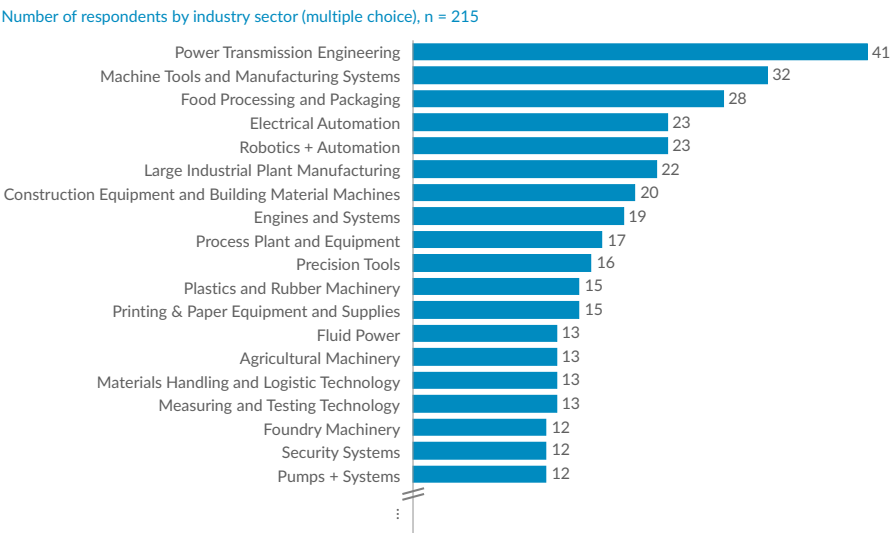


EXHIBIT 2

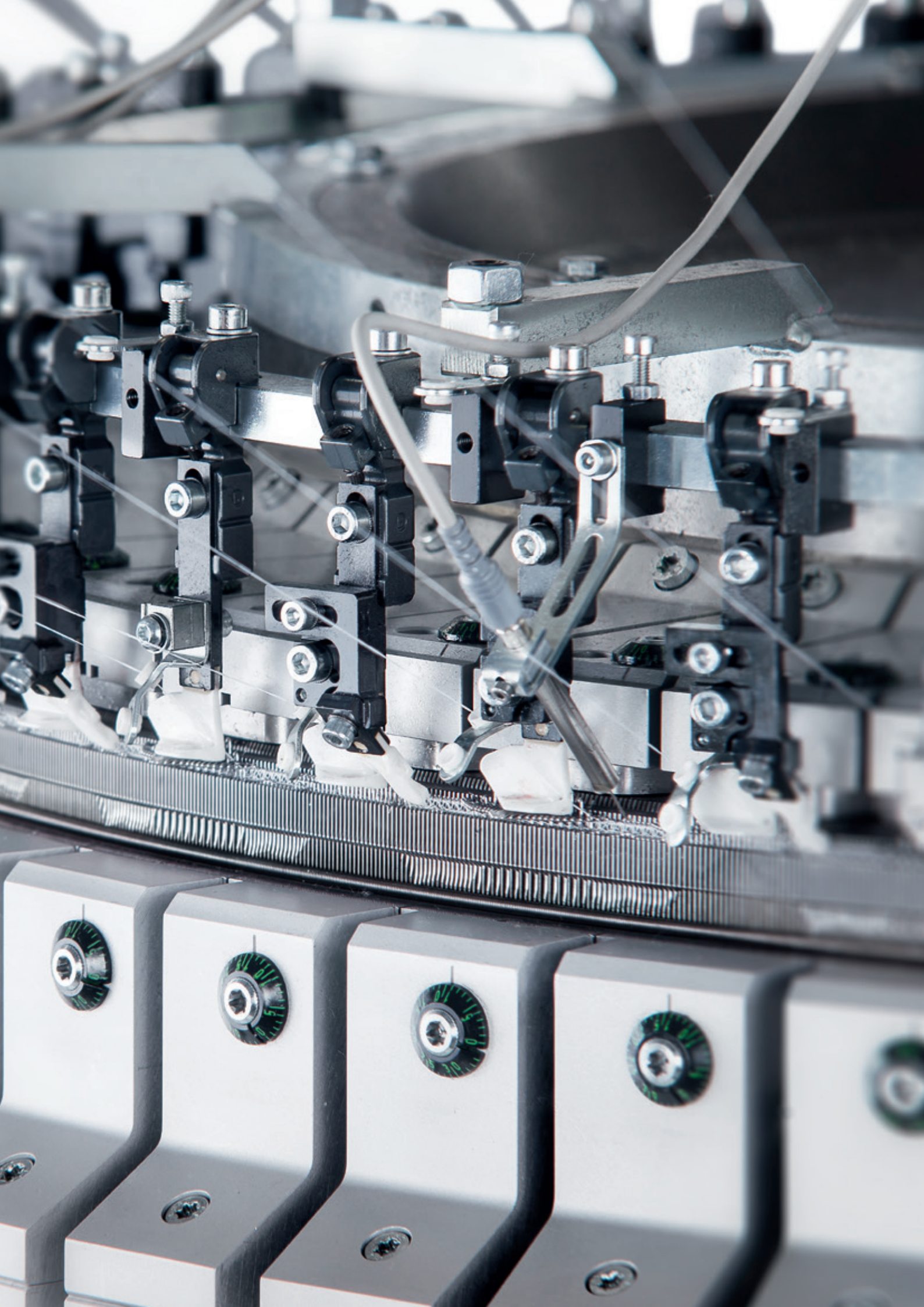


# 1. BUSINESS MODEL ARCHETYPES IN THE EUROPEAN MACHINERY INDUSTRY

While machinery is their common denominator, players in the European machinery industry represent a broad range of business model archetypes. Where individual companies position themselves along the machinery value chain has implications for a variety of measures of performance from growth and profit to ROCE and R&D.









In some industries, business models tend to be very similar. Automotive manufacturers, for example, all operate using more or less the same business model. They design and make cars, but purchase most components externally and make only key components, such as engines, in-house. In contrast, companies in the European machinery industry are highly diverse with respect to their business models. The level of variation can be illustrated with key criteria such as net value added, value chain positioning, and primary source of profit.

**Net value added.** The level of net value added differs widely across the machinery industry. Some companies have an extremely high share of value added (70 percent and more), meaning they develop and manufacture products mainly from raw materials. Others outsource key activities, purchase finished components, and focus their value add only on assembly. Companies that take this approach often have a share of value added below 40 percent.

**Value chain positioning.** Some companies position themselves across the whole value chain. Other companies produce basic, highly standardized, high-volume components like valves, gears, and bearings; others combine these parts into gearboxes; and still others use the gearbox, an engine, pumps, and other components to build a pumping station. Some machinery companies use such a pumping station in a larger-scale, highly customized, low-volume or one-off production line – such as a paper machine – or in a piece of heavy engineering – like a waste water treatment plant. It is the company's position within such a value chain that determines its business model.

**Primary source of profit.** The primary source of profit differs widely across the machinery industry. Some companies use their original equipment manufacturing business mainly to build a profitable service business, the well-known model in the elevator segment. At the other end of the spectrum, some companies focus primarily on original equipment as their source of profit and provide service only on request by the customer.

Notwithstanding this variety across the machinery industry, it would be impossible to discuss the results in a way that is useful for survey participants and nonparticipants, without aggregating the companies into groups. The survey results indicate recognizable patterns within the company business models. For example, a wide range of companies participating in the study focuses on making components, and therefore mainly on development and production functions. Other companies are better characterized as integrators, because they combine components to form machines and systems. Their core competence is not production but rather the integration of third-party modules.

## 1.1 Operational focus of business model archetypes

By clustering companies with similar business model patterns, five archetypes were defined, each having their own distinct characteristics (see the appendix for more details). Only a few companies come close to being an exact match with the entire set of characteristics associated with one particular archetype. However, nearly all companies

participating in this survey can be assigned to one major archetype and, in some cases, one additional secondary archetype (Exhibit 3).

The survey revealed that 73 percent of the participating companies earn more than 50 percent of their revenues in a particular part of the value chain. Three archetypes have been identified based on that pattern:

**Component specialists.** Machinery companies that earn more than 50 percent of their sales from components are categorized as component specialists. This criterion is met by 32 percent of the survey participants, and many of them even have a sales share of over 80 percent from selling components. Their main business focus is on the development and production of components for industrial machines and equipment, such as drives, automation technology, bearings, and valves.

**Machine manufacturers.** Machinery companies that earn more than 50 percent of their sales from single machines are categorized as machine manufacturers. One-quarter of the survey participants meet this criterion. Their main business focus is on the development and production of single machines such as milling and grinding machines or mobile off-road equipment (e.g., agricultural or construction).

**Equipment & machine system provider.** Machinery companies that earn more than 50 percent of their sales from integrated equipment & machine systems are categorized as equipment & machine system providers; 16 percent of survey participants fulfill this criterion. Their main business focus is on the assembly and integration of combined machinery systems, lines, and equipment, such as processing machinery equipment (food and beverage, wood, textile, etc.) and packaging lines up to entire turnkey solutions (power plants, etc.).

### 5 business archetypes exist across the European machinery industry

	Component specialists	Machine manufacturers	Equipment & machine system providers	Aftersales providers <sup>1</sup>	Software/ system providers <sup>1</sup>
Rationale for classification	≥ 50% of revenue share in respective revenue source			≥ 20% of revenue share in respective revenue source	
Main business focus	Development and production of components	Development and production of single machines	Assembly and integration of combined machinery systems, lines, and equipment	High share of aftersales business compared with industry average	High share of software development as percent of revenues compared with industry average

<sup>1</sup> Companies can be part of other archetypes as well

In addition to these three predominant archetypes, two additional archetypes have been defined:

**Aftersales providers.** Machinery companies with more than 20 percent of sales from aftersales business (i.e., parts and services) are categorized as aftersales providers. Looking at the entire sample, 23 percent of survey participants fulfill this criterion, equally populated by component specialists, machine manufacturers, and equipment & machine system providers. However, equipment & machine system providers show a much higher aftersales share in revenues than the other archetypes do.

**Software/system providers.** Machinery companies that earn more than 20 percent of their sales from software development are categorized as software/systems providers. Of the survey participants, 12 percent fulfill this criterion.

## VOITH

### The multi-segment, multi-model business play

Many machinery companies have a strong focus on a single business model and a narrow product range – and thus clearly correspond to one archetype. But there are also companies that are active in multiple segments, employing multiple business models. Voith, with its 150-year history, is one such company.







With its four divisions – Hydro (hydro power plants, services), Paper (supplier for the worldwide paper industry with paper machines, products, and services), Turbo (turbomachinery such as retarder or high-speed gears), and Digital Solutions (digitization and automation technology) – Voith focuses on different markets and customers with different products. Furthermore, within these divisions, the company has different business models, including plant engineering for hydro power plants, component production for turbomachinery, and service-based business lines in paper. Additionally, Voith's offering covers a range of business areas – from pure project-based, large-scale businesses to medium-sized series production.

Success within this level of complexity depends, in part, on separating the different business models into small, easy-to-manage business lines. Each line has its own P&L, a high level of freedom of choice, and a stringent supervisory structure. The company also leverages its global footprint across all businesses, especially with respect to manufacturing, engineering, and purchasing. So even though the company is working in smaller units, it can leverage scale effects in multiple dimensions.

For a family-owned company like Voith, this setup has a broad set of advantages. For one, the diversity of the approach works as a hedge against market volatility. Involvement in multiple segments keeps the company balanced and shields it from the ups and downs of individual segments.

## 1.2 Performance characteristics of business model archetypes

For each of the five archetypes, KPIs have been calculated to derive commonalities and differences across business models as well as actionable recommendations for each archetype. In addition to financial KPIs (i.e., size, growth, and profitability), the study also considered qualitative KPIs, such as covered price segments, unique selling proposition (USP), and regional and strategic focus going forward (see table below). The survey participants tend to perform above industry average leading to the conclusion that participating companies represent a more innovative and successful share of the industry already engaging with growth beyond the core.

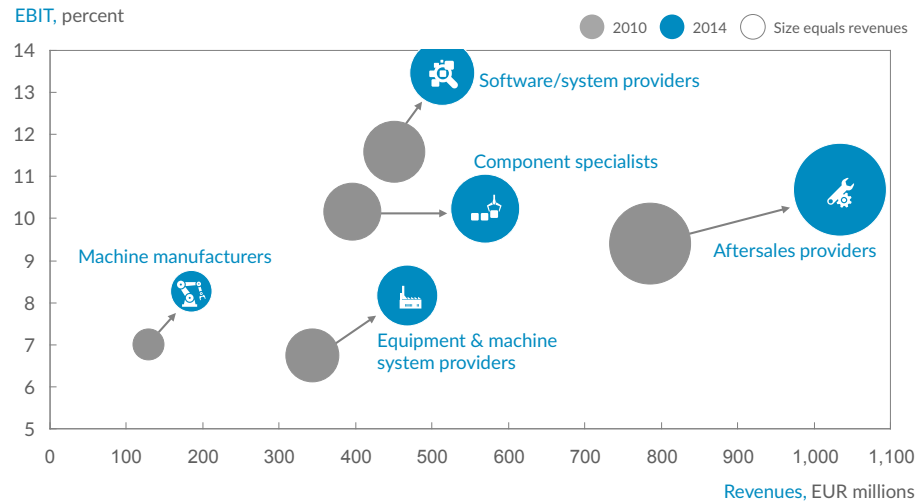
COMPANY CHARACTERISTICS BY BUSINESS MODEL ARCHETYPE						
	 Component specialists	 Machine manufacturers	 Equipment & machine system providers	 Aftersales providers	 Software/system providers	 Average
Employees	3,764	786	2,164	4,931	2,356	2,530
Share of employees in home country, percent	78%	76%	79%	64%	79%	77%
Sales abroad, percent	57%	77%	76%	80%	50%	66%
Sales outside Europe, percent	28%	46%	46%	49%	27%	38%
Revenues 2014, EUR millions	571	186	468	1,034	514	476
CAGR 2010 - 2014, percent	5.6%	9.7%	8.3%	4.8%	6.1%	7.2%
Expected CAGR 2014 - 18, percent	8.0%	7.1%	5.9%	6.9%	11.1%	7.1%
EBIT 2014, percent of revenues	10.2%	8.3%	8.2%	10.7%	13.5%	10.0%
EBIT change 2010 - 14, percentage points	0.1	1.3	1.4	1.3	1.9	0.8
ROCE 2014, percent	20.5%	17.5%	16.3%	16.1%	22.4%	17.8%
Break-even point, percent of revenues	74.5%	75.6%	80.7%	77.1%	68.3%	76.3%
SG&A quota, percent of revenues	12.2%	13.3%	12.0%	12.9%	11.1%	13.1%
R&D quota, percent of revenues	5.7%	6.5%	4.5%	6.5%	12.4%	6.9%
Net value added, percent of revenues	54%	49%	50%	55%	58%	52%

Assessing those KPIs reveals interesting differences by archetype:

**Size, growth, and profitability.** All archetypes performed very well over the last four years with an average growth rate of 7.2 percent p.a. and an average EBIT margin of 10.0 percent (Exhibit 4). However, this performance might have been influenced by the exceptional order situation in 2010 and 2011 when the industry made up for the crisis

## All archetypes grew revenue and improved margins between 2010 and 2014 except component specialists

Profitability and revenue development by archetype, n = 215



NOTE: Entire industry yearly revenue growth rate (CAGR 2010 - 14): 4.8% (Eurostat)

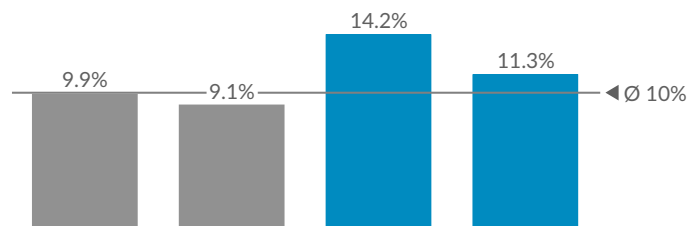
EXHIBIT 4

of the years before. Growth was particularly strong among machine manufacturers (+9.7 percent). In contrast, component specialists recorded below-average growth (+5.6 percent). Above-average profitability was achieved especially by software/system providers (13.5 percent EBIT margin), whereas machine manufacturers and equipment & machine system providers saw somewhat lower EBIT margins of around 8 percent. Moreover, archetypes differ significantly by size: aftersales providers are generally larger companies (revenues of around EUR 1 billion); machine manufacturers

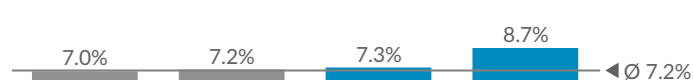
## Larger companies tend to achieve higher EBIT margins and higher growth rates

n = 135

**Profitability**  
EBIT margin 2014,  
percent of revenues



**Growth**  
CAGR 2010 - 14,  
percent



**Company size**  
Global revenues,  
EUR millions

< 100    100 - 500    500 - 1,000    > 1,000

EXHIBIT 5

as well as software/system providers are on the other end of the spectrum with average revenues between EUR 100 million and EUR 200 million.

Based on the survey sample, EBIT margins vary with company size (Exhibit 5). Small companies (revenues of less than EUR 100 million) achieve margins of around 10 percent (with a huge spread between companies). As companies grow beyond EUR 100 million, the costs of internationalization tend to drive profitability down towards 9 percent. Once companies grow into the revenue range between EUR 500 million and EUR 1 billion, scale effects kick in and profitability tops 14 percent. For companies whose revenues exceed EUR 1 billion, however, returns once again diminish, as further scale does not yield additional margin. The higher cost of complexity eclipses any additional margin that might come from scale, and profitability dips back down to about 11 percent.<sup>4</sup> In addition, the study established a mild correlation between company size and growth rate with big companies (revenues of more than EUR 1 billion) reporting a CAGR of 1.5 percentage points above average between 2010 and 2014.

**Break-even point** (in percent of revenues). Despite its strong performance, the machinery industry shows quite high break-even points of around 76 percent on average (Exhibit 6). One out of three component specialists, machine manufacturers, or aftersales providers even have break-even points above 80 percent. Around 40 percent of the survey's equipment & machine system providers respondents estimate break-even points at over 80 percent (many of them even over 90 percent). In contrast, software/system providers report a much lower break-even point of 68 percent. Given these figures, European machinery companies should be aware of the fact that – despite the high industry profitability of 10 percent – an industry cyclicity of up to 20 percent, which

#### Equipment & machine system providers have the highest break-even point, while software/system providers have the lowest

Percent of companies, n = 129

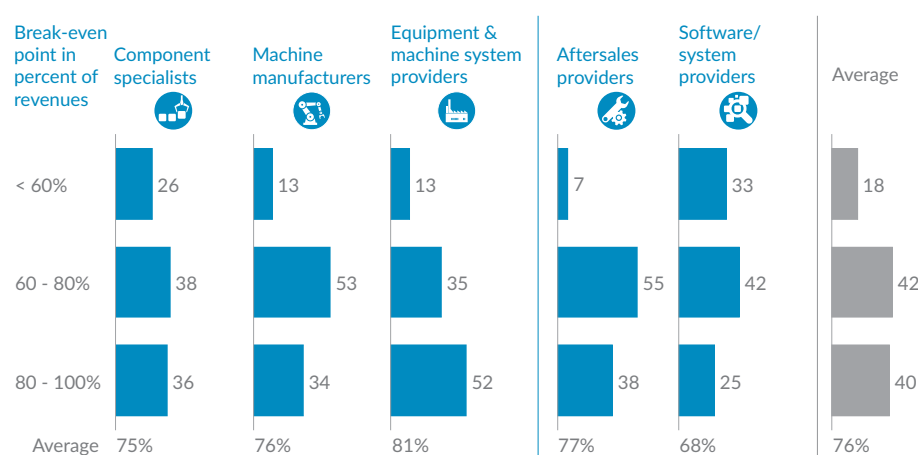


EXHIBIT 6

4 Also see previous VDMA-McKinsey study: "The Future of German mechanical engineering – Operating successfully in a dynamic environment," 2014

is not unseen in the industry, would send these 40 percent of the surveyed companies into the loss-making zone. On the other hand, there are also around 17 percent of the machinery companies with a break-even point of less than 60 percent, which are thus particularly well prepared for a volatile environment.

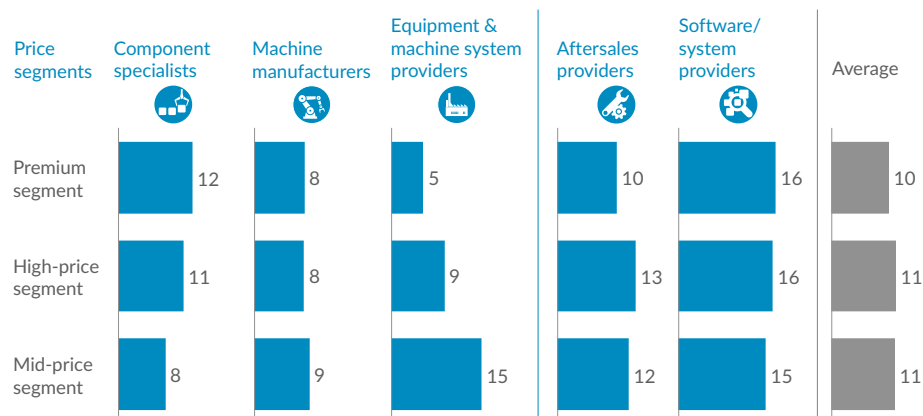
**Fixed cost structures** (especially SG&A and R&D spend). The average R&D spend of the surveyed companies lies around 7 percent of revenues. However, equipment & machine system providers tend to spend less (4.5 percent), while software/system providers allocate almost twice as much funding to R&D as the average, 12.4 percent. This correlates with the actual focus of R&D conducted: while equipment & machine system providers focus on less innovation-intensive R&D, such as process enhancement (49 percent compared to 35 percent at software/system providers) and incremental product or service improvement (83 percent compared to 42 percent at software/system providers), software/system providers have a stronger focus on innovation-intensive R&D, such as basic and foundational research (15 percent compared to 6 percent).

SG&A costs across all archetypes average around 13 percent with no significant correlation with profitability.

**Price segments.** The European machinery industry has a strong focus on the high-price/premium segments with 36 percent of companies active in the premium and 41 percent in the high-price segment. Machine manufacturers and aftersales providers are the leaders in the high-price and premium segments: both sell more than 80 percent of their products and services in these segments. The low-cost or volume business is not relevant for most European machinery industry archetypes and is addressed by players from other regions, such as China. Only equipment & machine system providers do a small share (less than 5 percent) of business in the volume segment. Pricing appears to be a lever

#### Component specialists and software/system providers are more profitable in higher price segments, other archetypes show a reverse correlation

EBIT margin in percent of revenues in relation to price segment, n = 144





with some untapped potential for the European machinery industry, as only 40 percent of the companies surveyed are currently active in more than one price segment.

The most notable feature of the archetypes' pricing strategies is that playing in the premium segment actually only leads to higher profitability for component specialists and software/system providers (Exhibit 7). For all other archetypes, selling not in the premium, but in the high-price or even medium-price segment offers a higher EBIT margin. What accounts for this seeming discrepancy? The answer is threefold: first, there are economies of scale that pay off more at the lower price point. Second, premium offerings go hand in hand with higher R&D expenses putting pressure on EBIT margins. Third, R&D-intense premium products go hand in hand with higher customer expectation and therefore might have higher guarantee costs or even nonpayment risks.

The largest spread in EBIT margin occurs among equipment manufacturers: on average, they earn 5 percent in the premium and 15 percent in the medium-price segment. They are followed by component specialists, 12 percent in the premium segment and 8 percent in the mid-price segment. For the other archetypes, the spread and therefore the relevance of pricing is much smaller (about 2 percentage points).

Some machinery players have implemented successful strategies to play in two price segments. Creating offers for different price segments under one brand is usually not successful, since it is hard to differentiate products and services that have been developed by the same group of engineers and sold by the same group of salespeople. A more successful strategy is to offer products in different price segments under a new brand with a dedicated engineering and sales team.

**Net value added.** Survey participants on average add around 50 percent of net value on top of purchased materials and services. In general, this is independent of balance sheet, growth, and profitability. However, a slightly higher net value added can be observed among the larger and faster-growing companies.

Adding more net value added appears to be the way forward: 42 percent of the companies surveyed are planning to increase their level of net value added by 2020, making vertical integration an important growth theme. That said, another group, about a quarter of the respondents, intends to decrease net value adding in the future. Machine manufacturers appear to be the most divided on this strategic question: about half of them are planning an increase and about a third are planning to decrease the level of their real net value added. Less than 10 percent of the machine manufacturers intend to maintain their current levels of net value added.

This trend is valid across all archetypes. However, the effects and benefits of vertical integration can differ sharply by archetype (Exhibit 8). Interestingly, component specialists benefit from high vertical integration as it almost doubles their EBIT through increased net value added. This is also true for machine manufacturers although the effect is less significant. The opposite is true for equipment & machine system providers. In their case, a high level of net value added (between 61 and 80 percent) slashes their EBIT to less than three percent. This highly negative impact is due to the growing complexity of the

Component specialists benefit from high vertical integration, while equipment & machine system providers show a reverse correlation

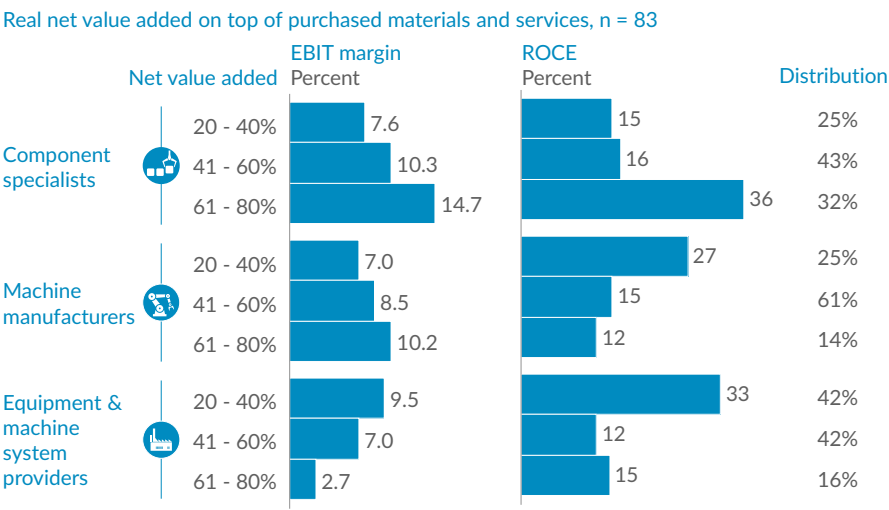


EXHIBIT 8

process steps associated with higher net value added and higher project management risks. This means that these companies should permanently question their core competencies and make adjustments based on the conclusions to keep the business lean and profitable.

Component specialists also show a positive correlation between net value added and ROCE – they achieve higher capital efficiency with higher net value added. For machine manufacturers and equipment & machine system providers this does not hold true. They achieve significantly higher capital efficiencies with a lower net value added. The reason for this might be the level of utilization of machines. Whereas a component specialist can usually fully utilize its machines even with a high net value added, this is significantly harder for a machine manufacturer or equipment & machine system provider with their diverse production mix. Therefore, it can pay off for a machine manufacturer or equipment & machine system provider to focus on a lean manufacturing footprint and leverage supplier base.

**International footprint.** The European machinery industry is export oriented while companies are deeply rooted in their respective homelands. On average, two-thirds of revenues are generated outside the home market, but about three-quarters of the employees are still based at home. The world's largest machinery export regions by sales are Europe (around 60 percent of the revenues are generated in Europe including homeland) followed by North America and China, both with a share of around 10 percent. On a regional level, the export share differs widely between Germany and the rest

*“Small regional players have a huge advantage: they know their customers extremely well and are very good at responding to their requirements.” [Component specialist]*

of Europe. While German participants generate more than 40 percent of their revenues in Germany (followed by more than 20 percent in the rest of Europe, 10 percent in North America,

and 8 percent in China), the rest of the participants generate about 80 percent of their revenues outside their respective homelands given their smaller home markets (around 20 percent in homeland, 40 percent in the rest of Europe, 10 percent in North America, 10 percent in China). Only Southern Europe has generated slightly lower revenues in Europe (around 45 percent in Europe including homeland).

**Customer value proposition.** Within the European machinery industry, companies across archetypes compete on three main unique selling propositions: customer orientation, innovative products/services, and quality of products/services (Exhibit 9). All three are a good fit with the upper-end price segments the industry is playing in.

### Distinctive customer orientation is the USP most attributed to equipment & machine system providers

#### Unique selling proposition

Percent of companies, n = 215

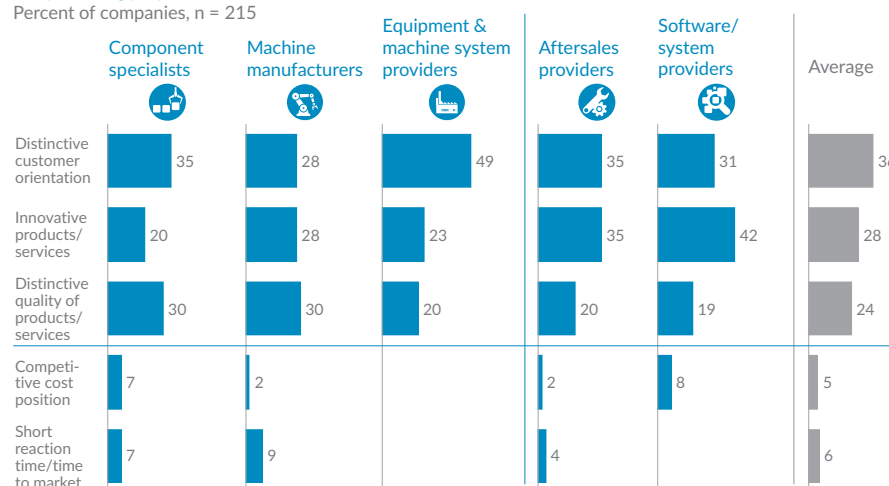


EXHIBIT 9

- The customer orientation as a unique selling proposition is especially relevant for equipment & machine system providers, with half of the companies highlighting this approach as their source of competitive distinction.
- Innovative products are especially applicable to software/system providers (42 percent) and aftersales providers (35 percent), as both archetypes compete in environments marked by short product life cycles and rapid advances in technology.
- Distinctive quality of products/services is most relevant for component specialists and machinery manufacturers (around 30 percent).

Practically none of the companies said its unique selling proposition consisted of a competitive cost position or a short reaction time/fast time to market.

*"Distinctive customer orientation and technology innovation are the keys to our success as an equipment provider. If we do not remain number one or two in the market, we are lost."*

*[Equipment & machine system provider]*

Western & Northern European countries note a somewhat greater importance of innovative products and service (37 percent) compared with the average (28 percent).

All USPs seem to have their own distinct value with no correlation between certain USPs and a higher EBIT being observed.

However, there are regional differences. For example, distinctive customer orientation is more important for Southern European machinery companies (53 percent) than for those in other regions (36 percent). Other



## 2. STRATEGIC THEMES IN THE EUROPEAN MACHINERY INDUSTRY

Fundamental developments in market patterns and technology will have a significant impact on the machinery industry in Europe. Players' ability to thrive amidst the change will depend, in large part, on their capacity to build agile organizations that can adapt to the shifts in the spaces and places of growth. Success will also be linked to their ability to prove business models that capitalize on increasing digitization.









Three major strategic themes characterize the changes the European machinery industry is expected to face in the coming years:

- Shifting growth patterns – both geographically and along the value chain and with this also shifting revenue and profit pools
- Increasing pace of digitization – which is posing questions around the sustainability of traditional business models
- Organizational change – which becomes necessary to adapt to the first two themes as well as a volatile and competitive business environment.

Industry players across Europe expect that growth in traditional markets will slow down. Therefore, machinery companies are seeking opportunities to enter new geographical markets, broaden their product/service offering, and/or integrate vertically along the value chain. Since new services and digital business models are becoming increasingly important, digitization will play a key role going forward. Digital business models offer new revenue sources and enable efficiency improvements for internal operations. While the focus of the machinery industry currently is on operational excellence, the threat from new market entrants with new business models (especially from the US) should not be underestimated.

In order to respond to these changes, organizations need to remain flexible. Shifting growth sources and the business models made possible by digitization ask for new capabilities and talents. Attracting and retaining qualified personnel is already a barrier to growth, and competition is likely to increase. Additionally, organizations need to become more agile to be able to react to the increased volatility of customer needs and demand.

While companies feel rather prepared how to react to growth shifts, they assess their preparedness regarding digitization and organizational change much lower. They are especially less than confident when it comes to knowing how to develop and profit from new digital business models and being prepared for digital's implications for the organization.



## 2.1 Shifting growth patterns

Despite slowing down macroeconomics in many geographies, the global machinery market in 2015 realized a global sales volume record of EUR 2.6 trillion (+10 percent). However, the result was distorted partly vigorously by the appreciation of many currencies against the euro. This includes in particular the appreciation of the dollar in relation to the euro by nearly 20 percent and the Chinese RMB by 17 percent. The currency- and price-adjusted world turnover stagnated in 2015 compared with the previous year and shows the disappointing picture of a weak developing world demand for investment goods. While revenues grew in real terms in China's mechanical engineering industry by 2 percent, it stagnated in the US and Germany and declined in Japan by as much as 1 percent.

China further expanded its leading position and holds 38 percent of the global machinery market (2014: 35 percent). Europe's share (EU-28) amounts to 25 percent (Germany: 10 percent). The market share of the US players is 14 percent.<sup>5</sup>

Over the past years, the European machinery industry also succeeded in growing faster than the economy, largely driven by a strong demand from China, Russia, and other emerging markets. All signs indicate, however, that the period immediately ahead will be characterized by slower economic growth globally. Machinery companies looking to replicate their past performance recognize that growth beyond the core will need to be an essential part of their recipe for success.

### 2.1.1 Shift towards growth beyond the core

Survey participants grew at an average rate of 7.2 percent p.a. (from 2010 to 2014). Machine manufacturers were in the lead, almost doubling revenues, whereas other

archetypes grew their business by roughly one-third. For the next several years, machinery companies expect similar growth rates (+7.1 percent p.a. from 2014 to 2018), even with increasing EBIT margins (from 10.0 percent in 2014 to about 11.5 percent in 2018).

However, growth patterns are shifting. In the past, the predominant source of growth (30 percent) was "growing with the market," i.e., maintaining a constant market share with an existing portfolio in an already covered, growing market. For most companies, strong growth in the BRIC countries, especially in China, was the key driver behind this. The second largest growth pocket (28 percent) was market share gains in those growth markets as well as companies' home markets. Other sources of growth, such as entering new regional markets or broadening the product/solutions portfolio, played a less important role (Exhibit 10).

### While growing with the market was a main driver of growth in the past, vertical and horizontal integration will gain importance in the future

#### Drivers of growth

Percent of companies, n = 215

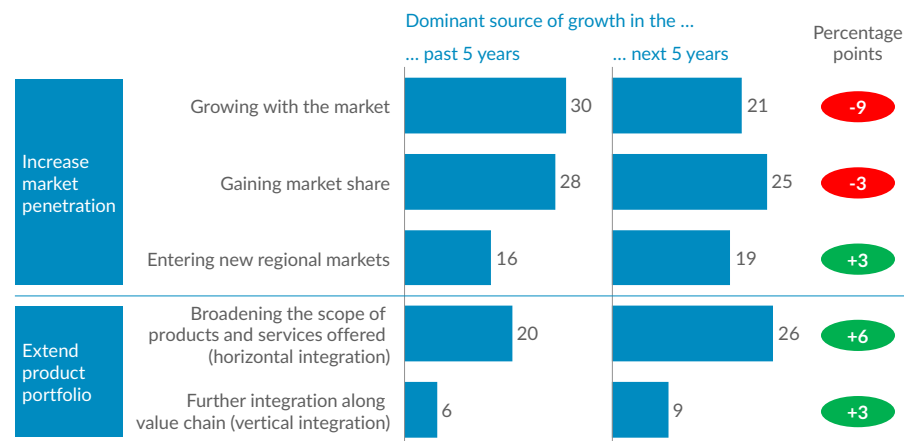


EXHIBIT 10

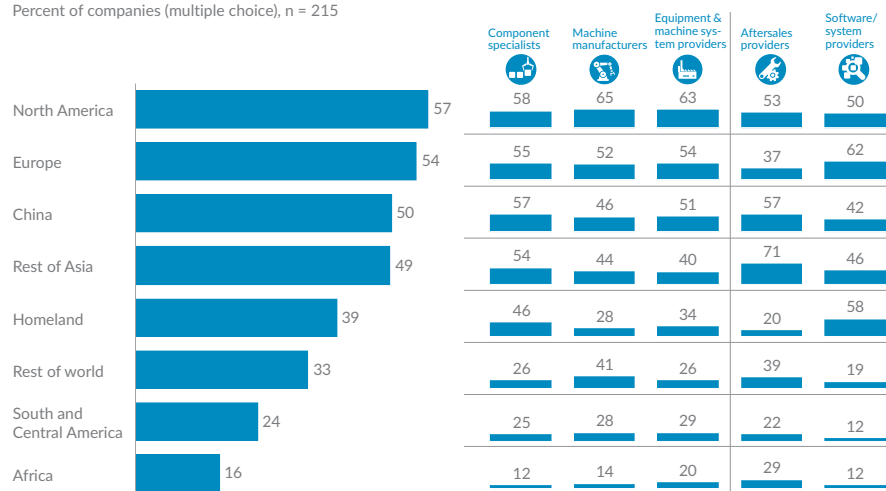
In the light of macroeconomic slowdowns in China (high uncertainty), Russia (behind expectations), and Latin America (stuck in a structural recession) as well as in other core machinery markets (growth forecast of 1 to 2 percent p.a. until 2025<sup>6</sup>), survey participants expect significantly less tailwind from already covered geographies. Consequently, anticipated growth with the market and market share gains are considered to be less strong. Instead, companies expect other growth sources to gain importance, such as entering new regional markets (+3 percentage points) like ASEAN, African countries, and Iran (Exhibit 11). Others are betting on growth by broadening their product/solutions offerings horizontally (+6 percentage points) or through vertical integration, such as towards services (+3 percentage points). Overall, it can be concluded that growth is shifting beyond the core.<sup>7</sup>

<sup>6</sup> Source: World Industry Service, 02/2016

<sup>7</sup> See also Y. Atsmon and S. Smit: "Why it's still a world of 'grow or go'," *McKinsey Quarterly* (2015)

## North America, Europe, and China are the most important markets for gaining market share

Most important markets for gaining market share<sup>1</sup>  
Percent of companies (multiple choice), n = 215



<sup>1</sup> Ordered by percentage across all archetypes

EXHIBIT 11

The shift in growth priorities is consistent across business model archetypes and company size. Within regions in Europe, the cluster of other Western & Northern European countries shows slightly higher levels of growth beyond the core than Germany or Southern European countries. Fast-growing companies still tend to focus on market share growth, while slowly growing companies rely much more on growing with the market. Companies that experienced negative growth in the past four years have indicated disenchantment with market growth (-20 percentage points) and want to focus on horizontal integration (+11 percentage points) to turn around their situations.

*"Growth beyond the core is spot on. Over the past decade, our product portfolio narrowed, but now it is the other way around."*

[Machine manufacturer]

more fragmented, with very heterogeneous market and customer requirements. Extending the product/solutions offerings and covering further parts of the value chain both require additional investment and often bear the risk of customer acceptance and willingness to pay.

Therefore, most European machinery companies need to ask themselves whether their successful growth rates and profitability developments in the past years really can be replicated in the future.

Overall, companies should be aware of the fact that future growth opportunities will be much harder to tap. Geographically, while growth in BRIC countries is slowing down, other growth markets are much

### 2.1.2 Organic versus inorganic growth levers

Organic growth is expected to remain the main growth driver across growth paths, yet with varying significance. While around 80 percent of the respondents would choose organic options to grow with the market or market share gains, only around 60 percent see this as the best strategy to grow beyond the core.

For growth beyond the core business, mergers and acquisitions (M&A), joint ventures (JVs), and cooperations are gaining importance. Especially M&A are considered a valid alternative for horizontal integration; JVs and cooperative agreements are recognized as a viable lever for the entry into new markets (Exhibit 12).

Even though there are many recent successful M&A transactions in the European machinery industry, M&A as a whole are still treated poorly. Most companies do not have a systematic approach to M&A and many deals are based on opportunistic behavior.

**While growing with the market is driven organically, mergers and acquisitions and joint ventures play a big role in growing beyond the core**

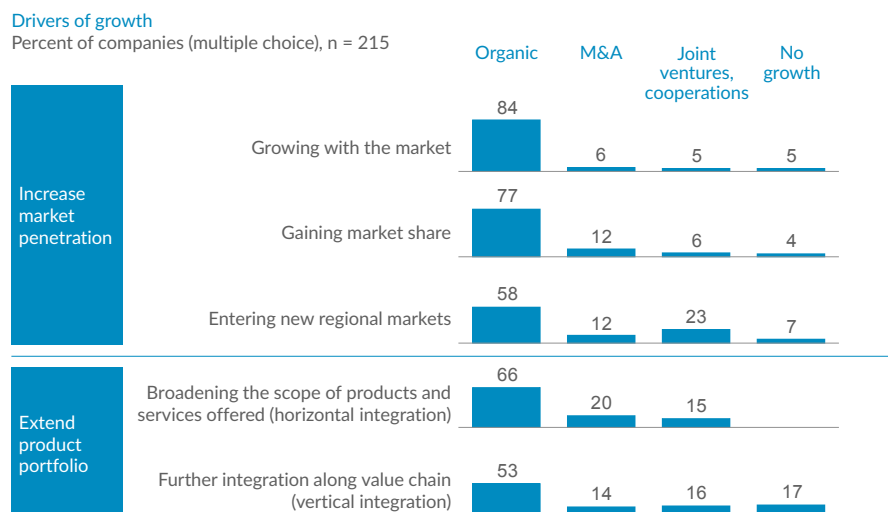


EXHIBIT 12

Across the growth sources, differences between archetypes emerge. For growth with the market, the picture across archetypes is rather homogeneous, as organic growth is clearly the dominant strategy.

For competitive market share gains, only 50 percent of the component specialists still see organic opportunities – perhaps due to an already high industry consolidation. In contrast, 75 to 80 percent of the machine manufacturers and aftersales providers still see a valid opportunity in organic market share gains.

Similarly, for entry into new markets, machinery manufacturers prefer the organic lever, while component specialists and software/system providers prefer JVs or other forms

of cooperation. Equipment & machine system providers as well as aftersales providers see more potential in M&A activities.

When pursuing horizontal and vertical integration, aftersales providers prefer M&A, whereas equipment & machine system providers as well as software/system providers choose JVs.

#### **ASM ASSEMBLY SYSTEMS “ASM AS”**

##### **Support of Industry 4.0 and integration along the value chain by acquisition**

In the business of surface-mount technology electronics assembly (SMT), it's key to build high-quality, reliable, and high-performance machines. At the same time, satisfying the increasing needs of factory integration and process optimization within an Industry 4.0 framework is becoming more and more important.

Very small components, highly mixed components, small lot sizes, and the highest quality expectations are making the production process increasingly complex. This level of complexity can increase the risk of defects. The first production process (solder paste screen printing) was identified as the main source of defects in the assembled printed circuit boards (PCBs).

To master this complex situation, ASM – a leading company in SMT placement machines – aimed to provide an integrated solution. This solution required both printing process know-how and placement process know-how. In response to this need, ASM acquired DEK Printing Machines, the market leader in SMT solder paste printing machines. On the basis of the combined process know-how and an integrated inspection machine, a completely new solution to process control became possible. By fully integrating the printing, inspection, and placement processes into a new software-based expert system (Process Expert), the parameters of the line can be optimized continuously in series production. Secondly, the Process Expert also helps to find optimal settings for new product introductions.

As a result of the acquisition, group sales have gone up because ASM can now offer the combination of both machines and a closed loop software solution, which is a unique selling proposition in the industry. Furthermore, it allows greater process knowledge and efficiency improvements in service and leads to a more frequent and more intense customer relationship. It also gives the customer “one-stop shop” convenience.

The top three challenges for organic growth are limited labor/production resources (47 percent), limited management capacities (40 percent), and a slow time to market (39 percent). While component specialists and aftersales providers identify time to market as their largest challenge, software/system providers face a larger hurdle in finding sufficient labor and workforce with the necessary skills and capabilities.



The reasons for growing through M&A vary widely across companies. Overall, the two main reasons are to extend the product portfolio (35 percent) and to gain access to new customers and sales channels (32 percent). A third reason is obtaining additional know-how or capabilities, which is especially important for equipment & machine system providers and software/system providers.

### 2.1.3 Shifts in profit pools

Next to a shift in growth patterns, survey participants also believe that profit pools are shifting (i.e., that profits will come from different sources in the future). These shifts are expected to occur mainly beyond the core and along the value chain. Further, shifts in profit pools by geography are also anticipated (Exhibit 13). There are moderate expectations that profit pools will continue to shift away from Europe, mainly to China, the US, and especially to other regions. The industry does not expect that profit pools will shift back to Europe.

#### **BOSCH PACKAGING**

##### **Online shop for spare parts**

Purchasing even simple spare and replacement parts is typically inconvenient. The process is complex and involves several stakeholders. To make things simpler for our customers, we launched the Bosch Packaging Services “E-Portal” ten years ago – an online information and ordering platform for customized and machine-specific parts. The portal allows for the transparent flow of information, simplifies the ordering process, and increases the efficiency of spare parts logistics. With our E-Portal, searching for spare parts is fast and easy. Detailed up-to-date information on products, prices, availability, and delivery times is available 24/7 in different languages. The option to track offers and orders ensures transparency and gives a comprehensive overview of all customer orders and quotes over the past 24 months.

Today, more than 400,000 parts are available online, and customer acceptance increases from one year to another. For us, this portal is not only a unique selling proposition and a huge benefit for our customers; it also helps us protect our direct link to our customers over the lifetime of the machines.

The shift from products to services is generally considered to be substantial. In general, higher profits are expected from services than from physical products in the future. This might be due to the fact that physical products become more and more a commodity while differentiation becomes more viable with services. The expected shift towards digital services and business models is not yet dominant, but still visible.

Regarding shifts along the value chain, the belief across archetypes is unanimous, as all participants expect up- and downstream shifts, likely depending on the industry.



## All archetypes expect a shift in profit pools from products to (digital) services

Expected shift in profit pools, n = 215

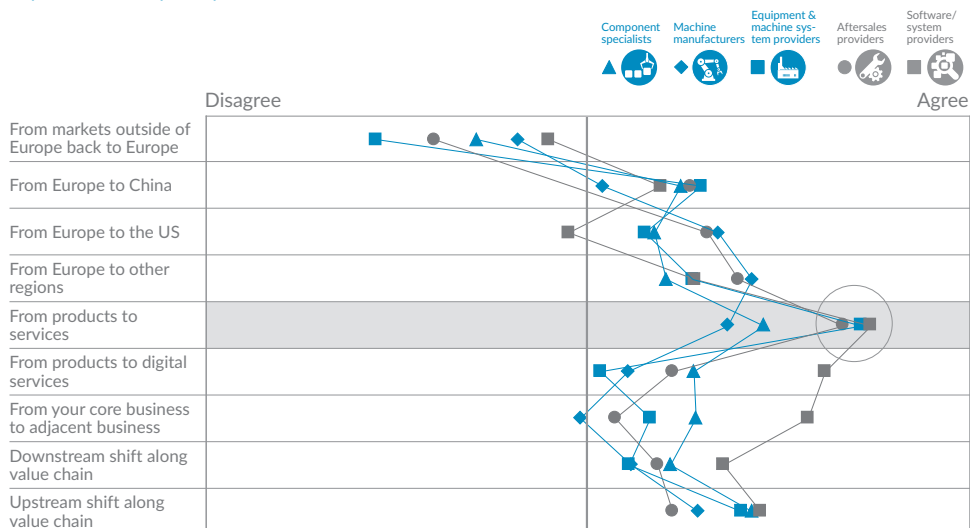


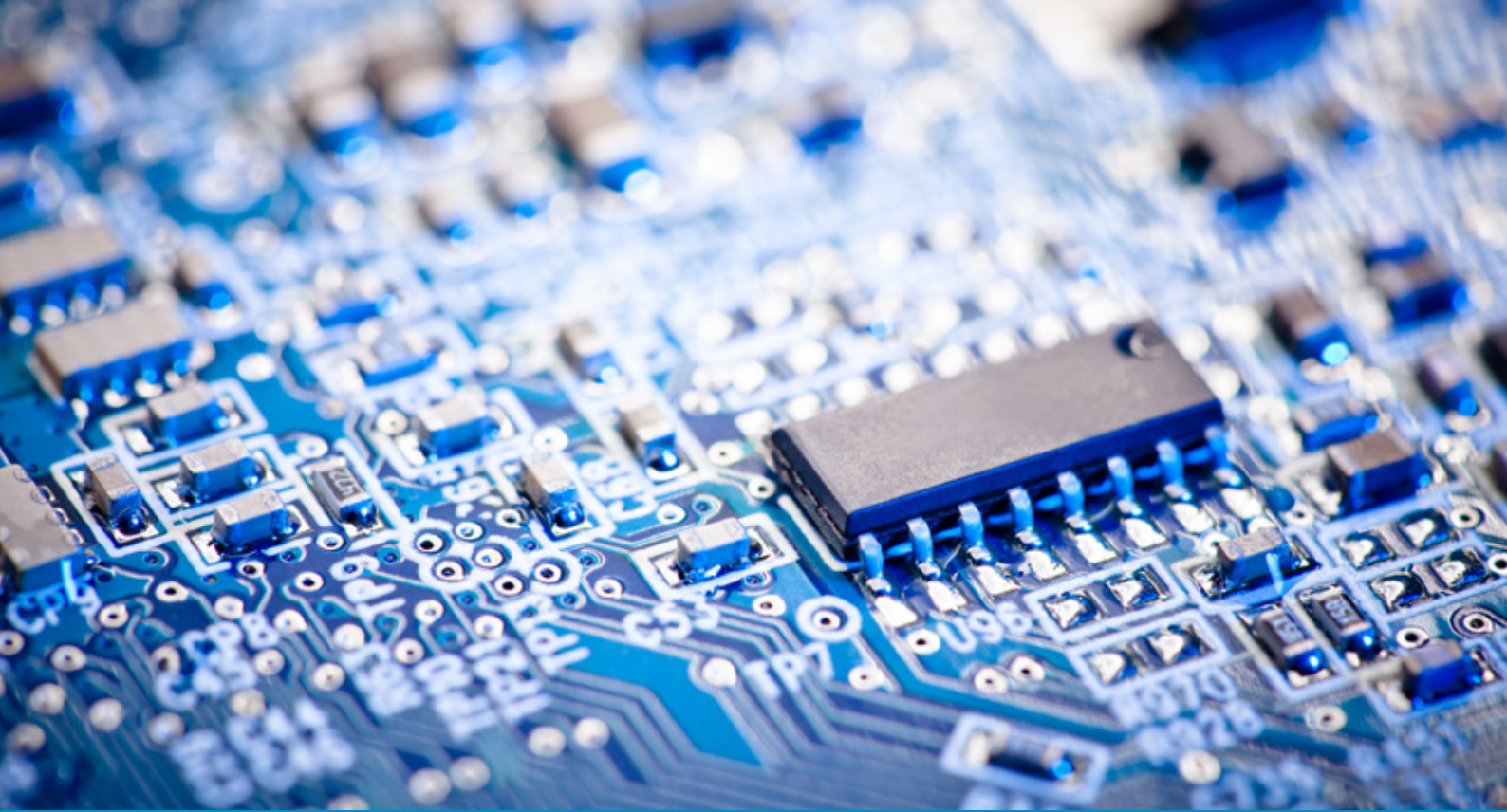
EXHIBIT 13

### 2.1.4 Conclusion

Overall economic growth globally is predicted to remain slow over the coming years. Against this backdrop, margin pressure will likely increase as companies plan to enter new markets geographically as well as along the value chain, extending product portfolios and intensifying efforts to take share away from competitors in markets they already cover. As a result, most machinery companies recognize the need to take action beyond the traditional strategies of growing with the market or increasing their market share in their established “turf.”

While the main growth driver is expected to remain organic growth, companies will increasingly turn to strategic growth instruments such as M&A, JVs, and cooperative agreements.

The role that digitization may play in helping European machinery companies succeed in their integration and cooperation strategies is likely to be large, if companies can speed up their preparations and extend their initial experiments from operational efficiency into the realm of new digital business models. JVs and M&A activity may also be the solution to the talent gaps many companies are experiencing as well as a way of developing a vision beyond their current focus and helping them succeed in a changing environment.



## 2.2 Increasing pace of digitization: New business models and operational improvement

The spread of digitization and in particular of modern information and communication technologies (ICT) has gained tremendous momentum in recent years.<sup>8</sup>

While generating, handling, and analyzing data are prerequisites for leveraging digitization, the key activity is the strategic use of data. For a business to be strategically digital means that it knows how to create value in new business areas and with new technologies, provide an added value in the core processes and customer experience, and build basic technical and organizational capabilities that digitally join up all parts of the enterprise and beyond – linking with suppliers and most importantly with customers. Adding value through digitization has two dimensions: operational improvements to internal processes and new business models.

*“Digitization will change the machinery industry, but it still has a long way to go.”*

*[Machine manufacturer]*

In general, players across all machinery industry archetypes have made digital a priority in increasing the operational efficiency of the business and thus reduce costs, with

machine manufacturers and equipment & machine system providers expecting to capture less potential from digitization than component specialists. For the most part, machinery companies perceive digitization as having a bigger impact on operational excellence than on new business models and revenue sources. This perspective is substantially the same across the business model archetypes with the exception of software/system providers, who expect digitization's biggest impact to be in tapping new revenue sources.

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<sup>8</sup> For reference see also VDMA IMPULS Foundation: Industry 4.0 Readiness (2015); VDMA: Guideline Industry 4.0 (2015); McKinsey: Industry 4.0 after the initial hype: where manufacturers are finding value and how they best capture it (2016); McKinsey: Industry 4.0: how to navigate digitization of the manufacturing sector (2015)

All archetypes rate the importance of digitization at the same high levels for their own business model as for the industry. Only machine manufacturers rate digitization's impact on their own operational excellence higher than the overall industry.

### 2.2.1 New digital business models

In the industry landscape as a whole, it is possible to make out four major categories of digital business models (Exhibit 14). These are changing the terrain as individual companies adapt their business models to capture Industry 4.0 potential:

**Platform-based business models.** The purpose of the platform is to facilitate the exchange of products, services, and information. Two options are emerging: interaction platforms and ecosystems. On interaction platforms, the supplier connects multiple parties and coordinates their interactions. The value add of the platform provider is the quality assurance regarding companies permitted to be platform members as well as the optimal distribution of goods and services. To benefit from ecosystems, companies can use platforms to facilitate the further development of products and applications based on their own product offering. This can lead to increased sales and the promotion of one's own brand and standards to other members of the platform as ecosystem.

#### NETZSCH

##### NETZSCH-Connect – Web-based remote maintenance

At the core of Industry 4.0 is connectivity between machines, databases, and services. Harnessing this power, we developed NETZSCH-Connect to offer our customers flexible and tailor-made solutions for their specific needs. The Web-based software enables the remote monitoring and maintenance of all grinding and dispersing machines. All performance parameters are saved in a cloud system and reported as soon as they change, and the software can be used in any browser without specific software.

The system is independent of the installed machine or configuration and can be easily adapted. It is built in as standard for complex configurations, but also offered as an optional add-on to all our customers. NETZSCH-Connect enables our customers to monitor the process data of their machines during operation and check the current production conditions. Process data are continuously recorded and thus the process with all its parameters is reproducible. On request of our customers, we also provide remote services and other process support.

More and more of our customers have become NETZSCH-Connect users since we launched the system in 2013. The software has also had a positive impact on our hardware sales, as the ability to monitor machines is more and more important in order to optimize the processes. NETZSCH-Connect also gives us valuable information regarding production and reasons for downtimes of our machines. This information highly impacts our product development/improvement efforts and ensures future benefits for our customers.

## Platform- and IPR-based business models show highest level of integration

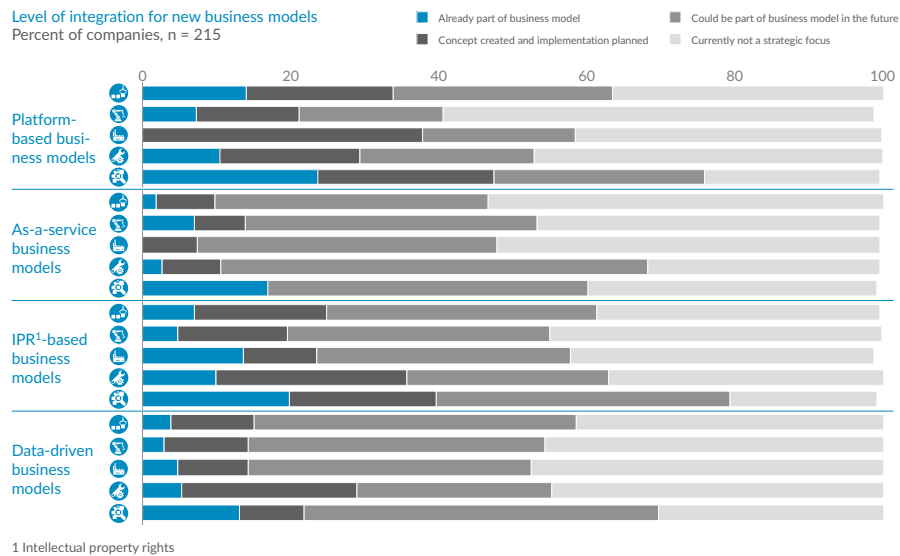


EXHIBIT 14

**As-a-service business models.** This is the pay-per-use or subscription-based model for selling machinery. Instead of high fixed cost/capex, the customer can translate the fixed machinery cost into variable cost, i.e., capex becomes opex. The supplier is able to realize constant revenue streams instead of a one-off asset sale. By retaining title to the hardware, a company can also retain control over both maintenance, enabling it to extend the service life of its machinery, and end-of-life disposal, allowing the company to obtain higher scrap prices for metal and electronic scrap, especially if the machinery is designed for easy disassembly. Another effect could be the modularization of production networks, where machine idle times can be sold to other manufacturers in the same area, allowing for increased flexibility and higher capacity utilization.

**Intellectual property rights (IPR)-based business models.** The approach consists of leveraging existing in-house intellectual property to create further recurring revenue streams – for example, by offering subscriptions to software, maintenance, and support. Suppliers of machinery could offer add-on services in the form of specific trainings and customer consultations to achieve higher asset utilization.

**Data-driven business models.** New ways of collecting and using data (e.g., combining internal and external data to generate insights) can be used to create new data-driven business models that monetize data either directly or indirectly. For direct monetization, revenue is created directly from the collected data and the derived insights. For indirect monetization, the insights are used to customize the product offering – for example, through microsegmentation or the definition of highly specific maintenance plans, based on the customer's actual usage pattern.

Across all archetypes, there is still a low level of implementation of new business models based on digitization with software/system providers and aftersales providers being

slightly ahead. Less than 20 percent of the participating companies have implemented new business models already, and for more than one-third of the companies, digital business models are not yet a strategic focus. The main barriers for implementation are insufficient supply of qualified personnel and the identification of a positive business case.

## WITTENSTEIN

### Implementing Industry 4.0 with current technologies – a success story

As a driver of innovation in mechatronic drive technology, we also see ourselves as a pioneer for Industry 4.0. Together with four research institutions and 16 leading industrial companies, such as Siemens, TRUMPF, and BMW, we conducted one of the first implementation projects for Industry 4.0: CyProS (cyber-physical production systems). The goal of CyProS, a project sponsored by the Federal Ministry of Education and Research, is to improve productivity and flexibility by interconnecting smart systems in the factory – in other words, by blending production and Internet technologies.

Cyber-physical production systems go beyond current approaches of data collection, decentralized information processing, and networking in factories. They allow for the ad hoc networking of components as well as the exchange of information via machine-to-machine communication. These functionalities foster the self-configuration and the self-optimization of individual machines and total machine systems.

In our showcase factory in Fellbach, Germany, we have taken a two-pronged approach to gradually introducing Industry 4.0 to make our production faster, more flexible, and more efficient. First, we are implementing these cyber-physical systems on the shop floor. At our factory, production planning and control is transparent and uses intelligent sensors and intuitive apps with integrated recommendations. The introduction of these technologies and processes provides a resilient plant that then again enables diverse applications in the context of Industry 4.0. Second, we worked on the development of smart drives that communicate via a newly developed cloud infrastructure. This includes drives comprised of sensors, actuators, processing intelligence, memory, and external interfaces.

With CyProS, the project several times referred to as “the key project of Industry 4.0,” we have proven that Industry 4.0 can already be implemented with today’s technology. However, an open, receptive mindset is key, too. On our road to the factory of the future we have realized that for change, we must overcome mental blocks, perform with a cool head, and be open to new approaches.

## LEUCO

### A mutually beneficial business-as-a-service model

As a medium-sized company, LEUCO does not intend to explore each and every potential benefit of digitization. Our approach is to choose specific initiatives, business models, and levers to improve operational efficiency that are both beneficial to our customers' businesses and to our own business.

Initially, as a provider of quality tools for the machining of wood, wood-based panels, plastic, and composite materials, we used to sell our tools to our customers and then pick up the tools again on our frequent visits when the time came for sharpening. Doing this, resharpening became our biggest product family and is nowadays approximately 30 percent of our total business.

Today, we offer our customers another choice: business as a service or, as we call it, "tool leasing." In specific industries, such as the production of furniture or wood-based flooring, we "lease" tools to our customers and bill them based on the output produced – for example, square meters of laminate flooring. It is our job to make sure that our customers always have a sufficient quantity of tools in place to cover all of their production requirements. To provide new tools and resharpening service just in time, the tools can be equipped with digital data carriers such as chips, sensors, accompanying cards, or data-matrix codes. The data captured tells us when a customer's tool needs replacing or resharpening, or it simply gives us an information about the performance of the tool.

Providing our tools as a leasing service is beneficial in multiple ways. For the customer, this business model keeps initial investment costs low and reduces downtime. Furthermore, tooling costs are now completely variable and only incurred if our customer actually produces goods. Collected data can be used to schedule predictive maintenance or tool changes, which helps avoid tool breakdowns and reduce setup times. Also, due to our close customer relationships, in combination with the collected usage data, we jointly realize efficiency gains and further improvements based on new experiences at the customer site. In our perspective, two factors are especially critical to make this business model successful.

First, to select the products to cover with business as a service, we recommend differentiating between the level of individualization of products. It is easier to measure output when you work with standardized tooling concepts used for standardized products. Second, how to charge for the work on individualized products remains challenging. It is essential to plan and discuss the production volume together with the customer to mitigate potential fluctuations and arrive at a realistic output volume.

Our business-as-a-service leasing model is already more than 50 percent of our diamond service business in our domestic market, we believe we have only just begun.



### Potential options for solving the digital (business building) dilemma

Currently, within the European machinery industry, companies want to grow with new digital business models (e.g., as-a-service offerings), yet progress and preparation are limited.

On the one hand, in response to the survey, companies overall expect to grow sales from digital business models from about 3 percent in 2015 to more than 10 percent in 2020 (a share that is comparable to the current average revenue share of aftersales/service). Component specialists and software/system providers expressed the highest growth aspirations in this area (14 percent for component specialists and 17 percent for software/system providers). Respondents indicated that the most relevant digital business models currently are platforms (e.g., for sharing production capacity or online sales systems) and as-a-service business models. A correlation between profitability and the level of implementation of digital business models was not (yet) observable.

So far, companies' progress and preparation in the digital sphere are rather limited: less than one-third of the participating companies said they have implemented or are actively planning to implement such concepts, and more than half currently do not have any digital business models as one of their strategic focus activities.

For the European machinery industry, digitization is a dilemma that is only just becoming apparent. New digital-based business models are increasingly perceived, at least theoretically, as essential to maintaining market leadership and to developing new growth opportunities at a time when traditional sources of growth are drying up. Building up digital business models often requires significant resources and investments, diverting skilled workers and funding away from the core business. Finally, some of the new digital business models threaten to cannibalize traditional business – an online sales channel, for example, might cannibalize traditional sales channels.

Potential options for resolving this dilemma are, for example, to take a **two-speed approach** or **intrapreneuring**. Two-speed approach means to set up separate business units to fully focus on developing these new business models while the core business continues to operate with its traditional business model. Intrapreneuring, i.e., encouraging entrepreneurship within the four walls of an existing company or group of companies, is another option. A board is formed to request new business ideas in-house and sponsors the best ideas by allocating resources. These internal "speedboat" projects (projects with the objective of achieving fast results under a very tough timeline and budget) can be more motivating for the organization than the two-speed approach, because it facilitates focus and management attention.

So far, no clear-cut winning solutions have emerged for digitization in the machinery industry. But if the European machinery industry is to grow and maintain its global leadership, companies must step up their efforts to find winning digital formulas.

## 2.2.2 Operational excellence

Along with new business models, digitization also supports improvements in operations, and this is the area in which the European machinery industry has currently made the most progress. Digital solutions are available and have been successfully put into practice to improve the ten key value drivers in operations, which are segmented as internally and externally focused drivers (Exhibit 15).

Internally focused value drivers, such as asset utilization, resource/process, inventories, labor (productivity), and supply/demand match, affect in-house processes and do not have a direct benefit for the customer. Externally focused value drivers, such as customization, time to market, sales, services/after-sales, and quality, are levers that improve the value of the product and/or service offered to customers.

At the moment, the European machinery industry uses digitization mostly for externally focused value drivers, which help to differentiate a company's product offering versus its competitors' offerings and which are more visible to others. The most commonly used levers are "customization" and "sales." Two-thirds of the equipment & machine system providers have already implemented customization drivers, reflecting their high importance.

Internally focused value drivers currently receive significantly less attention from the companies surveyed. Two potential explanations of this relative "neglect": companies may underestimate the potential of digitization for internal process improvement, or cost improvement has lower priority than improvements to visible, external value drivers. Additional critical aspects for digitization are, for example, data security, standards, employee qualifications, legal issues, or infrastructures.<sup>9</sup>

### Digitization efforts are largely focused on external value drivers

Level of integration of value drivers  
Percent of companies, n = 215

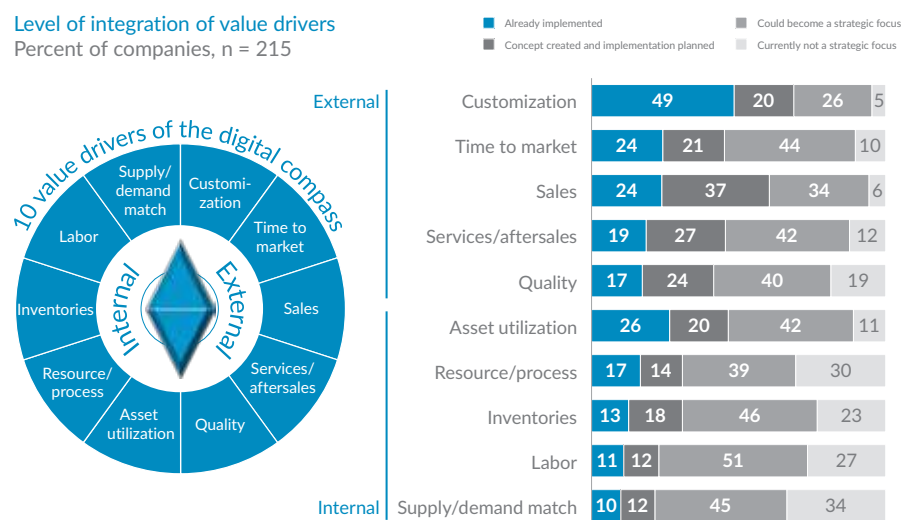


EXHIBIT 15

<sup>9</sup> For reference see also VDMA: Industry 4.0 Readiness (2015); VDMA: Guideline Industry 4.0 (2015); McKinsey: Industry 4.0 after the initial hype: where manufacturers are finding value and how they best capture it (2016); McKinsey: Industry 4.0: how to navigate digitization of the manufacturing sector (2015)



**NETZSCH****Connected processes**

Production and assembly at NETZSCH's Pumps & Systems business unit are characterized by solutions that are tailor-made to our customers' demands. The specific design of our products determines very small batch sizes – 1 to 100 units only. On average, each pump design is used just 1.6 times. Because significantly reducing complexity is not an option for us, we implement connected processes as an efficiency measure. An integrated and fully automated surveillance of our pumps and systems processes guarantees the highest quality of our products and optimizes productivity in our assembly.

Isolated, manual process steps are a thing of the past. Connected processes – consolidated and automated backtracking, data transfer, and reporting – are the future, and that is what NETZSCH is striving for.

Core and centerpiece for connected processes is a comprehensive ERP system. Automating the input of data and production parameters minimize inaccuracies. As more and more production processes become automated, our staff members are freed up to work in other areas. Connected processes also create transparency and allow for the control of production processes and traceability of individual parts and assembly steps. Departments get linked and exchange data, enabling continuous improvement throughout a product's life cycle.

*"It would be too much to say that we are living Industry 4.0. We perceive ourselves as a supporter of our customers. It is only secondarily that this is a topic for our own production."*  
[Component specialist]

Overall, the most important internal drivers are "asset utilization" and "resource/process" improvement. Asset utilization is especially relevant for equipment & machine system providers as well as for aftersales providers: both archetypes have implemented the majority of the concepts or are planning to do so.

Compared with "revenue growth," the operational improvement side of digitization is being implemented by far more of the participating companies: 20 to 40 percent of the companies have already implemented concepts for operational excellence or are planning to do so, and another 20 to 40 percent see operational improvement via digital solutions as a strategic focus in the future; only about 20 percent reported that this is not a focus area in the future. Companies expect a total cost saving potential of 5 to 10 percent (with a large spread) from operational excellence based on digitization solutions, with a substantial impact on their EBIT.

**MÜLLER MARTINI****Using new software tools to reduce complexity in product development**

Today, in our IT systems we have more than two million parts. Roughly a quarter of them are active, meaning they can be used to develop new machines and to supply parts. Managing complexity is a top topic. The key driver of complexity is that it is easier for our engineers to create a new drawing than to find and re-use an existing one when developing products. But this comes at a high cost. To reduce the complexity and cost, we are investing in tools and methods that make it easier to search for existing parts for re-use whenever possible.

Among these tools and methods is software that automatically searches for existing parts that are similar to the ones required for the development of a new machine and alerts the engineer to any matches. With that information, the engineer can make an informed decision regarding the use of an existing part or the creation of a new or similar one. This method leads to product developments with a high re-use factor. At the same time, it doesn't have negative effects on the level of innovation because engineers are free to add new parts wherever they can be justified. By re-using more parts, we're getting higher economies of scale in manufacturing and purchasing. We also have lower risk and quality costs as well as faster time to market because most parts of the machines have already been engineered and tested. All the approaches together have a positive impact on reducing our parts complexity and cost. In the end, our customers benefit from higher quality and faster development time.

**2.2.3 Barriers to digitization**

The participants identified a range of barriers and expect some negative impact, which will slow down the implementation of digitization levers over the next five years.

The largest barriers are an insufficient availability of qualified personnel (56 percent) and insufficiently attractive business cases (38 percent). Recruiting qualified personnel is ranked the number one challenge across all archetypes and is an especially large hurdle for equipment & machine system providers as well as aftersales providers. Difficulty finding qualified talent is rated lowest of all barriers by software/system providers (48 percent). The same applies for the identification of a profitable business case for digital business models, which seems most challenging for equipment & machine system providers and aftersales providers. Software/system providers are additionally concerned about data security (44 percent), which is not on the agenda of the other archetypes (overall: 29 percent), especially not for equipment & machine system providers (11 percent). This indicates a potential blind spot in the assessment of possible threats. Across the archetypes, companies rated as minor concerns the ability to access required technologies and insufficient broadband expansion (with the exception of Southern Europe where broadband expansion is a concern for over a third of the participants).

Assessments of the negative impact of digitization vary across the regions. New entrants who change the market are a common theme (53 percent), but are feared most in Germany (57 percent), Switzerland and Liechtenstein (52 percent), and other Western & Northern European companies (52 percent), whereas Southern European companies tend to assess the impact much milder (26 percent). A top threat among other Western & Northern European companies – and also relevant for the other regions – is increasing cost pressure from existing competitors and the growing risk of cyber-hacking attacks. In Switzerland and Liechtenstein, the shifting balance of power away from suppliers and towards customers is seen as especially troublesome with over half of the companies highlighting this threat. The number one negative impact for Southern European companies is the very fundamental threat that the existing business model becomes obsolete (42 percent), while this is only a minor aspect in the other regions (overall 19 percent).

European machinery companies are well aware of the implications of moving slowly in the digitization space. More than 50 percent of survey respondents fear negative business repercussions from new entrants who upend the market with new business models. This fear is most visible among the software/system providers (68 percent). Just over half of aftersales providers express concern (55 percent), and about a third of machine manufacturers (35 percent) see a digitization-driven threat from new entrants.

#### 2.2.4 Conclusion

Digitization is a topic everyone is talking about. Many companies have started the process of developing a strategic point of view around digitization, but most efforts are still in their infancy. But when new attackers arrive at the gates of markets dominated by established companies for decades, isn't it high time for these companies to develop new business models of their own? Still, very few companies have implemented digitization in their day-to-day business. The survey confirms two main reasons for this slow pace of change: trouble finding qualified people and the challenge of coming up with a profitable business case. To ensure no growth opportunities are missed, digitization must be on every CEO's agenda.



## 2.3 Organizational change

The business environment for the European machinery industry is changing rapidly and becoming increasingly volatile. New growth patterns and digitization are the latest challenges to arrive in this already fiercely competitive setting. Companies must adjust to new trends at ever-faster speeds, while squeezed by pressures from relentless competitors and slow economic growth worldwide. All this will have an impact on the organizational setups of machinery companies. In this new business environment, sustainable success will elude companies that cannot respond swiftly and flexibly to the new challenges. Along with much greater volatility, companies will need to adjust their organizational structures to handle more cooperation, boost international diversity, and win in an intensifying war for talent.

Apart from enhanced processes and structural changes, a skilled, flexible, and specialized workforce will be key to rising to the new challenges. While traditional engineering capabilities retain their fundamental importance, new skills are required to keep up with or shape digitization within the machinery industry. This will have a direct effect on the organizational setup, as companies will have to position themselves to both attract and retain top talent.

### 2.3.1 Drivers of organizational change

According to the survey results, the European machinery industry will need to make organizational adjustments to deal with challenges in three areas (Exhibit 16):

**Disruption.** Survey respondents identified new technologies (around 44 percent) and digitization (around 39 percent) as two major trends expected to rapidly change the business environment. The effects of these trends are assessed differently depending on company size. While smaller companies are more likely to highlight the disruptive effect of new technologies, larger companies rate the likely disruption more moderately. This may be explained by larger companies' more extensive R&D resources, which better

equip them to respond to product innovation challenges. Attitudes towards digitization are roughly the reverse, with smaller companies rating the impact of digitization as low or moderate, while larger companies have identified it as having a big impact on their already complex organizational setups.

**Economic volatility.** Accelerating and unpredictable economic cycles are a challenge for business planning in general and a major organizational challenge for the European machinery industry. Increasing volatility goes hand in hand with ever-shorter product life cycles, and both together exert severe pressure on businesses, especially those that lack organizational flexibility.

**Growth and profit shifts.** New growth trajectories (32 percent) and shifting profit pools (26 percent) constitute the “shift” theme impacting companies in the European machinery industry. The perceived impact of new growth trajectories – away from the core, and thus more vertical and horizontal growth, as opposed to growing with the market or growing market share – correlates with the size of the company. While smaller companies see a moderate impact (29 percent), big companies rate the impact as more severe (41 percent). The shifts require organizational adjustments, which are less feasible for complex organizations than for smaller, more flexible companies.

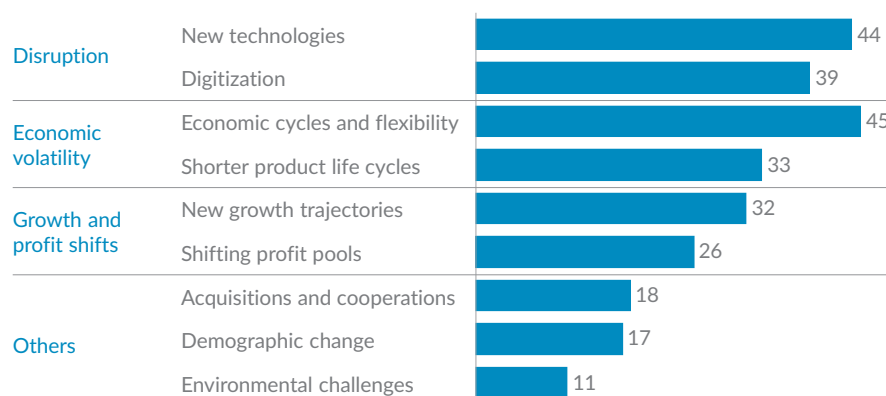
Other trends were mentioned, such as acquisitions and alliances, demographic change, and environmental challenges, but are not associated with similarly substantial impact on the organizational setup.

The sense of preparedness for the above trends differs across companies. Very few companies report the extreme cases of feeling either fully prepared or completely unprepared. Most (around 60 percent) report that they are in the process of preparing,

### Economic and digital trends will require changes in the organizational setup

#### Trends that have the biggest impact on the organizational setup

Percent of companies (multiple choice), n = 215





but need to make additional changes and still have to find answers for how to implement. Approximately one-third assesses themselves as not prepared, but having identified the most important issues.

But how can the companies prepare best for the challenges ahead? Four main strategic actions have been identified: increase agility, intensify cooperative agreements, expand and deepen international diversity, and win the war for talent.

### 2.3.2 Strategic, portfolio, and operational agility

Agility can be broadly defined as the ability of an organization to quickly respond and adapt to change in the business environment. It is considered very important by companies to respond to the volatile and disruptive environment, especially in product development and sales. However, implementation so far has been mostly achieved at the operational level, i.e., the ability to seize opportunities within a company's existing business model.

Product development has been identified by over 80 percent of the respondents as the most crucial area for greater agility, reflecting the exceptional demands posed by the combination of ever-shorter product life cycles, the introduction of new technologies, and the digitization trend (Exhibit 17). The pressure for fast action also applies to sales (67 percent) where companies have to respond rapidly to volatile economic cycles. The demands in these two functions, in turn, increase the need for agile manufacturing processes (53 percent) where flexible production capacities will be crucial in the future.

Agility can be broadly divided into three types: operational, strategic, and portfolio agility.

**Operational agility.** Machinery companies' implementation of agile approaches has so far focused on operational agility, with the aim of building capacity to exploit opportunities within a focused business model. Three-quarters of the companies have planned or completed agility improvement initiatives in this area.

**Strategic agility.** The other two forms of agility are less advanced in their implementation. Strategic agility, the capability to spot and seize opportunities, has only been considered by half of the companies surveyed.

**Portfolio agility.** Similarly, 56 percent of the companies have implemented or considered implementing a concept for portfolio agility, the capability to shift resources quickly and effectively out of less promising into more attractive business areas.

In terms of implementation, boosting operational agility typically requires the most effort as it entails changes to structures and processes at the shop-floor level and corresponding negotiations with labor representatives, customers, and suppliers. Strategic and portfolio agility typically involve top-down decisions, but often deliver the highest impact.

## Agility is considered important, but so far mostly implemented on operational level

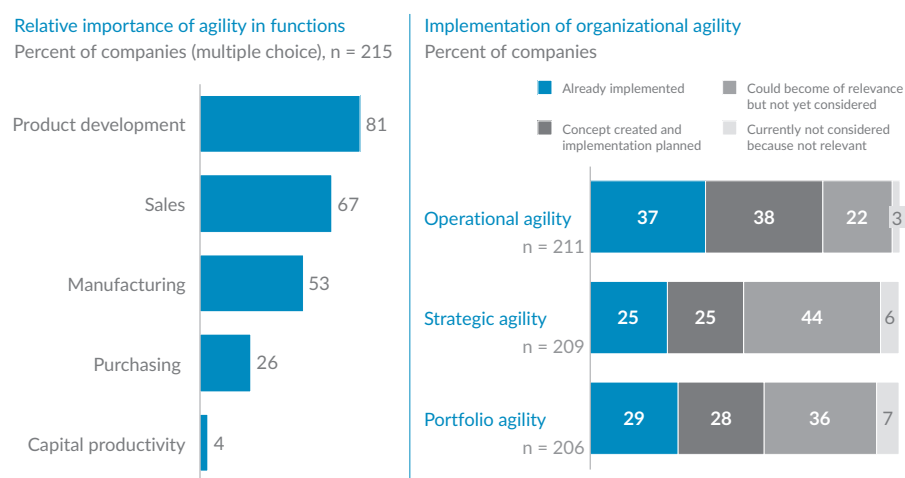


EXHIBIT 17

### 2.3.3 Cooperation

The number of small and medium-sized companies in the European machinery industry is particularly high. While this is often perceived as an advantage when it comes to agility and flexibility, smaller companies experience more challenges in getting access to markets and customers or interacting with other key external stakeholders. Systematic and institutionalized cooperation is an important instrument to ensure the exchange of crucial information and gain competitive advantages.

Cooperation is already widespread in the machinery industry, with only 5 percent of the companies reporting that they have no cooperative agreements or no plans in that direction (Exhibit 18). These companies are mostly small, profitable companies, typically niche champions with no need to find a way to enhance their market positions. In terms of regional differences, Southern European countries have less cooperations.

Main areas of cooperation are the following:

**Customers.** With customer orientation being the major unique selling proposition of the European machinery industry, the most widespread type of cooperation is with customers (72 percent). This allows companies to better understand the market and tailor their products, pricing, and services to customer needs.

**Research facilities.** These facilities are an important instrument to tap external know-how and perspectives (64 percent). This type of cooperation appears to be the most common among larger companies due to their advanced financial resources and their

greater brand value for research facilities. While direct cooperation by small or medium-sized companies with research facilities is less common, regional business clusters offer a good way to facilitate such agreements.

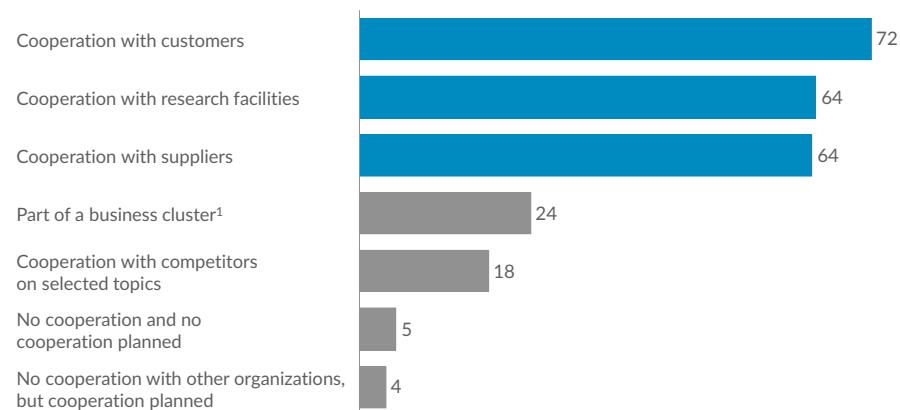
**Suppliers.** Cooperation with suppliers (64 percent) prevents supply shortages and enables companies to influence the specifications of the products supplied. This is especially important for highly customized or innovative products for which “off the shelf” supply is less common. Nowadays, machinery companies have also started to form cooperation with software suppliers to benefit from the full potential of digitization.

**Competitors.** Companies are, however, reluctant to cooperate with competitors. Only one company in five is currently cooperating with competitors on selected topics. At a regional level, German companies rank as the most reluctant, as only 15 percent of the companies report cooperating with competitors. This is similar in Switzerland and Liechtenstein where only 7 percent of the companies have cooperation with competitors. In Southern Europe and other Western & Northern European countries, on the other hand, more than 30 percent of the companies have such an agreement. To be sure, cooperating with competitors is subject to a number of restrictions, such as nondisclosure of proprietary data and compliance with a strict competition law regime. Keeping this in mind, it can be an important way to gain scale effects otherwise not available to small or medium-sized companies.

**Intermediaries.** For sensitive areas such as cooperation with competitors, intermediaries can serve as an effective bridging and shielding device. In addition, they can offer a way to exchange crucial information and gain competitive advantages to an extent otherwise not available to small or medium-sized companies. This includes joining forces in regional business clusters and cooperating through business associations at the national and international level.

### Companies cooperate with customers, research facilities, and suppliers, but are reluctant to cooperate with competitors

Current degree of cooperation with other companies and institutions to gain competitive advantages  
Percent of companies (multiple choice), n = 215



1 A geographic concentration of interconnected businesses, suppliers, research facilities, and associated institutions in a particular field

### 2.3.4 Diversity and interculturality

The European machinery industry operates in a deeply connected and global world. Research increasingly shows that more diverse companies and institutions are achieving better performance.<sup>10</sup> Global machinery companies have a 3 percent higher EBIT and have grown 30 percent faster than domestic ones from 2010 to 2014 – a correlation that had already been established in the preceding study.<sup>11</sup>

Having an internationally and culturally diverse staff and, especially, international management equips organizations with a broader perspective, a wider network, and better insights into different markets. These factors are considered extremely beneficial for the export-focused business pursued by companies in the European machinery industry.

Global companies that have key and operational support functions located in foreign countries tend to have a higher EBIT than companies with less internationalization. This might have two causes. First, global companies are likely to be larger-than-average organizations. As research shows, larger companies tend to have a higher EBIT due to scale effects. Second, moving functions abroad directly affects the EBIT by increasing revenue and reducing costs. An international presence facilitates access and enhances knowledge of regional markets. At the same time, the receiving country may offer cost benefits, which has a direct impact on profitability.

In addition to international structures, most organizations, especially export-oriented machinery companies, need to do more to take full advantage of the opportunity that diverse teams represent. This is particularly true for their talent pipelines: attracting, developing, mentoring, sponsoring, and retaining the next generations of global leaders at all levels of organizations. Of the archetypes, the currently most advanced in internationalization are component specialists and aftersales providers, followed closely by machine manufacturers and equipment & machine system providers.

Most companies in the European machinery industry are international; around 60 percent of the companies surveyed report having an international supplier network and an international and culturally diverse staff (Exhibit 19). However, only a third of the companies have taken a step further towards building global companies with an internationally and culturally diverse management and/or operational support functions or key functions located in foreign countries. Based on their home market size, companies in other Western & Northern European countries tend to have the most international structures, with 80 percent having an international supplier network and half of the companies having an internationally and culturally diverse management. In contrast, only half of the German companies have an international supplier network, and only one in three has an international management team. Southern European companies have the most international management team (63 percent of the companies) but have relocated the least operational support functions abroad (5 percent). On contrary, Germany as well as Switzerland and Liechtenstein have relocated around 30 percent of these functions in foreign countries and other Western & Northern European countries more than 50 percent.

<sup>10</sup> McKinsey, Diversity Matters, Feb 2015

<sup>11</sup> VDMA-McKinsey study: "The Future of German mechanical engineering – Operating successfully in a dynamic environment," 2014

### Most organizations have an international supplier network and diverse staff, only a third reports international (support) functions

Organization's level of internationality and interculturality  
Percent of companies (multiple choice), n = 215

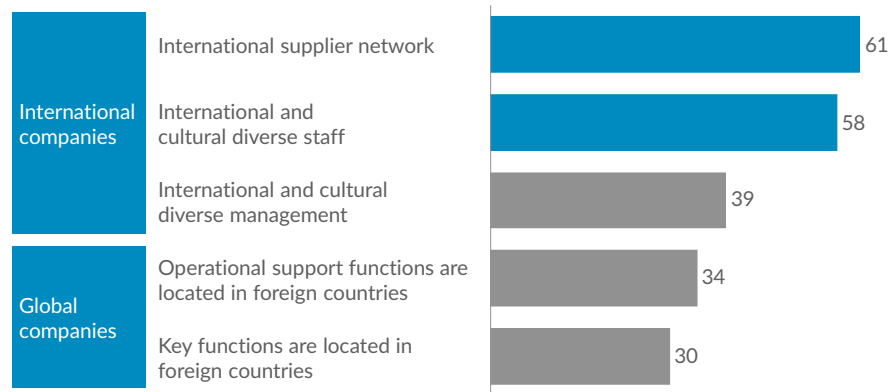


EXHIBIT 19

### 2.3.5 War for talent

With the rapid change in the business environment and new growth paths comes the need for new capabilities. In addition to traditional engineering capabilities, new skills such as software design and advanced analytics will be crucial to an organization's capacity to respond to digitization. The war for talent is intensifying, especially for smaller and medium-sized companies in rural areas. Limited labor resources have been identified as one of the major challenges to organic growth. Similarly, almost half the companies in the industry say that the lack of qualified personnel is a major obstacle to competing in the race to launch innovative products. Organizations have to position themselves to win the war for talent in order to have a skilled workforce in place to respond to the new challenges.

*"In many aspects, we offer better working conditions than the large corporations: flat hierarchical structures, rapid development opportunities, more freedom, and more capability building, i.e., employability insurance."*  
[Component specialist]

In this context, more than half of the companies surveyed see software skills, mechanical engineering skills, mechatronic engineering skills, and international experience as increasingly important over the next five years (Exhibit 20). This skill set is closely

followed by electronic engineering (44 percent) and expertise in data analytics (31 percent). Only about a quarter of the companies see relevant work experience as an increasingly important quality, an assessment that highlights the need to develop talent in-house.



### Software development considered most important skill in the next five years, directly followed by mechanical and mechatronic engineering

#### Relevant skills and expertise when recruiting and selecting employees in the next 5 years

Percent of companies (multiple choice), n = 215

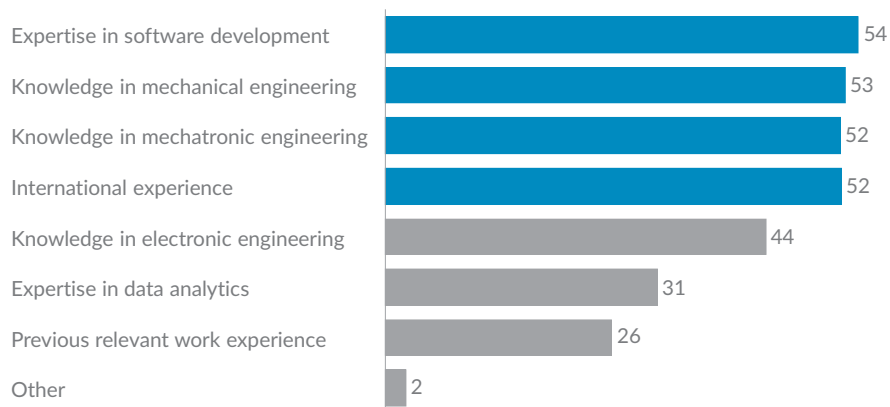


EXHIBIT 20

*"In R&D, we are now recruiting more software developers than mechanical engineers."*

*[Machine manufacturer]*

Previous relevant work experience is ranked fairly low (26 percent). Thus, having the right skills seems to be more important than having significant experience. While the need for software development skills has surpassed the need for traditional engineering skills

in Germany as well as Switzerland and Liechtenstein, traditional engineering skills will remain more important in Southern Europe.

To attract qualified personnel, European companies are applying a mix of different instruments: about one-quarter of the companies consider development opportunities and competitive compensation as crucial for attracting talent. More than one in five of the companies surveyed already offers greater flexibility in the workplace.

In order to manage and retain talent, companies report using classic instruments, such as external trainings (30 percent), internal training programs (28 percent), and support for executive study programs (21 percent). Rotation programs – both functional (11 percent) and geographic (9 percent) – are also in use but are less widespread.

### 2.3.6 Conclusion

Companies in the European machinery industry have long proven that they are capable of being agile. They have moved parts of or even the entire value chain to other locations in Europe or to other countries, such as China. They have massively changed their product portfolios or adapted their business models in response to a changing environment. Organizational change, however, is more than outsourcing and product adjustments. It requires an honest examination of personal philosophies and approaches to business and a shift in mindset and behavior that is more difficult than a portfolio change. Organizational change requires companies to ask themselves how their values play out internally with talent and structure and externally with competition and partnerships. The answers might not always be convenient; but in a more and more complex and competitive environment, an agile and diverse organization with a cooperation orientation can be a real differentiating factor.



### 3. EUROPEAN MACHINERY IN THE GLOBAL COMPETITIVE CONTEXT

Creativity, efficiency, and quality are characteristics that machinery players willingly apportion by geography. When it comes to the competitive advantages granted by these industry hallmarks, however, it becomes a bit more complicated than just geography. In thinking about their competitive positioning, European machinery players place more importance on the relevance of certain qualities to their markets and the incumbent status of their fellow players than on region.









European mechanical engineering serves the world as a constant source of product innovation; it also sets the standard for quality in products, service, and talent. The managers taking part in this survey extolled innovations in the areas of energy efficiency, sensor technology, automation, and expanded business services, which aim at total optimization of customers' operations.

However, Europe's strengths are matched if not surpassed by different strengths in the US, which is home to the masters of business model innovation, and China, the faster, cheaper competitor on the world stage. There is a risk that Europe's competitive position will be increasingly threatened, because the effects of digitization will amplify the strengths of competitors in the US and China and make Europeans pay a higher penalty for their traditional weaknesses.

By focusing on agility and flexibility, European machinery players can free themselves from this squeeze. Even if it is uncomfortable, it will be crucial for companies to find ways both to emulate and to defend themselves against the "trial-and-error" approach companies are comfortable with in the US and the "quick-and-lower-cost" virtues of Chinese competitors.

These are general outlines of the competitive terrain, and each company is asked to fill general recommendations with real substance. As with vineyards in a similar terroir, each actor needs to position itself for future competitiveness by making the most of its own specific SWOT profile in a shared environment.

### 3.1 Competitive positioning of European machinery versus the US and China

To grow beyond the core and develop new business models, the European machinery industry has competitive advantages compared with the US and China, which companies can build on. All three geographies were assessed in multiple dimensions, with respondents asked to identify the leading region in each dimension (Exhibit 21).

**US: creativity and renewal.** Although US companies were not seen as a source of innovative products (18 percent) or product/service quality (4 percent), the industry in the US did get high marks for its creative business models (74 percent) and continuous renewal of existing business models (59 percent).

**Europe: superior skills and quality.** Survey participants give European companies credit for employing highly qualified personnel (95 percent) and offering superior product/service quality (94 percent). These two strengths – the only ones ranking in the 90th percentile – were assessed to be distinctively higher than in all other regions. Additionally, Europe ranks as the leader in developing innovative product ideas (80 percent) accompanied with a high customer orientation (55 percent).

**China: low cost and fast time to market.** The industry in China is appreciated for its traditional qualities: an extremely advantageous cost position (75 percent) and a short time to market (45 percent). These strengths are reinforced by high agility and flexibility in reacting quickly to market trends (35 percent).

### Biggest strengths of Europe are qualified personnel, product/service quality, innovative product ideas, and customer orientation

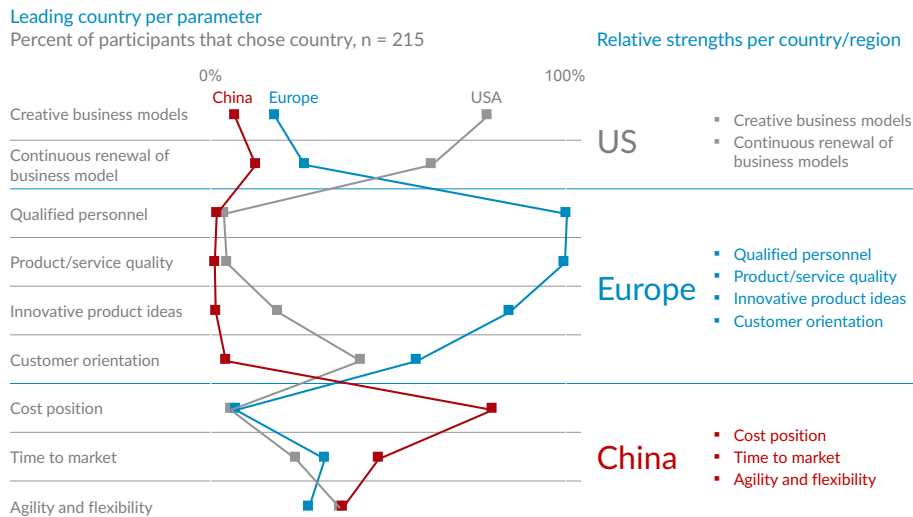


EXHIBIT 21

*"It is not surprising that the US and China get much higher ratings for agility. Both countries are very pragmatic and flexible. In contrast, Europe often takes a 'checklist approach' paired with inflexible regulations and structures."*

[Aftersales provider]

Comparing the industry's competitive advantage in Europe with the other regions generates a number of further insights into the strengths that the industry can build on. Europe's advantages in quality, reliability, and innovation are significantly higher relative to China and to the US; advantages from having skilled employees

are on the same level. Another very significant topic is the customization of the offering, although this is again more relevant in competition with China than the US.

At the other end of the spectrum, ease of doing business and access to capital are ranked very low against China as well as the US. This indicates disadvantages with regard to available funding and European bureaucracy/regulation.

### Europe and the global economy

A more detailed analysis of Europe's strengths reveals that survey participants perceive Europe's regional advantages as being manifested in its single currency and the stability of the region:

- The main strength of Europe is seen in the euro as the **single currency** (70 percent) of the eurozone countries. A large majority of the companies surveyed judges the euro as having a "definitely useful" impact on its business. In this context, respondents especially cite the elimination of transaction costs for currency exchange, increased price transparency, and the removal of exchange rate uncertainties as beneficial aspects of the single currency.
- The strength of the currency is accompanied by the **stability** (60 percent) of the region and **legal certainty** (61 percent), supported by Europe's institutions, as the second and third most important strengths. Legal certainty is especially valued by the central European companies from Switzerland and Liechtenstein (78 percent) and Germany (67 percent), while it is less important for companies from Southern Europe (32 percent) as well as other Western & Northern European countries (37 percent).
- Additionally, respondents mentioned the economic strength of a single, harmonized market within the EU; most notably, the existence of a **large tariff-free market** was cited by more than half the respondents (56 percent).
- Further benefits, such as **comparable legislation** (36 percent) and **cultural proximity** (35 percent) with other EU member states, were minor factors. These factors ranked lowest among other Western, Northern, and Southern European countries, while comparable legislation was not seen as a strength by Southern European respondents.

## 3.2 Sources of competition

Across all archetypes, companies consistently identify current European competitors and companies in China as the largest threat. The strongest responses came from equipment & machine system providers. They assess the threat from current European and Chinese competitors the highest and give much lower rankings to the threat from companies in the US (9 percent) and new European competitors (11 percent) than the other archetypes do. It is especially crucial for equipment & machine system providers to know their customers very well, making new market entrants a bigger challenge for them than they might be for the other archetypes.

*“Product innovation in Europe is still strong; what we lack is the courage to take steps in new directions.” [Machine manufacturer]*

Overall, the European machinery industry sees companies in the US as a relevant but not dominant source of competition.

Surprisingly, this is also the case for software/system providers. Despite the business world’s continuing fascination with Silicon Valley, the survey results show that the threat from current European and Chinese competitors is rated almost three times as high as the threat from the US.

These ratings are, however, not homogeneous within Europe. Some notable differences exist depending on machinery companies’ home region. The largest differences from the average are in Eastern Europe, where companies expect competition from current European players to be well below the overall average, while Eastern European respondents see China as the main source for competition. This is a sign that the Eastern European and Chinese players compete in similar areas, especially based on their lower cost positions.

## 4. PRIORITY ACTION AREAS FOR EUROPEAN MACHINERY COMPANIES

Market shifts, technological developments, and advances in digital pose challenges and business opportunities for players in European machinery. To capitalize on these trends, companies can prioritize actions in the areas of examining their growth strategies in a changing macroeconomic environment and optimizing their operations in ways that allow them to take advantage of the digital opportunity.







Over the last years, European machinery players have been highly successful – in terms of both growth (+7.2 percent p.a. between 2010 and 2014) and profitability (about 10 percent EBIT margin on average). Realizing new growth potential will become more difficult and put profitability under pressure if a shift in a company's business model is needed.

## 4.1 Reacting to strategic themes

To position themselves to take advantage of growth opportunities and optimize margins, European machinery players would benefit from taking a step back and reassessing their strategies for the next five years. Are growth and profitability expectations in the magnitude of previous years really realistic? What exactly is the digitization agenda of our company to improve bottom-line efficiency on the one hand (5 to 10 percent reduction on total cost base by 2020) and to monetize digital business models on the other hand (more than 10 percent revenue share by 2020)? And, where are the weak spots in my organization (e.g., regarding agility, interculturality) relative to growth trends and digitization?

Exhibit 22 shows a sketch of an exemplary action plan that decision makers of European machinery companies can take as a starting point to develop their agenda along those strategic themes until 2020.

A detailed overview and description of the need for action per archetype can be found in the appendix.

### Exemplary action plan for European machinery companies along strategic themes

	Now	Short-term (2017 - 18)	Long-term (2018+)
Growth	Reassess strategic and financial planning for next 5 years (expected revenue growth and profitability upscaling unlikely to happen)	Develop sound growth strategy incl. business cases for new market entry opportunities and portfolio expansion	Continuously review strategic and financial planning and adjust, if necessary
Digitization	Further drive total cost down through digitization/Industry 4.0 measures (5 - 10% by 2020)		
	Develop integrated digitization strategy (customer insights, strategic control points, partnership options, technology road map, etc.)	Assess and prioritize customer use cases for digitization; start first projects	Monetize digital business models at scale (> 10% revenue share by 2020)
Organizational change	Evaluate current rate of organization and define necessary ranges	Design organizational transformation	Drive organizational transformation



## 4.2 European machinery industry – areas for improvement

While the European machinery industry has been very strong historically, how can it improve to best position itself for future growth despite pressure from strong competitors in China and especially the US?

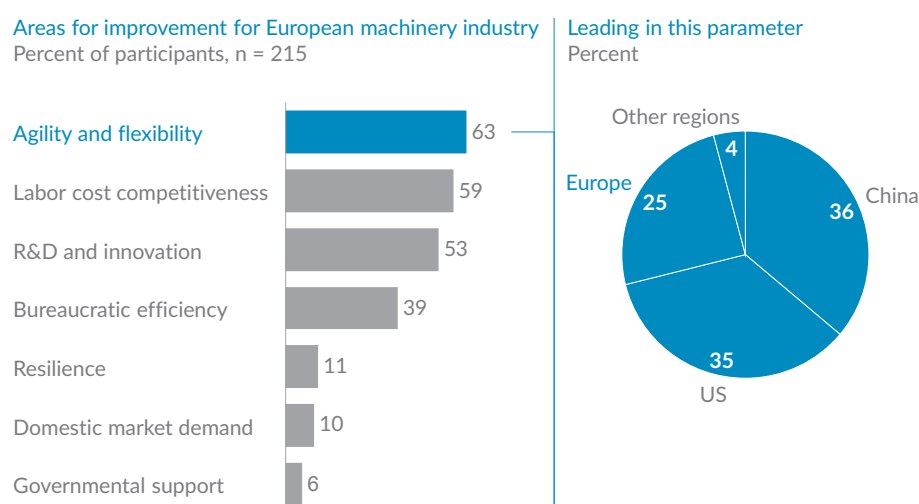
At the broadest level, the European machinery industry has the most catching up to do in agility and flexibility (understood, respectively, as the ability of a company to pivot or strike quickly and smoothly when faced with a threat or opportunity and the ability to adapt readily to change). In agility and flexibility, the US and China are perceived to be far advanced, with each country ranked number one by more than one-third of the respondents (Exhibit 23). Many survey respondents agreed that their agility and flexibility are somewhat limited due to heavier European regulation in the areas of labor, consumer protection, safety, and the environment.

*“We need know-how while also having affordable employees.”*

*[Component specialist]*

While the European industry as a whole cannot realistically aspire to becoming number one globally in agility and flexibility by 2020, it is all the more important for individual companies to close their specific areas of greatest vulnerability. In parallel, they need to pinpoint functions where building “spikes” in agility and flexibility will have the biggest positive impact.

### The European machinery industry needs to catch up regarding agility and flexibility



The survey results indicate that the European machinery industry must also address the following areas for improvement:

**Qualified personnel at competitive costs (59 percent).** Across all archetypes, companies have identified the lack of qualified personnel as a major barrier to improvement in terms of business environment. At the same time, labor cost competitiveness is one of the most important priorities. This conflict between increasing labor cost pressure on the one hand and shortage of qualified personnel on the other hand forms a second major challenge for the industry.

**R&D and innovation (53 percent).** For successful innovation, companies require the necessary knowledge and skill base as well as sufficient funding. A current or potential lack of qualified personnel curbing innovations is mentioned across all archetypes, but software or system solution providers say their innovation capacity is mostly limited by a lack of governmental support in R&D funding and procurement. While the survey respondents rate the quality of product innovation in Europe as still very high, they see Europe as lacking the courage for disruptive (business model) innovations, and their self-assessment of their own innovativeness is rather conservative.

**Efficiency of public administration (39 percent).** Across all archetypes, machinery companies report regulatory and legal frameworks as an area in need of improvement. Only in Southern Europe, bureaucratic efficiency is rated lower (26 percent). Survey respondents cite the average cost of founding a business in Europe, which is many times higher than in the US, for example, and high energy prices, which they partly attribute to Europe's strict environmental regulations, as competitive disadvantages.





## CLOSING

The European machinery industry has a successful track record based on high-quality, innovative, and export-oriented products focusing on the high-price or premium segment. This will still be the core business model over the coming years. However, this will not be a guarantee for continuous success. The business environment is changing with diverging growth patterns in a volatile macroeconomic environment and ever-faster digitization, questioning the sustainability of traditional business models and the need to enable organizations to keep pace with these developments. Therefore, the way forward will be innovation, digitization, and diversification.

The study highlights a number of fields of actions available to the industry: tapping new growth potential through vertical and horizontal integration with special focus on services, increasing profitability through operational excellence by embracing digitization and new technologies, and enhancing efficiency through organizational change including boosting organizational agility and internationalization.

The study also highlights the global dimension of the changes ahead. While the industry is in a strong position to master the changing business environment, certain preconditions must be ensured: this includes safeguarding the stimulating effect of European integration and improving access to a qualified workforce as well as embracing innovation and the digital revolution. Europe has a strong starting position in the global competition but must keep up to speed to defend its lead in machinery over the United States and China. Not all of the approaches discussed apply to every company. Instead, the study should serve as a thought-provoking prompt for each company to reflect their current strategic positioning.

# APPENDIX



## COMPONENT SPECIALISTS

### Overview

Revenues 2014, EUR millions	571.0	ROCE 2014, percent	20.5
CAGR 2010 - 14, percent	5.6	Break-even point, percent of revenues	74.5
EBIT 2014, percent of revenues	10.2	SG&A quota, percent of revenues	12.2
EBIT change 2010 - 14, percentage points	0.1	R&D quota, percent of revenues	5.7

- Strong focus on **homeland markets** with production footprint linked to machine manufacturers
- Focus on **premium segment** and customization leads to high profitability

### Opportunities and challenges

- Currently, there is **significant growth in international markets** that component specialists need to leverage, but required proximity to machine manufacturers poses an additional challenge
- **Premium segment focus is a potential hurdle to access new markets**
- High investments to accelerate digitization could be manageable by establishing business cooperations
- **Operational efficiency and flexibility** for mass customization **remain key requirements to succeed**

### Strategic focus

#### Growth



- **Regional focus and limited size prohibit rapid growth** in international markets
- **Strong growth in China**, but limited focus on the US due to strong local industry

#### Digitization



- **High growth expectation** regarding new digital markets
- **Ongoing digital initiatives developed** – ahead of other archetypes
- Further operational improvements difficult as required investments are high

#### Organizational change



- Changes are driven by technology and digitization
- **Focus on process changes, less on people** as business-to-business customer contact is less complex

### Recommendations

- **Grow internationally** through joint ventures and cooperations
- Explore **adjacent business** through horizontal integration
- **Enter new price segments/ several price segments** (e.g., from premium to mid-price)
- Further understand and address needs of **target customers**

- Use **digitization in production** to improve cost position and flexibility
- Strengthen customer interface through **online store** or configurator while investing in data security
- Use digitization for **customization of products and services**

- Build up a **global organization** across functions
- Continuously **review strategic positioning** (both business model and products)
- Increase **operational agility** to respond to economic cycles and increased customization

Need for action: ■ High ■ Medium ■ Low



## MACHINE MANUFACTURERS

### Overview

<b>Revenues 2014</b> , EUR millions	186.0	<b>ROCE 2014</b> , percent	17.5
<b>CAGR 2010 - 14</b> , percent	9.7	<b>Break-even point</b> , percent of revenues	75.6
<b>EBIT 2014</b> , percent of revenues	8.3	<b>SG&amp;A quota</b> , percent of revenues	13.3
<b>EBIT change 2010 - 14</b> , percentage points	1.3	<b>R&amp;D quota</b> , percent of revenues	6.5

- European players with **77 percent of sales abroad**
- Strong **focus on high-price segment and limited diversification** (only 46 percent with focus on more than one segment)
- Quality of products/services as unique selling proposition
- EBIT margins, on average, lower than for other archetypes

### Opportunities and challenges

- To achieve vertical integration, new approaches beyond organic growth need to be evaluated carefully
- Digital spike needs to be developed to invest effectively based on a clear strategic vision

### Strategic focus

#### Growth



- Strong focus on growing internationally by exploring segments beyond premium
- Organic growth in new regional markets as viable solution – limited focus on M&A and JV activities

#### Digitization



- High expectations for operational improvements
- Rising risk of increased cost pressure from existing competitors
- Risk of underestimating impact on own business models as new digital sources of revenue could be captured by new market entrants

#### Organizational change



- New technologies and economic cycles as key drivers for organizational change
- Low willingness to cooperate with competitors on urgent topics (e.g., new digital business models)

### Recommendations

- Shift from products to services through vertical integration such as **aftersales and offering software solutions, consulting services, etc.**
- Further increase already strong level of internationalization through **intensified local value creation and shorter time to market**







- Assess new revenue sources and design new business models such as **pay per use or platform**
- Use digitization to improve production costs

- **Strengthen internationality of organization** to further support growth abroad
- Build **capabilities in business development and sales** to identify and implement new business models

Need for action: ■ High ■ Medium ■ Low






## EQUIPMENT & MACHINE SYSTEM PROVIDERS

Overview	Revenues 2014, EUR millions		468.0	ROCE 2014, percent		16.3
	CAGR 2010 - 14, percent		8.3	Break-even point, percent of revenues		80.7
	EBIT 2014, percent of revenues		8.2	SG&A quota, percent of revenues		12.0
	EBIT change 2010 - 14, percentage points		1.4	R&D quota, percent of revenues		4.5
<ul style="list-style-type: none"><li>▪ European players mostly <b>focus on one price segment</b> only (about 70 percent)</li><li>▪ <b>Lowest R&amp;D spend</b> across archetypes</li></ul>						
Opportunities and challenges	<ul style="list-style-type: none"><li>▪ Focused <b>assessment of how to integrate new digital business models</b> to allow for sustainable growth</li><li>▪ <b>Shift in profit pools</b> requires additional focus on vertical integration</li><li>▪ Leverage existing high degree of cooperation in order to overcome shift in growth patterns (needed for vertical integration)</li></ul>					
Strategic focus	<div>Growth</div> <ul style="list-style-type: none"><li>▪ Key driver for growth is <b>vertical integration of downstream profit pools</b></li><li>▪ <b>JVs</b> as most viable option to ensure rapid vertical growth</li></ul>		<div>Digitization</div> <ul style="list-style-type: none"><li>▪ Limited impact on new revenue streams expected, biggest impact on operations</li><li>▪ Only <b>intellectual-property-rights-based business models</b> seen as highly relevant for future development</li><li>▪ Potential risk of new market entrants capturing digital profit pools</li></ul>		<div>Organizational change</div> <ul style="list-style-type: none"><li>▪ High degree of cooperation with customers, research facilities, and suppliers <b>to create competitive advantage</b></li><li>▪ <b>Economic cycles and digitization</b> are key drivers for organizational change</li><li>▪ <b>Shift towards services</b> requires people changes</li></ul>	
						
Recommendations	<ul style="list-style-type: none"><li>▪ <b>Shift from products to services</b> through vertical integration such as aftersales and offering software solutions, consulting services, etc.</li><li>▪ Offer <b>customer-specific solutions</b> at competitive cost through modularization/standardization to enable profitable growth</li><li>▪ Explore entry into <b>new regional markets</b></li></ul>		<ul style="list-style-type: none"><li>▪ Assess new revenue sources and <b>data-driven business models</b> (e.g., predictive maintenance)</li><li>▪ <b>Offer consulting services</b> on best usage of machines</li><li>▪ Explore opportunities to <b>reduce cost and to improve working capital</b> (e.g., inventories)</li></ul>		<ul style="list-style-type: none"><li>▪ <b>Establish controlling mechanisms</b> for customer cost-benefit analysis in engineering and sales</li><li>▪ Take <b>cross-functional cooperation</b> to next level</li><li>▪ Find right personnel with <b>data analytics capabilities</b></li></ul>	

Need for action: ■ High ■ Medium ■ Low



## AFTERSALES PROVIDERS




Overview	Revenues 2014, EUR millions		1,034.0	ROCE 2014, percent		16.1
	CAGR 2010 - 14, percent		4.8	Break-even point, percent of revenues		77.7
	EBIT 2014, percent of revenues		10.7	SG&A quota, percent of revenues		12.9
	EBIT change 2010 - 14, percentage points		1.3	R&D quota, percent of revenues		6.5
	<ul style="list-style-type: none"><li>▪ <b>Balanced geographical revenue streams</b> – only 21 percent of revenues in homeland with strong focus on premium segment (over 50 percent)</li><li>▪ <b>High profitability of companies above EUR 500 million in revenues</b> (above 12 percent)</li><li>▪ Innovative products/services as unique selling proposition</li></ul>					
Opportunities and challenges	<ul style="list-style-type: none"><li>▪ <b>Integration of new digital business models</b> (e.g., as-a-service business models) to develop growth beyond existing product portfolio</li><li>▪ <b>Additional growth</b> with focus on broadening scope of products and services <b>via horizontal integration</b></li><li>▪ <b>Successful horizontal integration requires organizational change to structure</b> (e.g., efficient reporting lines, clear responsibilities and role descriptions)</li></ul>					
Strategic focus	<b>Growth</b> 		<b>Digitization</b> 		<b>Organizational change</b> 	
	<ul style="list-style-type: none"><li>▪ Balanced geographical split in existing markets</li><li>▪ <b>Additional horizontal integration necessary</b> due to saturated existing markets</li><li>▪ <b>Limited options for organic growth into new markets</b> due to perceived lack of regional expertise</li></ul>		<ul style="list-style-type: none"><li>▪ <b>Focus on operational excellence</b> through digital internal processes</li><li>▪ <b>Risk of underestimating impact on own business models</b> as new digital sources of revenue could be captured by new market entrants</li><li>▪ <b>New market entrants identified as highest threat</b></li></ul>		<ul style="list-style-type: none"><li>▪ <b>Economic cycles and shifting profit pools</b> with significant impact on organizational setup</li><li>▪ Broad international footprint <b>requires organizational changes in structure</b> (e.g., roles, reporting lines)</li></ul>	
Recommendations	<ul style="list-style-type: none"><li>▪ <b>Broaden the scope of products and services</b> offered through horizontal integration</li><li>▪ Further explore growth opportunities in <b>new markets</b> (e.g., Asia beyond China)</li><li>▪ Further address <b>profitable mid-price segment</b></li></ul>		<ul style="list-style-type: none"><li>▪ Assess new revenue sources, e.g., increase <b>aftersales share through predictive maintenance</b></li><li>▪ Further develop <b>differentiating offerings</b>, e.g., establish platforms, to stay competitive vs. new entrants and grey market providers</li></ul>		<ul style="list-style-type: none"><li>▪ Increase <b>strategic agility</b> (e.g., portfolio definition) to respond to shifting profit pools</li><li>▪ <b>Manage internal organizational complexity</b> due to typically large size of organization and global footprint</li></ul>	

Need for action: ■ High ■ Medium ■ Low





## SOFTWARE/SYSTEM PROVIDERS

Overview	Revenues 2014, EUR millions		514.0	ROCE 2014, percent		22.4
	CAGR 2010 - 14, percent		6.1	Break-even point, percent of revenues		68.3
	EBIT 2014, percent of revenues		13.5	SG&A quota, percent of revenues		11.1
	EBIT change 2010 - 14, percentage points		1.9	R&D quota, percent of revenues		12.4
	<ul style="list-style-type: none"><li>▪ Strong focus on homeland with over 51 percent of sales covering all price segments to ensure dominant market position</li><li>▪ Highest profitability across archetypes</li><li>▪ Highest R&amp;D spend across archetypes</li></ul>					
Opportunities and challenges	<ul style="list-style-type: none"><li>▪ Data-driven and as-a-service business models to be explored as potential new revenue streams</li><li>▪ Various growth approaches (including M&amp;A, JVs, organic) need to be evaluated to ensure rapid internationalization of revenue streams – high dependence on home markets could pose high risk going forward</li><li>▪ War for talent as key organizational change to allow for fast adoption of new digital business models</li></ul>					
Strategic focus	<div>Growth</div> <ul style="list-style-type: none"><li>▪ New, international players pose a potential threat on home markets – international expansion as key priority</li><li>▪ JVs and cooperations seen as most viable approach to accessing new markets</li></ul>		<div>Digitization</div> <ul style="list-style-type: none"><li>▪ Digitization as key driver for new revenue sources</li><li>▪ High impact on business models and industry landscape expected</li><li>▪ New market entrants identified as key risks in the future</li></ul>		<div>Organizational change</div> <ul style="list-style-type: none"><li>▪ New technologies and new growth trajectories as key drivers for organizational changes</li><li>▪ Limited cooperation with suppliers, customers, and research facilities</li></ul>	
	<div><ul style="list-style-type: none"><li>▪ Explore further growth opportunities in Europe</li><li>▪ Explore adjacent businesses, e.g., establish service provider business model towards third parties</li></ul></div>		<div><ul style="list-style-type: none"><li>▪ Asses new revenue sources, e.g., by offering consulting services on best usage of machines</li><li>▪ Invest in data security</li></ul></div>		<div><ul style="list-style-type: none"><li>▪ Increase agility to respond to new technologies and new growth trajectories</li><li>▪ Further globalize the organization (increase share of international employees, relocating functions abroad)</li><li>▪ Form cooperations with other machinery companies to leverage capabilities</li></ul></div>	
Recom-mendations						

Need for action: ■ High ■ Medium ■ Low

## GLOSSARY

<b>Advanced analytics</b>	A range of analytic techniques and tools for the acquisition and transformation of raw data into information to predict future outcomes
<b>Aftersales providers</b>	Archetype defined as machinery companies with more than 20 percent of sales from aftersales business
<b>Archetype</b>	Business type cluster into which machinery companies can be categorized
<b>ASEAN</b>	Association of Southeast Asian Nations, an intergovernmental organization focusing on political and economical cooperation
<b>Asset utilization (digital value driver)</b>	Making the best use of a company's machinery park by minimizing planned and unplanned machine downtime and changeover times, e.g., through predictive maintenance (typically decreases total machine downtime by 30 to 50 percent and increases total machine life by 20 to 40 percent) or augmented reality
<b>Break-even point</b>	The break-even point describes the sales necessary to cover costs. Sales beyond the break-even point generate profit
<b>BRIC</b>	Acronym for Brazil, Russia, India, and China
<b>Business cluster</b>	Groups of businesses, suppliers, and institutions in a defined geographic area that share common interests or features in a particular field
<b>Business-to-business</b>	Commerce transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer
<b>CAGR</b>	Compound annual growth rate describes the mean annual growth rate over a number of years
<b>Component specialists</b>	Archetype defined as machinery companies that earn more than 50 percent of their sales from components

<b>Customization</b> (digital value driver)	The ability to modify a mass-produced design to meet requirements of a specific subsegment of customers or an individual customer; achieved through flexible and data-driven development and production processes
<b>Digital value driver</b>	Digitally driven levers for operational improvement
<b>Digitization</b>	Conversion of analog data to digital data, linking industrial processes and technologies with related business processes and using new information and communication technologies
<b>EBIT</b>	Earnings before interest and tax
<b>Equipment &amp; machine system providers</b>	Archetype defined as machinery companies that earn more than 50 percent of their sales from equipment & machine systems
<b>Grey market</b>	Market for spare parts that are not manufactured by the original equipment manufacturer but a third-party provider
<b>Horizontal integration</b>	Broadening scope of products and services at the same level of value or supply chain
<b>Industry 4.0</b>	Integration of hard- and software into industrial and customer relation processes based on cyber-physical systems and the Internet of Things and Services
<b>Inorganic growth</b>	Growth in the operation of a business resulting from mergers and acquisitions or joint ventures
<b>Internet of Services</b>	Services such as maintenance and customer care provided via the Internet
<b>Internet of Things</b>	Integration of connected software and data gathering software into physical end devices to allow exchange of data
<b>Inventories</b> (digital value driver)	Reducing excessive supply in stock through automated stocktaking and reordering processes based on actual fill levels and expected demand
<b>IPR</b>	Intellectual property rights, including copyright, patents, trademarks, and design rights

<b>Joint venture (JV)</b>	A business entity created by two or more parties, generally characterized by shared ownership, shared returns and risks, and shared governance
<b>Key performance indicators (KPIs)</b>	A set of quantifiable measures that a company uses to gauge its performance over time. These metrics are used to determine a company's progress in achieving its strategic and operational objectives, and also to compare a company's finances and performance against other businesses within its industry
<b>Labor</b> (digital value driver)	Improving labor productivity by reducing waiting time or increasing the speed of workers' operations, e.g., through human-robot collaboration, digital performance management, or automation
<b>Machine manufacturers</b>	Archetype defined as machinery companies that earn more than 50 percent of their sales from single machines
<b>Mergers and acquisitions (M&amp;A)</b>	Transactions in which the ownership of companies, other business organizations, or their operating units are transferred or combined
<b>Net value added</b>	Level of enhancement given to a product or service before offering the product on the market
<b>Organic growth</b>	Growth in the operation of an existing business based on increased output and/or sales
<b>Quality</b> (digital value driver)	Using real-time data analytics and advanced process control to minimize rework and scrap during the production process
<b>R&amp;D</b>	Research and development in order to develop new or enhance existing products or services
<b>Resource/process</b> (digital value driver)	Real-time and computer-based process improvements to reduce material consumption or to increase speed and throughput, e.g., through smart energy or real-time yield optimization
<b>ROCE</b>	Return on capital employed

<b>Sales</b> (digital value driver)	Improving demand forecasting, e.g., through CRM tools that provide better data analysis
<b>Services/after-sales</b> (digital value driver)	Improving the product offering by reducing the cost of operation for the customer, driven by service costs and machine downtime, e.g., through remote and predictive maintenance
<b>SG&amp;A</b>	Selling, general, and administrative expenses. General costs within the production or sales process, which cannot be directly linked to an individual product or service
<b>Software/system providers</b>	Archetype defined as companies that earn more than 20 percent of their sales from software development
<b>Supply/demand match</b> (digital value driver)	Leveraging advanced analytics and crowd forecasting to fully understand customer demand for quantity and quality and the product features that customers are willing to pay for
<b>SWOT</b>	Strengths, weaknesses, opportunities, threats. An analysis to identify the internal and external factors that are favorable and unfavorable to a project or business
<b>Time to market</b>	Amount of time it takes from when a product is designed and manufactured to when it is available on the market
<b>Time to market</b> (digital value driver)	Speeding up the development process through levers like concurrent engineering, open innovation, or rapid prototyping (e.g., via 3-D printing)
<b>Unique selling proposition (USP)</b>	Proposition by a seller that one product or service is different and superior to that of the competition
<b>Vertical integration</b>	Broadening scope of products and services along value and supply chains



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