



DANISH MANUFACTURING

— winning in the next decade

McKinsey&Company



THE TUBORG RESEARCH CENTRE
FOR GLOBALISATION AND FIRMS
INSTITUT FOR ØKONOMI
AARHUS UNIVERSITET

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DANISH MANUFACTURING IN FIGURES

MANUFACTURING IN THE DANISH ECONOMY

Some **7,700** companies

Annual turnover of around
DKK 230 billion

Higher export share than any other sector
– about **65 percent** of total sales

About **60 percent** more gross value added per hour than construction,
55 percent more than trade
and some **130 percent** more than the primary sector

Most internationally integrated
sector apart from transportation

Almost **20 percent** of total R&D investments

Intermediate products account for **two-thirds**
of total exports

More than **90 percent** of industry employment is located outside the Copenhagen area

65 percent are global players and exporters

More than **50 percent** consider themselves innovation leaders and target premium segments

70 percent of companies have a positive outlook on the future

More than **40 percent** consider a *relative shift of demand to markets outside Europe* a top future trend

The most productive quartile is **2 times** more profitable than the least productive quartile

Companies with high R&D spending are more than **25 percent** more profitable than companies with low R&D spending

Potential of additional **DKK 35 billion** in revenue, **DKK 23 billion** in export and up to **10,000** new jobs in 2025 if best practice is implemented across the sector

INTRODUCTION: MANUFACTURING IS A KEY INDUSTRY PILLAR



Manufacturing is a key pillar of Danish industry and has a global reputation in products ranging from generators, pumps, and thermostats to wind turbines and robotics. The industry is extremely diverse, with successful companies ranging from global conglomerates to local, family-owned businesses.





In 2013, the approximately 115,000 employees in Danish manufacturing generated a turnover of close to DKK 230 billion. With a higher export share than any other industry (about 65 percent of sales in 2010), Danish manufacturing accounts for almost one-fifth of total annual exports. With more than DKK 80 billion in total gross value added (GVA), Danish manufacturing delivered 60 percent more GVA per hour than construction, 55 percent more than trade, and 130 percent more than the primary sector (see Exhibit 1).



With a higher export share than any other industry (about 65 percent of sales in 2010), Danish manufacturing accounts for almost one-fifth of total annual exports.

The many high GVA jobs generated by the manufacturing industry span from white collar jobs such as software and mechanical engineers to high-value adding blue collar jobs - all greatly important to the Danish economy. The industry also support the general upgrading of workforce skills to meet the needs of the new digital age, as digitization is already reshaping the manufacturing industry at all levels and across all types of jobs.

Innovation is increasingly important for the manufacturing industry, and about 20 percent of total private R&D investment in 2012 was in manufacturing. Furthermore, manufacturing is critical for many communities, particularly in the central, western, and southern parts of Jutland as more than 90 percent of employees are located outside the capital region. Beyond direct benefits, manufacturing is an important contributor to sectors such as transportation¹ and services.

In this report we consider manufacturing as the production (including production of components) of machinery, metals, electronic equipment, motorized vehicles, ships, and other means of transportation. Support services for machinery and electronic equipment are included, while pharmaceuticals and food and beverages are excluded as they are considered sectors in themselves.

Though Danish manufacturing is in robust health, it faces a number of challenges that are reshaping the competitive landscape. Challenges include emerging market competitors capturing more of global profit pools, demand growth focused in geographically distant countries, and rapid digitization across the industry.

With these challenges, it becomes pivotal to address the following questions:

What actions are needed for Danish manufacturing to improve its current competitive position?

- How should Danish manufacturing companies react to challenges and opportunities facing the industry?
- How can policy makers ensure optimal conditions for Danish manufacturing in the future?
- How can stakeholders such as unions and interest groups support the future competitiveness of Danish manufacturing?

The aim of this report is to spark a debate around these questions by suggesting five key action areas – based on extensive research and discussions with industry executives and stakeholders. Combined, these action areas constitute our perspective on actions needed to ensure the future competitiveness of Danish manufacturing. We do not claim these to be exhaustive answers to the questions outlined above, but rather a perspective to kick-start the discussion among key stakeholders.

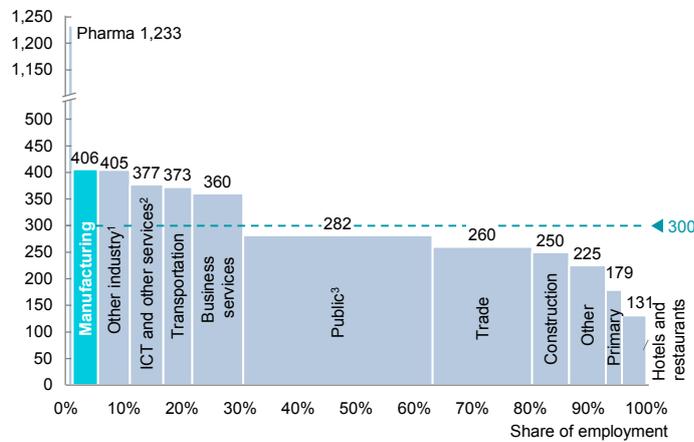
The report is divided into three sections. First the factors determining profitability and growth in Danish manufacturing are outlined and discussed. Secondly the most pressing and impactful future trends are analyzed and evaluated. Finally the insights from the first two sections are combined with expert insights to identify the five Action areas. These three sections are outlined below:

¹ Together with business services, manufacturing makes the biggest contribution to transportation (approximately DKK 8 billion p.a.). This is calculated by cross-tabulating input and output across all industries – arriving at an industry input-output table.

² Statistics Denmark.

Sector overview by share of employment and gross value added

Gross value added per hour, DKK, 2013 prices



Notes: Financial services has been excluded

¹ E.g. Food industry, textile industry, plastic- and rubber industry and oil refinery industry

² Excluding financial services

³ Including utilities

SOURCE: Team analysis

EXHIBIT 1

Chapter 1: Success patterns – what matters for Danish manufacturers

Danish manufacturing comprises some 7,700² companies (2013), which range in terms of size, internationalization, innovation, customer and product orientation, aftersales/service provision, industry affiliation, management type, and labor productivity. Chapter 1 considers how these factors have contributed to the current position of Danish manufacturing companies.

There is no blueprint for success, but, in general, companies that are bigger, more international, more innovative, led by professional management, and that have high levels of labor productivity are found to perform best.

Chapter 2: Understanding the key trends of tomorrow

Although Danish manufacturing is strong, it faces an evolving competitive landscape, presenting challenges and opportunities that will likely shape the success patterns of tomorrow. Chapter 2 presents a deep dive into the five trends most companies regard as important.

The trend regarded most important is that customers increasingly expect customized system solutions, placing a strain on supply structures and internal processes. Customers also favor comprehensive aftersales/service offerings and demand higher environmental standards, creating significant commercial opportunities.

The geographical playing field is shifting, with non-European markets, particularly China and the rest of Asia, growing in relative importance, and the US going through a “re-industrialization” phase. At the same time, the emergence of low-cost players offering high-quality products is fueling competition and pressuring margins. More volatile commodity prices add to cost pressures and require greater operational flexibility.

There are two additional trends worth noting. Production conditions are changing, with innovations such as digitization and additive manufacturing (for example, 3-D printing) changing markets and production processes. In addition, the ability of some industrial companies to grow and innovate is being hampered by a shortage of engineers and other skilled personnel.



The trend regarded most important is that customers increasingly expect customized system solutions, placing a strain on supply structures and internal processes.

Chapter 3: Action areas for policy makers and companies in positioning manufacturing for future success

Based on current success patterns and future trends, five potential action areas emerge:

1. Targeted internationalization with an emphasis on premium products
2. Investment in disruptive technologies to drive innovation
3. Customized solutions built on standardized and modularized platforms
4. Expanded aftersales/service offerings
5. Circular products and business models.

If the aim is to encourage the continuing importance of manufacturing to the Danish economy, manufacturers, stakeholders, and policy makers are recommended to give serious consideration to these five strategies, which will determine growth and profitability prospects in the years to come. This report sets out recommendations for policy makers, companies, and other key stakeholders.

This report is jointly authored by The Tuborg Research Centre for Globalization and Firms at Aarhus University and McKinsey & Company, with support from The Confederation of Danish Industry. We welcome feedback and comments.



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Methodology

This report is based on three primary sources:

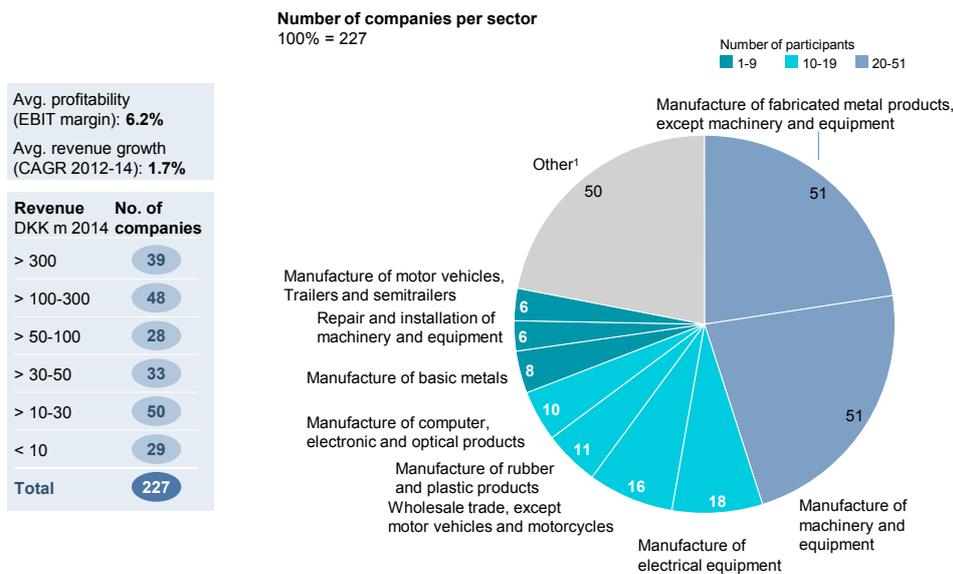
- A survey of Danish manufacturing companies
- Interviews with industry practitioners
- Expert insights.

A survey of Danish manufacturing companies.

The survey approached approximately 1,900 companies and elicited a response rate of approximately 12 percent (227 companies), contributing more than 100,000 quantitative and qualitative data points. Survey participants ranged from large multinational companies with over 10,000 employees to family-run, local players with less than 50 employees. The sample covers a broad spectrum of the focus sectors and is generally representative.

The survey covered key figures on the profitability, growth, and self-reported structure and strategies of the companies, while also appraising future industrial trends and perceived opportunities and challenges. Companies were grouped based on industry affiliation. Companies belonging to industries with less than six respondents were grouped together under “other.”

➔ A total of 227 companies participated in the survey



¹ Other consist of industries which are represented by less than 6 surveyed companies
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 2

Interviews with industry practitioners.

Expertise from industry practitioners has helped in analyzing and triangulating the survey results. Additional interviews with industry leaders have been used to refine results and pinpoint areas for further investigation and analysis.

Expert insights.

In deriving concrete strategic imperatives (action areas), survey results and input from practitioner interviews have been combined with expert insights. Experts from The Confederation of Danish Industry (DI), The Tuborg Research Centre for Globalization and Firms, and McKinsey & Company have been involved in this process to secure the robustness of strategic recommendations.

CHAPTER 1: SUCCESS PATTERNS - WHAT MATTERS FOR DANISH MANUFACTURERS



A study of over 225 Danish manufacturing companies shows there is no single archetype for success. Instead, the analysis points to **10 success patterns** of fast growing and profitable companies, which may characterize business models geared to succeed in a globalized economy.



The analysis points to 10 common patterns (Exhibit 3) driving success defined by key characteristics including size, internationalization, and labor productivity.

The identified patterns are supported by recent academic literature on corporate performance, confirming the robustness of the results. Each of the success patterns is analyzed below.

The study reveals 10 success patterns

			Impact on...	
			Profitability EBIT margin 2014	Growth CAGR 2012-14
A1		Company size. Companies with above DKK 100 m in annual revenue are on average 42 percent more profitable and grow faster (3.2 PP) than companies with less than DKK 30 m in annual revenue	↑↑	↑↑
A2		Internationalization. Global players are on average 17 percent more profitable and grow significantly faster (3 PP) than local players	↑↑	↑↑
A3		Satisfied customers. Companies with high customer satisfaction are on average 27 percent more profitable but grow 33 percent more slowly than companies with low customer satisfaction	↑	↓
A4		Innovation. Innovative leaders are on average 13 percent more profitable and grow 1.8 times faster than innovation followers	↑↑	↑
A5		Premium offerings. Premium players are on average 16 percent more profitable but grow 47 percent more slowly than low-price companies	↑	↓
A6		Solution scope. Component businesses are on average 14 percent more profitable than full-solution providers	↑	○
A7		After-sales. Companies with high degree of after-sales are on average 11 percent more profitable but grow significantly more slowly than companies with a low degree of after-sales (2 PP)	↑	↓
A8		Industry affiliation sets the pace. Average growth rates vary from 0.1-3.0 percent, while profitability varies from 5.6-7.3 percent	↑	↑↑
A9		Management incentives as a growth driver. Companies led by leaders with significant ownership grow on average 5 times faster than companies led by leaders with little ownership	↑	↑↑
A10		Labor productivity. Companies with high labor productivity are on average 2 times more profitable and grow considerably faster than companies with low productivity (4.8 PP)	↑↑	↑↑

SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 3

A1. Company size and serving larger customers provide opportunities

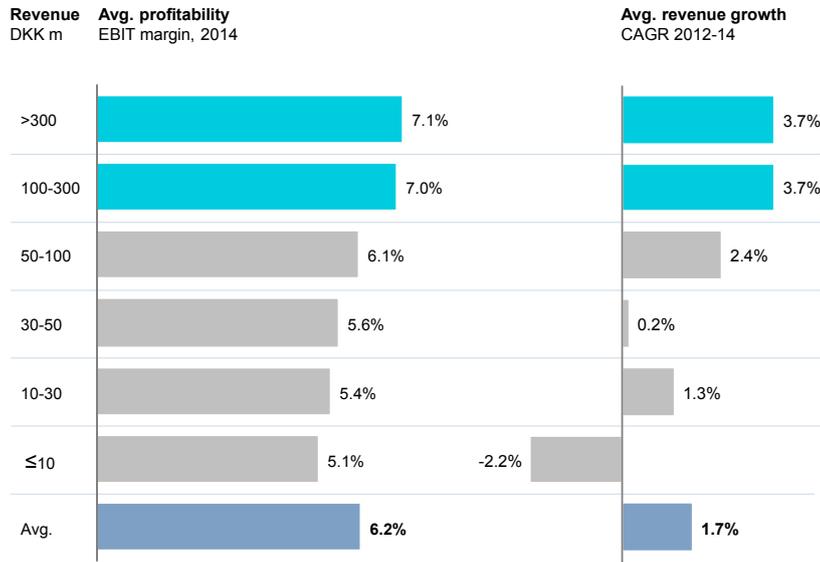


On average, larger companies (measured by revenue) are associated with higher profitability and better revenue growth.

Company size, profitability, and revenue growth go hand in hand.

On average, larger companies (measured by revenue) are associated with higher profitability and stronger revenue growth (Exhibit 4). Medium-sized companies, with revenues of DKK 50 million to 100 million, are on average 20 percent more profitable and grow 4.6 percentage points faster than small companies with less than DKK 10 million in revenues. For the largest companies, with more than DKK 300 million in revenues, the difference is even bigger, with an average profitability of 7.1 percent and average revenue growth of 3.7 percent.

Profitability and growth by revenue level



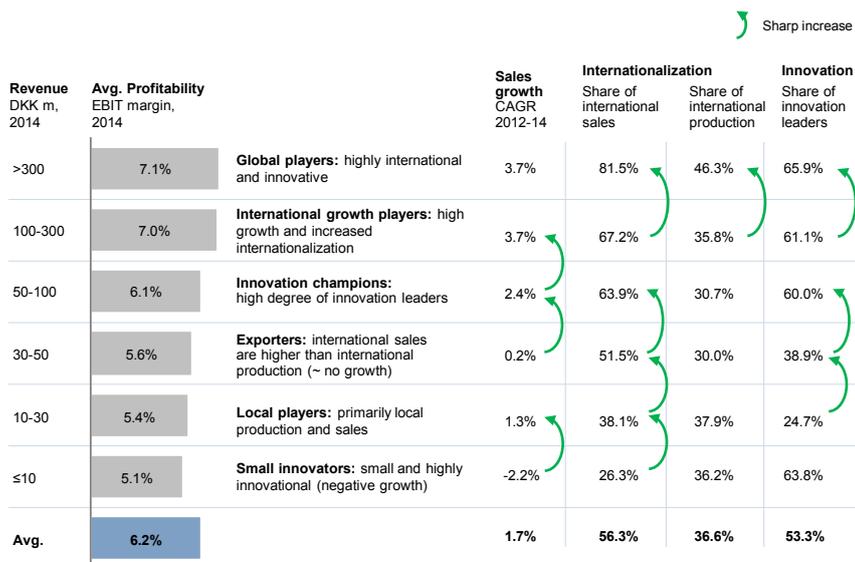
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 4

Large companies are characterized as more international and innovative.

Comparing revenue thresholds, our analysis reveals two characteristics associated with larger companies: internationalization and accompanying scale effects, and increasing innovation (Exhibit 5). The two characteristics and how they drive profitability are discussed below.

Characteristics of companies by revenue



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 5

1. Increasing internationalization and accompanying scale effects.

The report’s findings indicate that companies become increasingly more internationalized as they increase in size. Thus, the share of revenue outside Denmark rises continuously from 26.3 percent across the smallest companies to 81.5 percent across the largest companies. In addition, the share of offshore production among larger enterprises of 46.3 percent is considerably higher than that of medium-sized and smaller enterprises. Increased internationalization may lead to higher profitability, for example due to economies of scale. Internationalization typically implies increased purchasing volumes, leading to possibilities for greater standardization and a better negotiating position with suppliers. Furthermore, fixed costs in production, sales, and administration can be allocated to more units sold and additional cost benefits can be realized through better utilization (for example, in transportation). At last, internationalization allows companies to tap into international supply chains.



The apparent positive link between innovation and profitability can be due to increased product differentiation enabled by innovation.

2. Increasing innovation.

Higher revenues are generally associated with a larger fraction of innovation leaders. The share of innovation leaders across companies rises from 24.7 percent among smaller enterprises with revenues of DKK 10 million to 30 million to 65.9 percent among the largest companies. The apparent positive link between innovation and profitability can be due to increased product differentiation enabled by innovation. In addition, the process of innovation can lead to improved internal capabilities, with a positive effect on profitability. An exception to the general connection between size and innovation is the smallest companies (revenue less than DKK 10 million), which are often highly innovative. However since these are niche players, they may not obtain sufficient scale to cover the cost of innovation, meaning innovation does not always translate into high profitability.

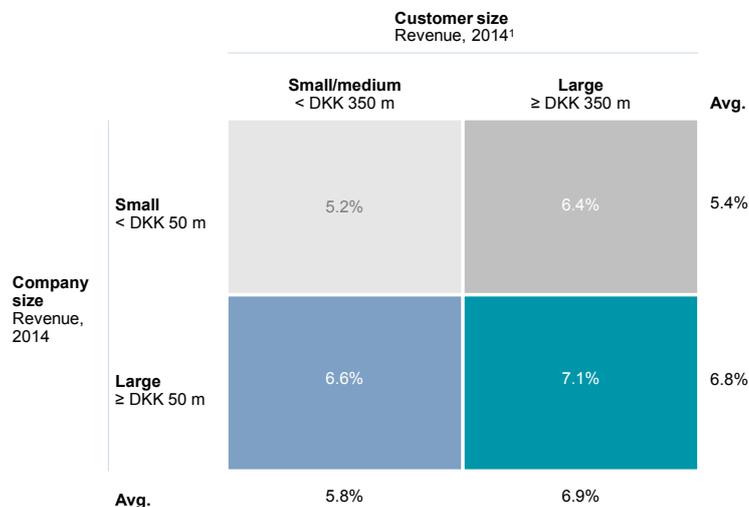
Serving larger customers is associated with increased profitability.

Serving large customers is beneficial for both small and large companies (Exhibit 6). The average profitability across all companies rises by 19 percent (from 5.8 percent to 6.9 percent) when moving from serving small and medium-sized customers to large customers, with a more pronounced effect for smaller companies. The higher profitability from serving large customers is likely due to scale effects from larger customer orders and knowledge spill over from larger and more professional customers.



Profitability by customer- and company size

Avg. profitability EBIT margin, 2014



¹ Customers’ avg. revenue
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

In addition, serving large customers eases cooperation with the customer and facilitates a proactive dialogue and customer-specific process knowledge, enabling the provision of tailored products and services. It might be a surprise that these advantages seem to outweigh the obvious disadvantage of increased customer bargaining power.

In conclusion, Danish companies must be ambitious and chase growth to ensure sufficient scale, in turn maximizing profitability and the probability of long-term survival.

A2. Internationalization is related to higher profitability and growth – the limited domestic market drives Danish companies to internationalize early

Operating in the global market is related to increased profitability.

A higher share of international revenue typically goes hand in hand with higher profitability (Exhibit 7). At first, profitability only increases 8 percent (0.4 PP) when companies move from less than 10 percent sales abroad to 40 to 70 percent sales abroad. The modest increases can likely be explained by companies employing distributors rather than having significant international production. Companies that attain more than 70 percent of revenue from abroad realize an additional 20 to 25 percent margin increase. These companies are typically larger and exploit the cost advantages of a global value chain, including lower purchasing costs and more cost-effective local salary structures.

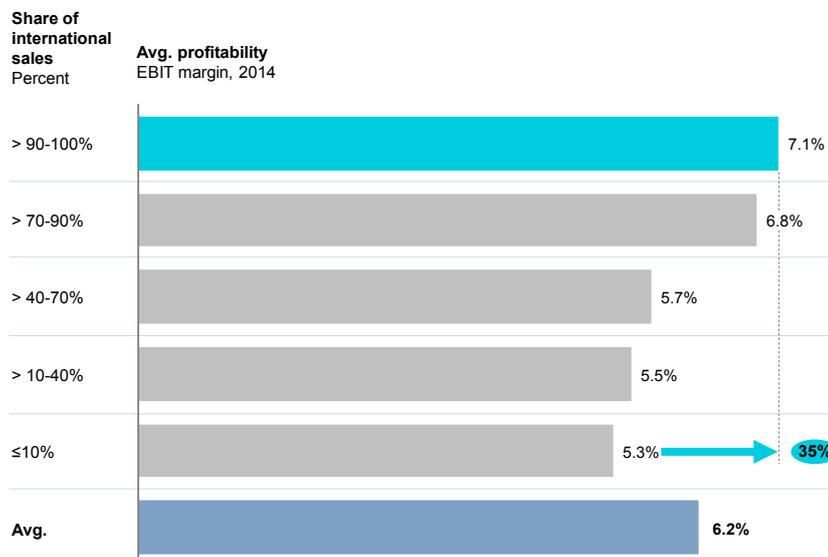


Companies that attain more than 70 percent of revenue from abroad realize an additional 20 to 25 percent margin increase.

“Small companies generally don’t sufficiently tap into global value chains and the low cost labor force.”

–Chief Executive Officer,
Danish industrial conglomerate

➔ Average profitability by level of international sales



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

A limited domestic market necessitates internationalization.

Given Denmark’s small domestic market, it is not a surprise that internationalization is usually a prerequisite of sufficient scale. Danish companies must expand abroad to tap growth opportunities, particularly with emerging markets expected to contribute up to 75 percent of global GDP growth through 2025.³

“You need to go international—the Danish domestic market is simply too small.”

—Executive Committee Member,
Danish engineering company



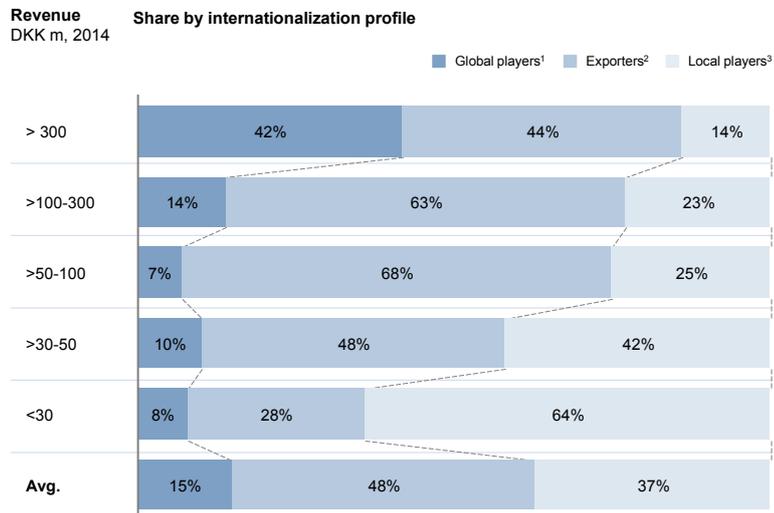
In general, “born global” companies have grown rapidly in number over the past decade.

Clear path to internationalization with some early globalizers.

When making the jump from a small to medium-sized company, more local players turn into exporters. As a company grows, it is more likely to become a global player (with production, assembly, and/or R&D abroad). However, there are also early internationalizers. Of companies with revenue below DKK 30 million, 28 percent are exporters. Likewise, 8 percent of these companies are born as global players, a fraction that does not change much before companies grow larger than DKK 300 million. Instead of going through the traditional migration from local to global, these companies instantaneously go for a global footprint, harvesting globalization advantages earlier than their peers. In general, “born global” companies have grown rapidly in number over the past decade.⁴



Internationalization profile by revenue level



¹ Global players are defined as having less than 50 percent of both production and sales in Denmark
² Exporters are defined as having more than 50 percent of production in Denmark, but less than 50 percent of sales
³ The remaining companies are defined as local players
 SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 8

³ McKinsey Global Institute.

⁴ Cavusgil, S. T., and Knight, G. A.: “The born global firm: An entrepreneurial and capabilities perspective on early and rapid internationalization,” *Journal of International Business Studies*, January 2015.

A3. Satisfied customers are a prerequisite for success

Sufficient customer satisfaction is associated with higher profitability.

Customer satisfaction matters – companies with low customer complaint rates (0 to 2 percent) are on average 30 percent more profitable than companies with high customer complaint rates (greater than 4 percent). The difference in profitability between companies with high and medium customer satisfaction is, however, less evident. Level of customer satisfaction can be seen as an indicator of process, product and service quality, or operational excellence. The message is clear: operational issues can severely undermine margins.



Level of customer satisfaction can be seen as an indicator of process, product and service quality, or operational excellence.

Profitability and growth by customer satisfaction level



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 9

Growth puts pressure on operational excellence and customer satisfaction.

In general, companies with low customer satisfaction have experienced the highest growth. The explanation is probably the other way around – that companies in high-growth situations are under pressure to keep up with demand, which is likely to lead to mistakes. Companies growing at a steady pace with little customer turnover find it easier to improve operational excellence, boosting customer satisfaction.

Customer satisfaction is a prerequisite, not a differentiating factor.

The majority of Danish manufacturing companies fall into the “high customer satisfaction” bracket (approximately 70 percent), according to their self-reported data, a testimony to their high-quality products and service. This also indicates that achieving high customer satisfaction serves more as a basic prerequisite for success than a differentiating factor.

A4. Innovation leaders are more profitable than late-following peers



Innovation leaders are on average 12 percent more profitable and grow 74 percent faster than innovation followers.

Innovation is related to profitability.

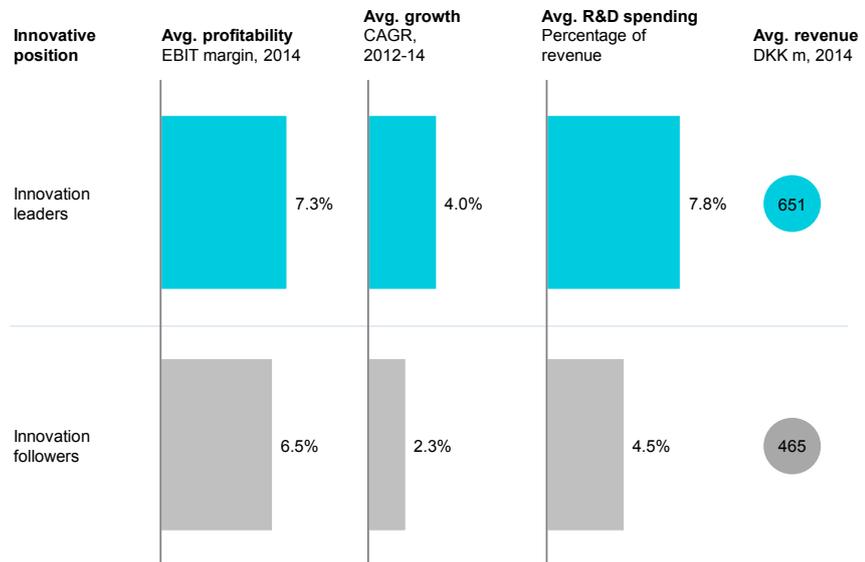
Innovation pays off for Danish industrial companies and is increasingly a prerequisite for success given increasing competition in the global market place. Innovation leaders are on average 12 percent (0.8 PP) more profitable and grow 74 percent (1.7 PP) faster than innovation followers. In addition, innovation leaders are on average about one-third larger than innovation followers – enabling them to reach sufficient scale to pay back innovation investment (Exhibit 10). The results of the analysis emphasize how innovation allows companies to differentiate products and attain clear market positioning, which in turn enables them to charge premium prices and attract demand. Furthermore, process innovation can help companies improve operations and margins accordingly.

“Innovation is a differentiator that helps you command a premium.”

–Executive Committee Member, Danish engineering company



Profitability, growth, R&D spending, and revenue by innovation position



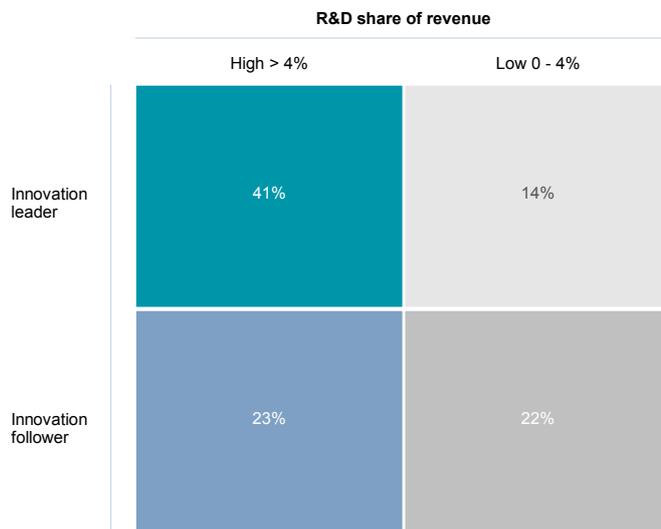
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 10

High R&D spending is necessary but not sufficient to become an innovation leader.

About three-quarters of innovation leaders have R&D spending that is above 4 percent of revenue, supporting the view that high R&D spending is key to becoming an innovation leader (Exhibit 11). However, high R&D spending is not sufficient to secure a strong innovation position – more than one-third of companies with high R&D spending do not succeed in becoming innovation leaders. Though the level of R&D investment necessary to become an innovation leader differs between industries, an industry breakdown reveals that even within industries, some companies achieve a high degree of innovation with little R&D investment, while others remain innovation followers despite high R&D investment.

→ Distribution of companies by R&D spending and innovation position



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 11

This observation highlights that the quality of R&D spending is as important as the quantity. It also shows the importance of looking beyond traditional product development when innovating. The sample of companies in the analysis demonstrates how innovation can come in many forms, from product development (new customers, product differentiation, and premium prices) to application, business model, and process innovation (costs reductions, inventory flexibility, and shorter lead times). The best combination and priority of innovation types depends on the dynamics of the specific industry.

A5. Focusing on the premium price segment pays off

Premium pays off.

Companies that focus products in the premium price segment display higher-than-average profitability (Exhibit 12). On average, profitability is 16 percent higher than that of companies focusing on the medium price segment, and 5 percent higher than that of those targeting multiple price segments.

Premium profitability potential is only realized through internationalization.

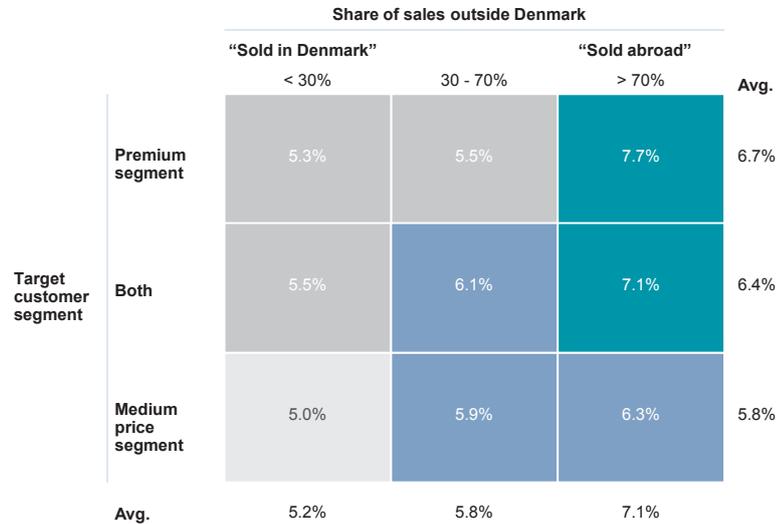
To reap the full benefits associated with selling in premium segments, Danish industrial players typically need to sell in international markets. Exhibit 12 illustrates how profitability increases 45 percent (2.4 PP) for premium companies that have more than 70 percent of their sales abroad, compared with premium companies with less than 30 percent of their sales abroad. Comparably, profitability for companies in the medium segment only increases 26 percent (1.3 PP), indicating that Danish companies that stay at home find it harder to absorb the higher cost structure of offering premium products (better service, innovative and higher-quality products, and shorter lead times). Only by selling to global premium segments can Danish companies reach sufficient scale to fully realize the benefits of being a premium provider.



Only by selling to global premium segments can Danish companies reach sufficient scale to fully realize the benefits of being a premium provider.

 Profitability by share of international sales and customer segment

Avg. profitability; EBIT margin, 2014



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 12

A6. Solutions scope – component businesses are on average more profitable

The highest profitability is in component businesses, but there are trade-offs with growth

Component businesses have an average profitability of 6.7 percent, on average 8 percent and 16 percent higher than end-product and solution businesses respectively (Exhibit 13). Component businesses are able to maintain high profitability by lowering costs through standardization and automation (see below), an option that solution businesses cannot achieve as easily due to more complicated commercial processes.

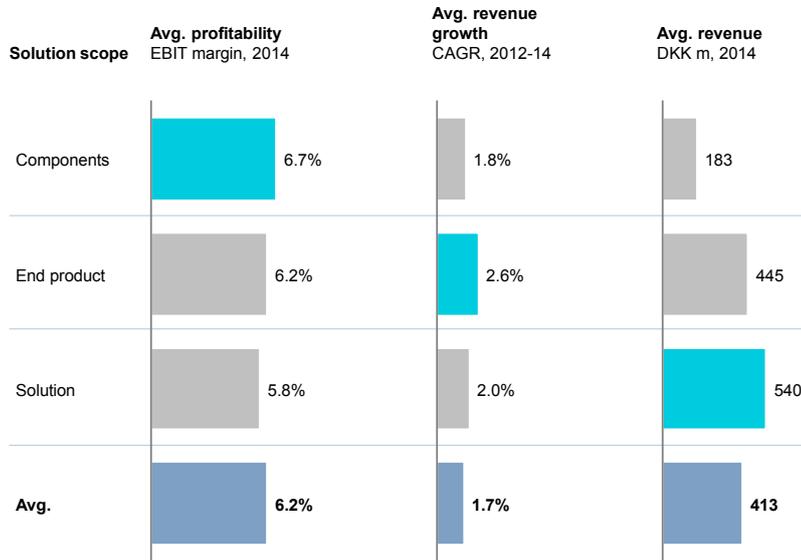
As customers, to an increasing extent, demand full solutions (see trend section B1), component businesses experience the slowest growth (1.8 percent), on average 31 percent lower than end-product businesses and 10 percent lower than solution providers. Measured by total revenue, component businesses are significantly smaller than both end-product and solution businesses.

COMPONENTS are part of *end products*, which are often single machines, while *solutions* typically are end-to-end systems tailored to the individual customer.

“Everybody tries to put things into a solution, because the whole must be greater than the sum of its parts, but customers don’t necessarily value it.”

—Executive Committee Member, Danish engineering company

Profitability, revenue growth, and revenue by business types



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

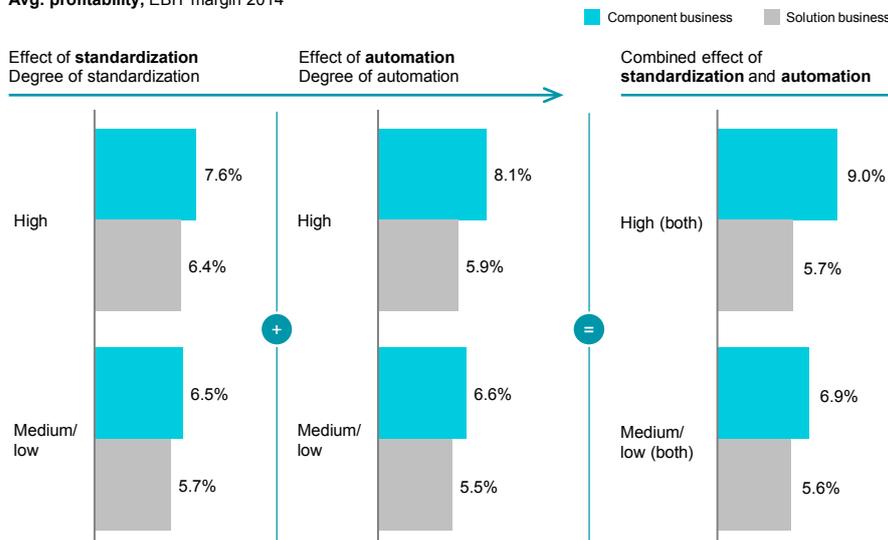
EXHIBIT 13

Automation amplifies the profitability gap between the component and solutions businesses.

Taking degree of automation into account, the gap between the component and solutions businesses widens. Thus, providers of single machines and components that have a high degree of automation are on average 37 percent more profitable than providers of end-to-end solutions with a correspondingly high degree of automation (8.1 percent vs. 5.9 percent – see Exhibit 14). One explanation is that it is less costly and more effective to automate the production of single components than to automate the various processes of a full solution provider.

Profitability by degree of automation and standardization

Avg. profitability, EBIT margin 2014



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 14

Profitability advantages of high automation and standardization.

For component and end-product businesses, the profitability advantage of high automation is amplified where there is also increased standardization, e.g. due to:

- **Economics of scale and efficiency benefits.** Component businesses are on average 58 percent (9.0 percent vs. 5.7 percent) more profitable than solution businesses where they have high degrees of standardization and automation. Economics of scale in R&D and efficiency benefits from automation across the process chain have positive effects. Despite this potential, only 24 percent of companies surveyed choose to standardize and automate the majority or all of their manufacturing.
- **Structural differences in the business model.** It is easier for manufacturers of single machines and components to achieve high levels of standardization and automation than it is for solution providers – implying savings in production and process costs. Change and request management is also easier for manufacturers of single machines and components.
- **Focus on core capabilities.** It is easier for manufacturers of single machines and components to focus on their core capabilities. Providing system solutions often requires the integration of components from outside a company's core capabilities. Extra costs may stem from a complex integration process and liability and warranty risks.



Though the share of aftersales, as expected, is higher for solution businesses (17 percent on average) it does not change the general impression that Danish manufacturing companies still have a way to go to fully exploit the aftersales market.

A7. The aftersales/service opportunity

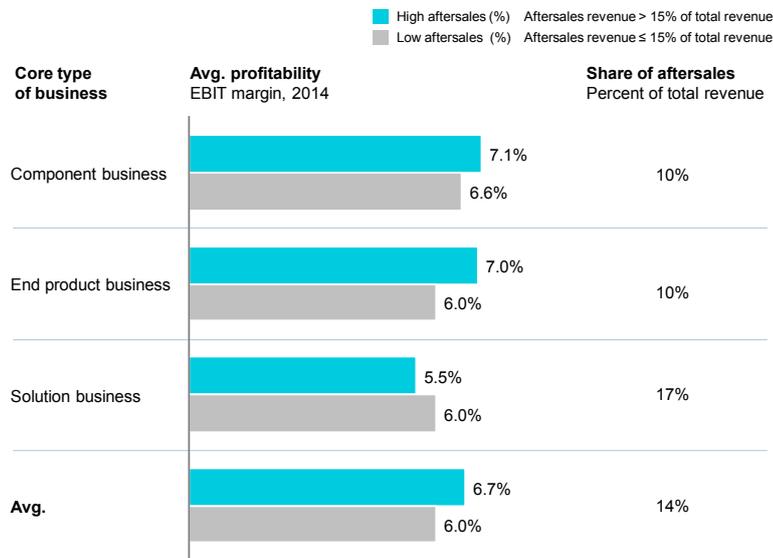
Aftersales currently plays a minor role

With an average revenue share of 14 percent, the aftersales/service business plays a minor role in Danish manufacturing (see Exhibit 15). Though the share of aftersales, as expected, is higher for solution businesses (17 percent on average) it does not change the general impression that Danish manufacturing companies still have a way to go to fully exploit the aftersales market. However, the pattern is not unique for Danish companies, as correspondingly low aftersales shares have been observed in Germany and Finland (15 percent and 13 percent respectively). The low fraction of aftersales/service business is an indication that traditional manufacturing companies find it challenging to achieve the somewhat different mindset behind providing aftersales/service. However, as we address in section B, it is one of the most significant trends likely to affect Danish manufacturing companies.

Aftersales is profitable – at least in components and end products.

Companies with more than 15 percent of revenue from aftersales/service attain on average 12 percent higher profitability than companies with less than 15 percent of revenue stemming from aftersales/service. It is likely that this profitability gap will increase as aftersales becomes increasingly important for Danish manufactures. The profitability advantage generated by a high share of revenue from aftersales/service is largest in end products (17 percent advantage), while the component business only sees a modest difference (8 percent). One explanation for this could be that when companies provide solutions, the complexity of servicing the systems eats up the price premium, as illustrated by the 9 percent advantage for companies with a lower share of revenue from aftersales/service. Another explanation is that solution providers are not sufficiently capable of pricing their services optimally due, for example, to complexity in cost allocation.

Profitability by business type and share of aftersales



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 15

“Willingness to pay is much higher for aftersales because if I don’t get the service, the machinery stands still.”

—Executive Management, Danish engineering company

A8. Industry affiliation sets the pace – but opportunities abound

Top performance is possible in all industries – as high variation within industries exists.

Though profitability differences are noticeable between industries, the largest average profitability gap between industries (30 percent) is outweighed by large intraindustry variations between the best and worst performing companies (Exhibit 16). This illustrates that although market dynamics and industry affiliation play a role in a firm’s profit potential, there are several levers that can influence profitability, for example, the success patterns described in this section. The success patterns are present even when controlling for industry affiliation, which underlines that intraindustry variation caused by success factors is more important than variation between industries.

Growth is possible across all industries through growth segments.

For growth, the pattern is the same, and intraindustry variations are greater than the gap between industries. Although mechanical engineering companies on average grow 2.9 percentage points faster than manufacturers of electrical equipment, the difference between the average of the top and bottom halves is larger for all industries. This observation is in line with e.g., other McKinsey research on the topic such as Granularity of Growth.⁵

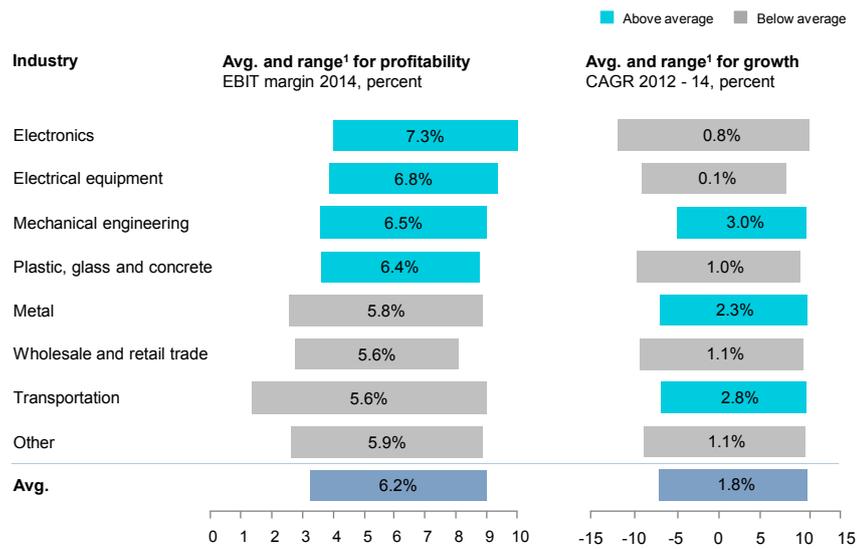


Although mechanical engineering companies on average grow 2.9 percentage points faster than manufacturers of electrical equipment, the difference between the average of the top and bottom halves is larger for all industries.

5 Baghai, M., Smit, S., Viguiré S. P.: “The granularity of growth,” McKinsey Quarterly, 2007, Number 2, pp. 42 - 51

In an analysis of a larger dataset of global companies, the research finds that even within mature industries, there are growth segments in which companies can grow without having to fight for market share. Successful growth companies will often be companies that are good at identifying and positioning themselves within these growth segments. This observation should encourage companies in industries with slow overall growth as it suggests that it is more about focusing time and resources on the fast-growing pockets of growth within an industry than seeking to change the industry – which can be a risky proposition for many companies.

Range and profitability and revenue growth by industry



¹ Left end points correspond to the average of profitability and growth for bottom 50 percent while right end points correspond to average of top 50 percent
 SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 16

A9. Professional managers powered by ownership drive profitable growth

A large proportion of Danish manufacturing companies remain family managed.

The majority of Danish industrial companies are family-owned businesses. Some 53 percent of surveyed companies are managed by either their founder or successors. When companies grow and reach a certain size, they often turn to professional management. Some 34 percent of companies say they are led by a professional management team without a substantial equity stake, while 13 percent are led by a management team with a substantial equity stake.

Professional managers with a substantial ownership stake outperform.

The advantage of strongly incentivized managers is particularly apparent from a growth perspective. When a company is run by a professional manager with a substantial equity stake, it produces about 7 times more growth on average than when managed by a professional manager without a significant equity stake, and 2.5 times (6.6 percent vs. 2.7 percent) to 3 times (6.6 percent vs. 1.9 percent) more than when it is family managed (Exhibit 17). Professional managers also improve profitability slightly, as professional managers reporting a substantial ownership stake produce 4 to 11 percent higher margins than family managers and professional managers without an equivalent stake.

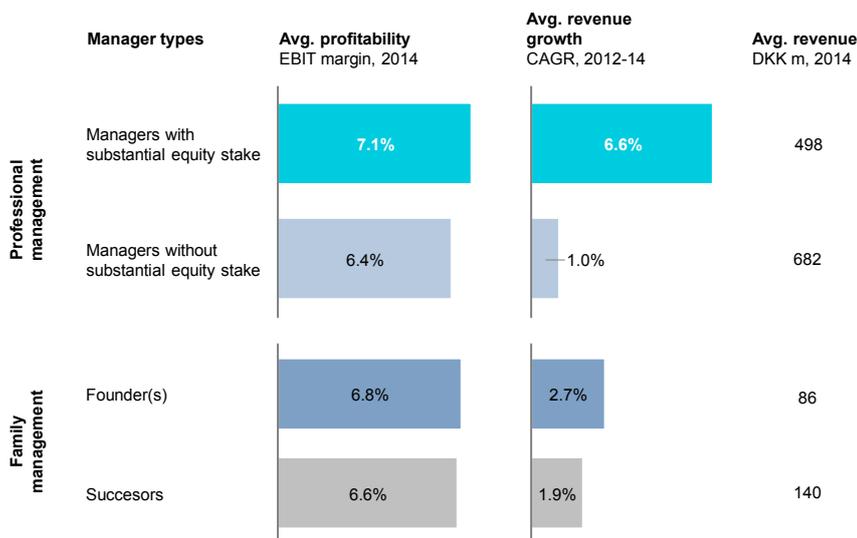


The advantage of strongly incentivized managers is particularly apparent from a growth perspective.

Professional management support is needed to sustain initial growth rates.

For the smaller (revenue < DKKm 150) family run (founders or successors) companies, the report finds that companies led by founders experience higher growth rates than companies that have been passed to successors. This is perhaps not surprising, since it is difficult without professional management support to maintain the initial high growth rates as a company matures.

Profitability and revenue growth by management type



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

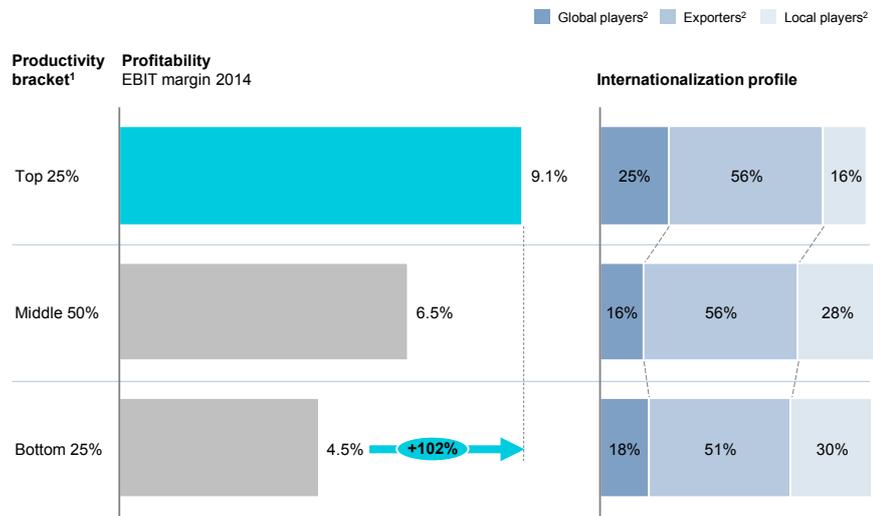
EXHIBIT 17

A10. Labor productivity drives profitability

Labor productivity drives profitability.

The 25 percent most productive companies on average outperform the 25 percent least productive companies by 102 percent in terms of profitability. Furthermore, as supported by academic literature, the most productive firms are larger, grow faster in terms of revenue, serve more markets, hire more workers, are more innovative, and invest more in R&D.

Profitability and internationalization profile by productivity level



¹ EBIT divided by number of employees in 2013

² Global player: less than 50 percent Danish production and sale; exporter: more than 50 percent Danish production, less than 50 percent Danish sale; local player: remaining companies

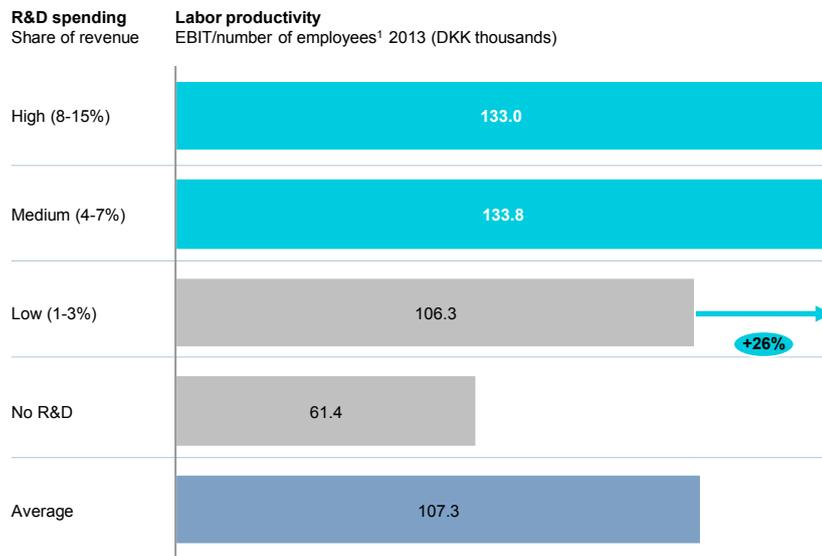
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 18

Labor productivity and internationalization constitute a virtuous circle through capital investment and competition.

Companies with high productivity are more likely to be global players than companies with low productivity, which could be explained by the mutually reinforcing nature of productivity and internationalization. Expanding a business to foreign markets often requires capital investment in local sales and marketing, production facilities, and distribution networks. Companies with higher productivity are naturally better positioned to afford the expenditure, given the link to higher profitability identified above. In turn, exposing a business to international competition increases pressure on the value chain, leading to continuous productivity increases – a case in point is the increase in productivity often observed when industries previously sheltered from competition through, for example, trade barriers, are exposed to global markets. Due to this learning effect, companies that internationalize not only obtain access to foreign markets, but also boost their competitive position at home.

Productivity by level of R&D spending



1 Measured as number of full-time equivalent
SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 19

R&D investments beyond 3 percent can help companies create virtuous circles

Companies that invest more than 3 percent of their revenue in R&D have on average about 26 percent higher productivity than companies that invest 1 to 3 percent and more than twice the productivity than companies that do not invest in R&D at all. R&D can help companies create virtuous circles in two ways:

First, R&D aimed at product development can help companies win or maintain a leading position in global markets, which supports internationalization and in turn fuels productivity improvements.

Second, investment in R&D aimed at process or capability development supports increasing labor productivity. This effect on human capital might partially explain why some companies invest in R&D without a clear impact on innovation.

Comparison with Germany and Finland

A common argument when comparing Danish manufacturing with that of its peers is that many Danish companies are small, making it more difficult to internationalize and innovate. This perspective, however, is erroneous, and Denmark’s industrial structure is not very different from Nordic peers when comparing the share of small and large companies in the economy (see appendix 1).⁶

The identified success patterns are also largely in line with the success patterns identified in similar surveys in Germany and Finland. However, there are some differences (Exhibit 20).

In contrast to German and Finish companies, customer satisfaction serves less as a driver of growth for Danish companies.



A common argument when comparing Danish manufacturing with that of its peers is that many Danish companies are small, making it more difficult to internationalize and innovate.

6 National statistical offices and Eurostat SBS database.

Comparison with German and Finnish surveys

↑ Positive effect
 ↓ Negative effect
 ○ No effect

		Danish study ¹		German study		Finnish study	
		Profitability	Growth	Profitability	Growth	Profitability	Growth
A1	Company size as an opportunity	↑	↑	↑	○	↑	n/a
A2	Internationalization as profitability driver	↑	↑	↑	↑	↑	↑
A3	Satisfied customers as basic prerequisite ²	↑	↓	↑	↑	↑	↑
A4	Innovation as criterion for competitiveness	↑	↑	↑	↑	↑	↑
A5	Premium companies	↑	↓	○	↑	↑	↑
A6	Component business	↑	○	↑	↓	○	↓
A7	Aftersales drive profitability	↑	↓	↑	○	↑	○
A8	Industry affiliation sets the pace	↑	↑	↑	↑	n/a	n/a
A9	Management incentives as key growth driver	↑	↑	↑	↑	↑	↑
A10	Labor productivity	↑	↑	n/a	n/a	n/a	n/a

1 The success pattern "Consistency in business model" is not part of the Danish analysis due to lack of data
 2 Impact of satisfied customers in Germany and Finland are based on the success pattern "Operational Excellence"
 SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 20

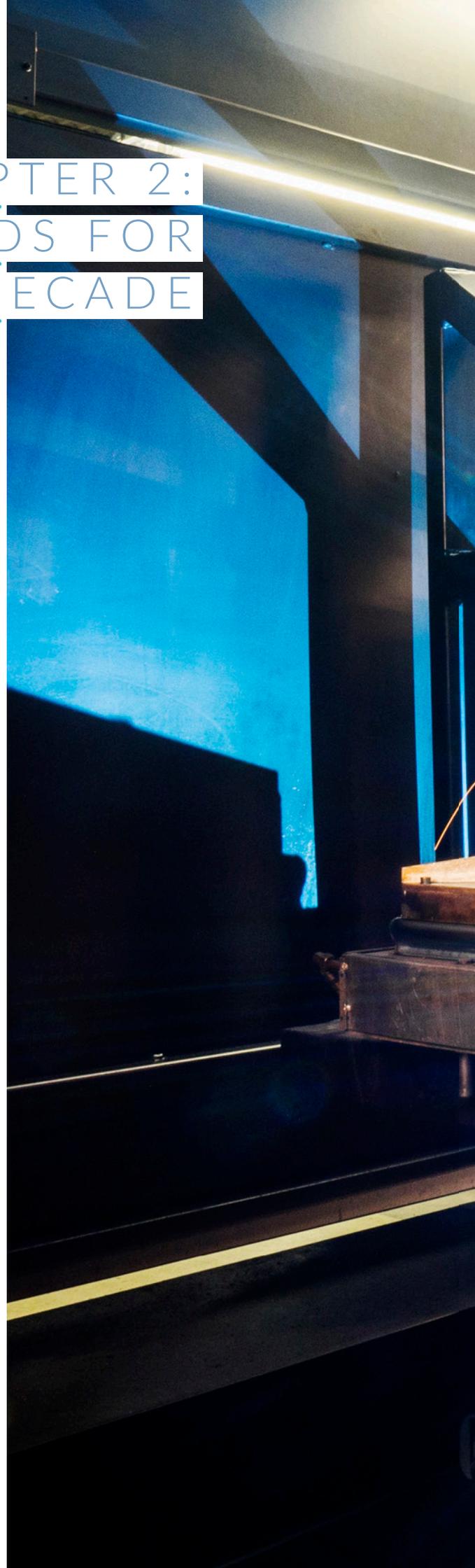
Danish companies focusing on premium products have higher profitability – a result also found for Finnish companies but not for German companies. However, German and Finnish companies focusing on premium products experience more growth. This could signal that Danish companies operating in the premium segment have been better at optimizing product cost structure and service level, but less able to find new high-growth markets.

The key message is that Danish manufacturing is as well positioned as German or Finnish manufacturing and should move forward with confidence.

CHAPTER 2: KEY TRENDS FOR THE NEXT DECADE



Building on the success patterns, the report outlines which trends Danish manufacturing companies perceive as likely to be most important in shaping the business environment over the coming decade.





This section outlines five trends that Danish manufacturing companies perceive as most important in shaping the Danish business environment over the next decade.

By combining an analysis of these trends with insights from the previous section, this report aims to construct an outlook for Danish manufacturing towards 2025 – laying the foundation for recommendations on factors to consider for the future.

Danish companies are generally optimistic about the years ahead. About 70 percent have a positive outlook and only 9 percent are pessimistic. This is also reflected in their understanding of key trends. On average, companies also see themselves as prepared to tackle the most important trends.

➔ Trends listed by perceived relevance

		⬆️ Opportunity / Prepared	⬇️ Risk / Not prepared	⚡ Large effect	○ Neither nor
The five trends that companies perceive most important and pressing going forward – focus of this chapter					
B1	 Increased demand for customer-specific system solutions and integrated services	⬆️⬆️			⬆️⬆️
B2	 Relative shift of demand to markets outside Europe	⬆️⬆️			⬆️
B3	 Rising and more volatile raw material costs		⬇️		○
B4	 Increasing importance of aftersales/service	⬆️⬆️			⬆️
B5	 Increasing environmental aspirations and requirements at both process and product levels	⬆️			⬆️
Two additional trends that is expected to be of major importance for the longer-term performance					
B6	 Shortage of engineers/skilled labor in Denmark		⬇️⬇️		⬇️
B7	 Disruptive technological innovations revolutionizing products or production processes	⬆️			○

SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 21

B1. Increased demand for customer-specific system solutions and integrated services



More than half of Danish manufacturing companies predict increased demand for customer-specific system solutions and integrated services.

Companies are planning to address the shift towards customized solutions.

More than half of Danish manufacturing companies predict increased demand for customer-specific system solutions and integrated services. This is in line with recent trends in Finland and Germany (see the end of the chapter for a comparison). It is also consistent with the ongoing internationalization of Danish companies (see section B2), implying that customer requirements are increasingly heterogeneous. Acknowledging the significance of this trend, 73 percent of companies plan to adjust their portfolio and provide more customer-specific solutions over the next three to five years. But the task is not easy, as indicated by the modest profitability of solution providers (success pattern A6). According to Danish companies, the task of improving customer-specific solutions is predicated on internal and external factors:

- Internally, companies will focus on building skills and adapting current products.** Some 58 percent of companies cite knowledge development as the most challenging obstacle to delivering customer-specific solutions. With that in mind, it will be important to develop technological capabilities. In any event, some 43 percent of surveyed companies are likely to tailor their current offerings rather than develop solutions from scratch. This is a way to manage complexity and cost, while ensuring a high degree of modularity and operational excellence.
- Externally, marketing and customer collaboration is imperative.** Almost half of companies see a key challenge in explaining the value of products to customers, and some 44 percent of companies are focused on generating demand, indicating that ensuring sufficient scale and protecting profitability continue to be important.

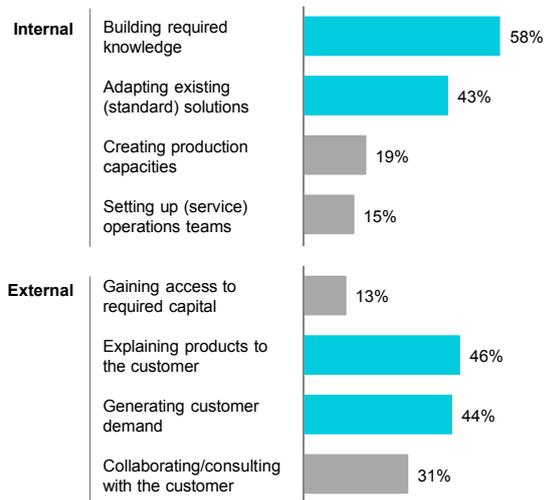
“We can never directly compete against the big component suppliers. Our strength is based on solutions and agility: integrating all the elements of the system.”

—Financial and Operating Officer,
Danish hi-tech equipment and service company

→ Key factors when developing customer-specific solutions

73%
of Danish manufacturers plan to adjust portfolio to include customer-specific solutions within the next 3-5 years

Key factors when developing customer specific solutions



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

B2. Relative shift of demand to markets outside Europe

Demand is anticipated to shift outside Europe.

Danish manufacturing is, to a large extent, an international business, with about 63 percent of revenues generated outside Denmark.⁷ When compared with other Danish industry sectors, manufacturing is second only to transportation as measured by participation in global value chains.⁸ Danish manufacturing is also more internationally connected than many rival European manufacturing sectors. Notably, about two thirds of exports are intermediate products that will be further processed before reaching the end customer.



Some 42 percent of respondents consider a demand shift to markets outside Europe a secular trend, and believe that the end customer is increasingly likely to be located in Asia or North America.

One impact of internationalization is that Danish manufacturing is highly affected by changes in foreign demand. Some 42 percent of respondents consider a demand shift to markets outside Europe a secular trend, and believe that the end customer is increasingly likely to be located in Asia or North America.

Although European markets continue to be important, 43 percent of sales in the global mechanical engineering industry are expected to come from the BRIC countries in 2017, up from 20 percent in 2002 and 39 percent in 2013.⁹ Like German companies, Danish firms perceive this to be more of an opportunity than a threat and feel well prepared for it.

Demand shifts will be driven by North America and Asia.

Some 41 percent of Danish industrial companies expect increasing demand from North America, fueled by demand similarities with Europe, “reindustrialization,” and Atlantic trade liberalization.¹⁰ Asia will also continue to gain prominence, and 35 percent of companies see China as a key driver of demand, while 39 percent see Asia excluding China and India as a key driver. This will be driven by growth in user industries as well as increasing demand for high-quality premium products supported by excellent service. However, it should be noted, that even within Europe there are also significant opportunities – especially in Eastern Europe

There may be opportunities for companies to seek growth opportunities in “alternative” emerging markets such as the ASEAN¹¹ countries. ASEAN, with its combined GDP of USD 2.4 trillion, is the world’s seventh largest economy, and by 2050, it is projected to be the fourth largest.¹²

7 Statistics Denmark, Statistical Yearbook 2015 – Business sectors.

8 Global value chain (GVC) participation rate – UNCTAD and OECD trade in value added (TIVA) database 2015. Summarizing up- and downstream value chain participation rates for all manufacturing subindustries and comparing across countries and main industries.

9 IHS data, December 2013.

10 The Transatlantic Trade and Investment Partnership.

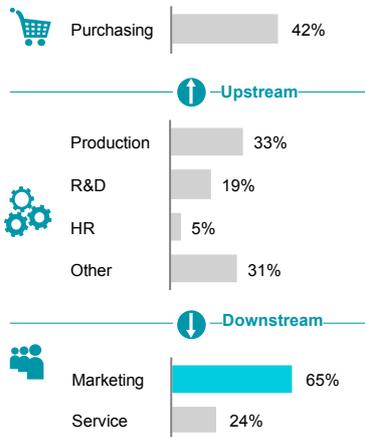
11 Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

12 Historical GDP figures from ASEAN. Forecasts from IHS.

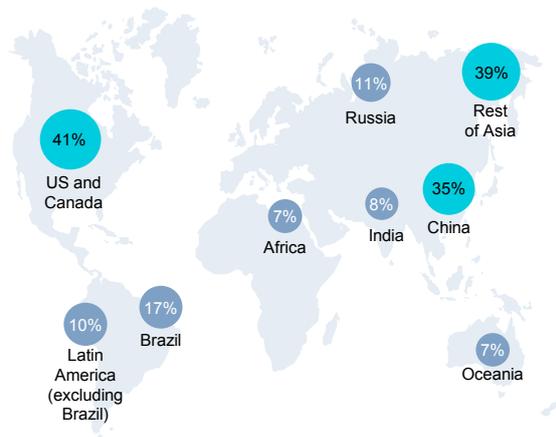
Key internationalization levers and important markets with a shift in demand

Percentage of respondents

Levers for internationalizing value chains



Most important markets with anticipated shift in demand to markets outside Europe



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 23

Companies will respond by increasing exports and internationalizing parts of their operations.

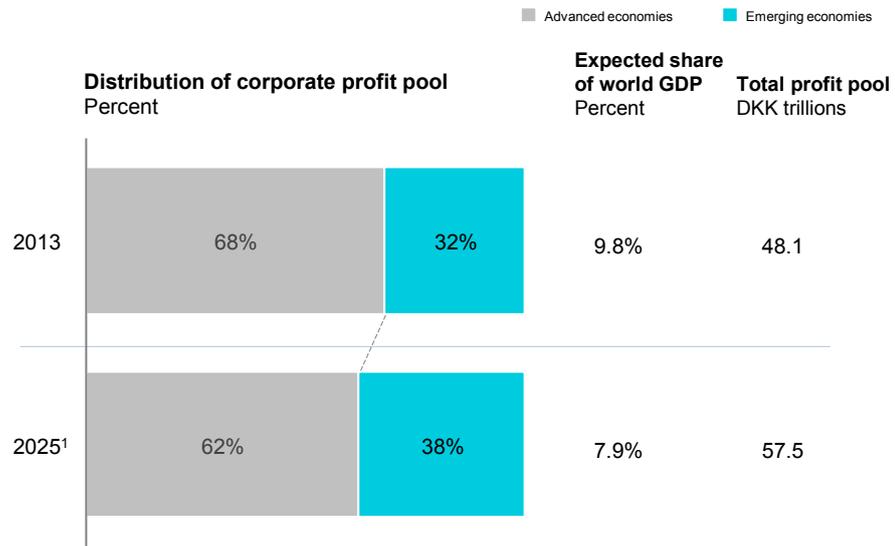
Of the companies that see a demand shift to markets outside Europe as a key trend, 58 percent will respond by increasing exports, while one-third will expand international value chains. Besides direct export to countries outside Europe, the focus on exporting domestic production reflects the fact that many Danish manufacturing companies serve foreign markets as subcontractors to large European original equipment makers. As such, keeping operations in Denmark ensures proximity to direct customers.

Most companies intend to move at least part of their operations abroad: 65 percent will move marketing and sales closer to markets driving demand growth, while 42 percent will internationalize procurement and 33 percent aim to internationalize production to reap cost advantages and move closer to markets. The share of companies focusing on internationalizing marketing and sales is greater among smaller companies, while larger companies focus more on internationalizing production and R&D. Only human resources is expected to remain in Denmark to a significant degree.

Few companies regard customer proximity in services and R&D as of primary importance.

Only 24 percent of Danish manufacturing companies expect to internationalize services and just 19 percent expect to internationalize R&D. Given the expected future importance of aftersales/services (see below), this might prove to be a challenging strategy. Moreover, when changes occur in non-European demand, local R&D might be valuable in reaping first-mover advantage and expanding market share.

Size and distribution of total corporate profit pool



¹ Based on projection regional and industry specific revenues and profit margins
 SOURCE: McKinsey Global Institute – Playing to Win, September 2015; Team analysis

EXHIBIT 24

Global corporate profit pool¹³ will follow shift in demand to markets outside Europe – emerging economies in particular.

Although Danish manufacturing companies view the shift of demand as an opportunity, there are related risks. In a recent study, the McKinsey Global Institute found that the high-demand growth in emerging markets has fueled the rise of aggressive emerging market competitors. Having established a foothold in their local markets, these companies are now ready to expand – threatening established western companies. In general, these companies are lean, risk taking, and rapidly expanding, in part through aggressive M&A strategies. As many of these are state- or family-owned, they can pursue long-term strategies, such as capturing market share by prioritizing revenue growth over short-term profits – a strategy public-owned western companies, with shareholders focused on quarterly earnings, might struggle to match.



In 2025, the total corporate profit pool is expected to shrink to 7.9 percent of world GDP, from 9.8 percent in 2013.

This intensifying competition is expected to contribute to shrinking of the global corporate profit pool, after almost three decades of record growth. In 2025, the total corporate profit pool is expected to shrink to 7.9 percent of world GDP, from 9.8 percent in 2013. Apart from increasing competition, it also seems like factors such as labor arbitrage and falling interest rates, which have previously acted as key growth drivers, are reaching their limits. As more companies will be fighting for a smaller slice of the pie, they will be under increasing pressure to become more agile and aggressive in their pursuit of new opportunities, innovative solutions, and productivity improvements that could help sustain and improve their market position.¹⁴

As a result, global profit pools will shift towards emerging markets, highlighting the importance of Danish companies (including manufactures) competing in those countries.

¹³ Worldwide aggregated corporate profits – not only manufacturing sector.

¹⁴ *Playing to Win*, McKinsey Global Institute, September 2015.

B3. Rising and more volatile raw material costs

Companies are generally less prepared for more volatile or rising commodity

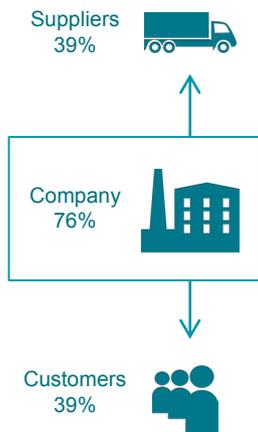
One-third of companies surveyed expect rising and more volatile raw material costs to be a key trend. That is in contrast to German and Finnish companies and might be driven by Denmark being a small, open economy with a limited supply of raw materials. It may also be due to the peak of the tension between Russia and Ukraine at the time of the Danish survey. In all three countries, however, the trend is perceived as a threat that companies do not consider themselves well prepared for.

Companies will be affected and will respond by driving efficiency.

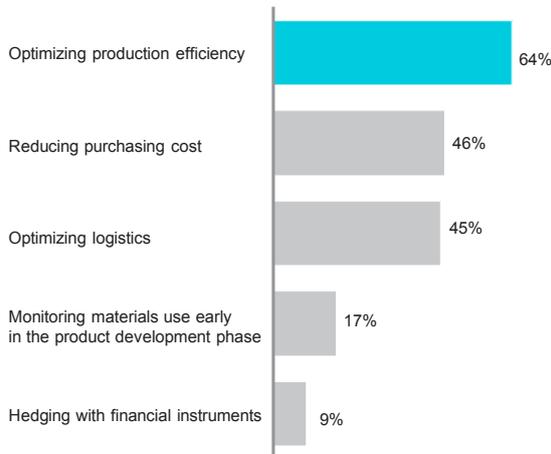
Some 76 percent of companies expect to be impacted by rising raw material costs, while 39 percent expect the impact to be borne by suppliers and likewise for customers. Companies will address the risk of more costly and volatile prices by focusing on continuous improvement, rather than using financial hedging: 64 percent of companies will make their operations more efficient, while 46 percent will cut costs in logistics, and 45 percent will seek to reduce purchasing costs.

➔ Actions to counteract the increasing cost of raw materials

Mainly affected by cost increase
Percent of respondents



Preferred actions to counteract increasing cost of raw materials
Percent



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

B4. The increasing importance of aftersales services

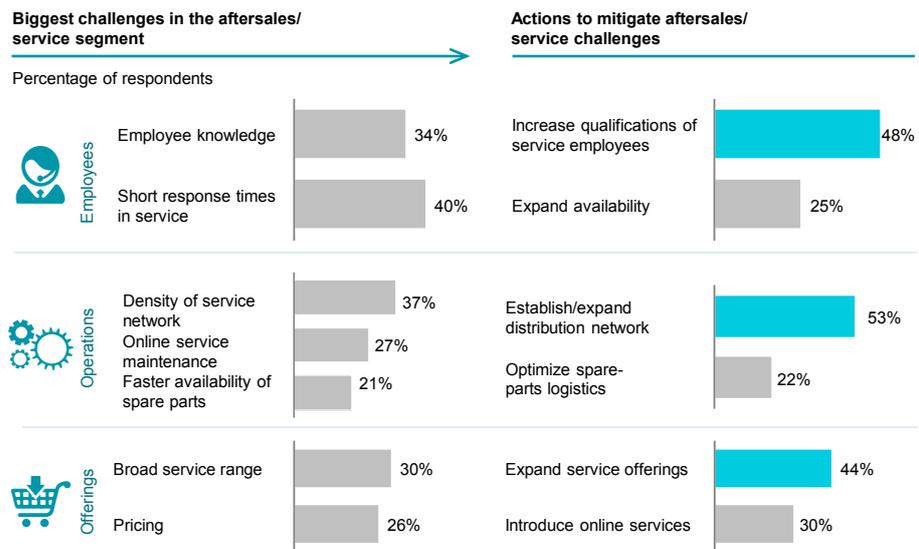
To exploit the aftersales opportunity, companies face markedly different challenges – and there is no one-size-fits-all solution.

Some 32 percent of companies expect the importance of aftersales/service to increase, despite its current weak link to better performance (success pattern A7) highlighting the potential to harvest profit pools in the areas which has not yet fully been realized. Furthermore, companies face markedly different challenges (Exhibit 26). One common theme seems to be a lack of resources to deliver on the opportunity, which manifests itself in long response times (40 percent), fragmented service networks (37 percent), a lack of employee skills and knowledge (34 percent), and a service offering that is too narrow (30 percent).

“Customers want a total cost to operate. This will be a source of success in the future.”

—Financial and Operating Officer,
Danish hi-tech equipment and service company

➔ Aftersales challenges and mitigation actions



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 26

Three main actions are identified as responses to the challenges.

The companies highlight a number of strategies to drive up the low share of revenue from the aftersales/service segment on which companies and policy makers should focus. This indicates that an industrywide best-practice model has not been established. The following three courses of action are widely cited:

- **Establishing/expanding distribution networks to sell aftersales/service.** Some 53 percent will focus on establishing or expanding their existing aftersales/service network (the most cited action). The focus on the aftersales/service network reflects the importance of customer proximity, ensuring fast availability of spare parts and undermining providers of replica parts.
- **Boosting employee qualifications and acknowledging the skill gap between aftersales/service and production.** Some 48 percent of respondents will take action to boost service employee qualifications and build capabilities.
- **Developing new service offerings to better meet customer demand.** Some 44 percent of respondents will expand their service offerings, recognizing that the weak link between aftersales/service and company performance (see success pattern A7) indicates a lack of willingness to pay a premium for current offerings. It is recommended that the expansion of service offerings is predicated on securing well-qualified service staff.

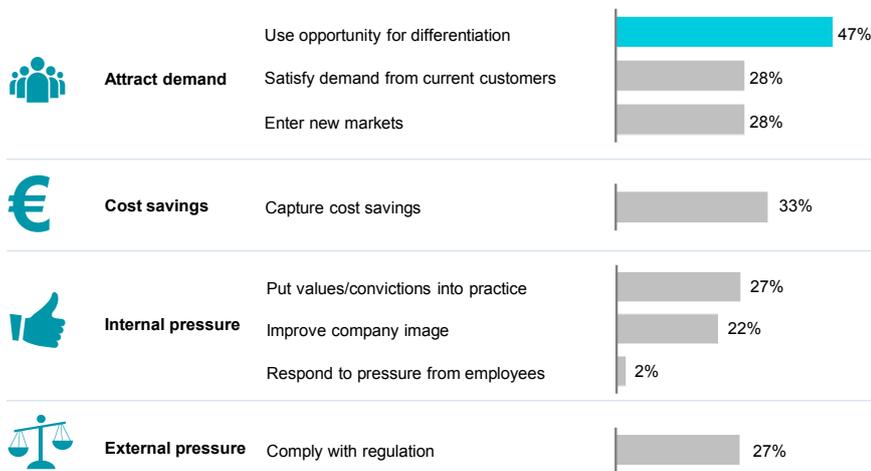
B5. Increasing environmental aspirations and requirements

Green technology and circular business models are a commercial opportunity.

Danish companies perceive higher environmental aspirations on the part of customers, regulators, and employees as a key trend and an opportunity to boost business. This may be achieved by attracting new demand, primarily by differentiation, and driving cost savings. Given an environmentally aware labor force and high levels of innovation, Danish manufacturing companies are ideally positioned to take advantage of this opportunity, leveraging and reinforcing the “Made in Denmark” label, associated with green and sustainable solutions.

➔ Motivation for focusing on green technologies

Motivation for focusing on green technologies
Percentage of respondents



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 27

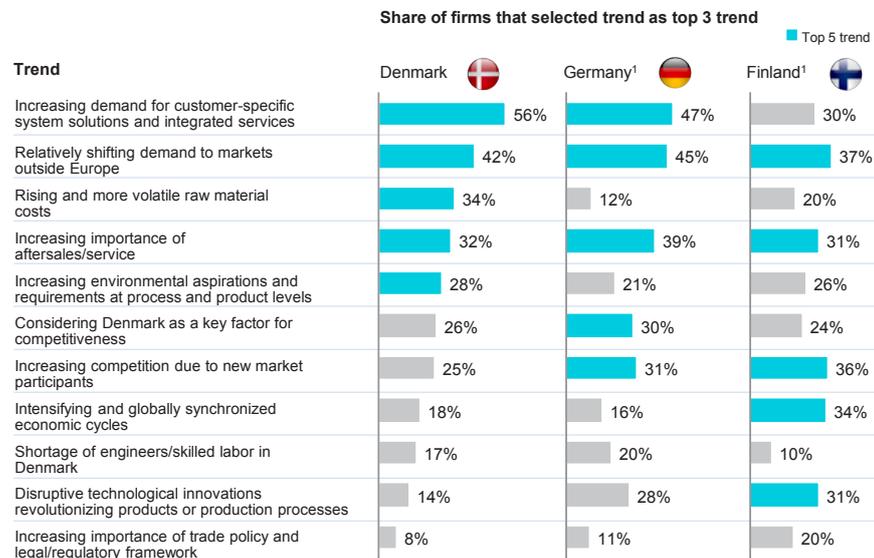
As the main motivation is differentiation, companies focus on products rather than processes

Manufacturing companies have a stronger focus on producing green products, cited by 69 percent, than producing them in a green manner, cited by 31 percent. Green products are the foundation of perceived differentiation, while green internal processes are often invisible to customers.

Comparison with Germany and Finland

Comparing the Danish analysis with studies in Germany and Finland, Danish manufacturing companies' views on future trends are aligned with those of their German peers, while Finnish companies prioritize somewhat differently.

Comparing trend prioritization of companies in Denmark, Germany, and Finland



¹ Benchmark is scaled to match Danish survey

SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 28

Danish companies have focused significantly more on rising and more volatile raw material costs and significantly less on disruptive innovations. Since the focus on rising and more volatile raw material costs might be born out of the timing of the Danish survey, which took place during a time of tensions between Russia and Ukraine and in a volatile oil price environment, no further explanation will be sought for this difference.

Although Danish companies regard innovation in general as important going forward (as exemplified by the focus on new customized solutions), few consider disruptive technological innovation an important trend. This is in contrast to both German and Finnish peers and is somewhat surprising given the widely held view that disruptive technologies are set to have a major impact on the industrial sector in the years ahead.

Overall, Danish manufacturing companies expect profound changes in the business environment over the next decade, which will call for collaboration between all stakeholders.

CHAPTER 3: ACTION AREAS



Based on expert insights and analyses of key intersections between the above success patterns and future trends, the report identifies five action areas. These are the key areas on which companies and policy makers must focus to sustain the current position of Danish manufacturing.

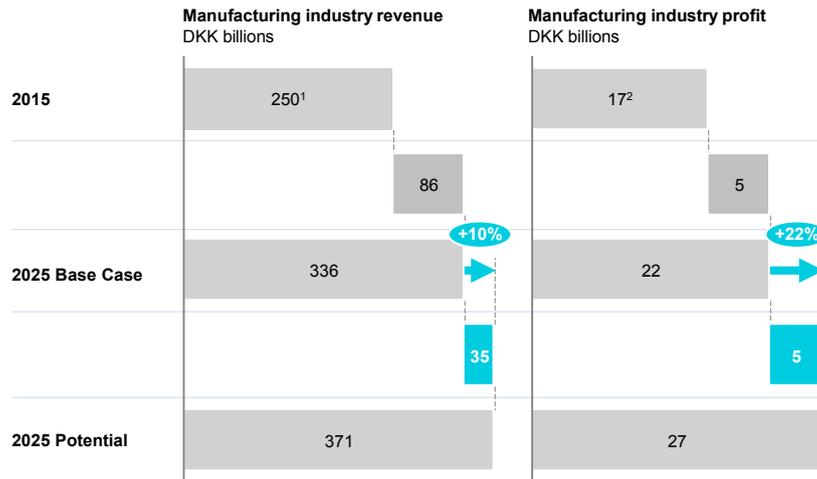


The analysis in this report has shed light on the trends that have driven the success of Danish manufacturers and will impact their operating environment in the years to come. For the vast majority of companies, acting according to these success patterns and trends could lift performance considerably. The potential for Danish manufacturing is estimated to be an additional DKK 35 billion in revenue and DKK 5 billion in profits by 2025 (Exhibit 29).

Estimation of 2025 potential

Billion DKK

ROUGH ESTIMATE



¹ Calculated by extrapolating industry revenue in 2013 with avg. 2000 - 13 nominal industry growth rate
² Calculated by multiplying current profitability with 2015 revenue

SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 29

To realize this potential, insights from the previous sections together with expert insights have been compiled into five key action areas on which companies should focus:

1. Targeted internationalization with an emphasis on premium products
2. Investment in disruptive technologies to drive innovation
3. Customized solutions built on modularization
4. Expanded aftersales/service offerings
5. Circular products and business models.

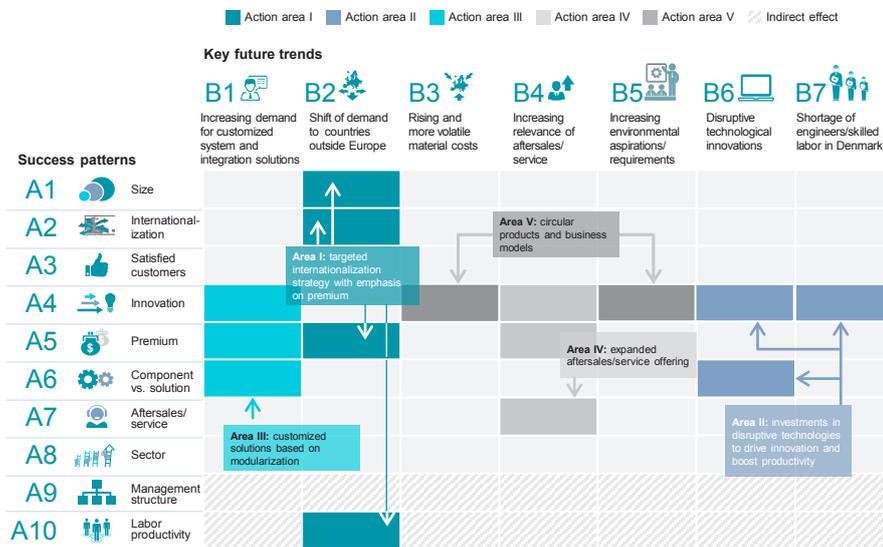


A potential reason for the relative lack of concern over the skills shortage is that companies regard the issue as beyond their control and in the hands of policy makers.

Exhibit 30 maps the primary interactions between the success patterns identified in section 1, the trends identified in section 2, and the five recommended responses highlighted in this section.

The exhibit includes two additional trends: the shortage of engineers and skilled personnel in Denmark (for which companies are ill prepared) and a general lack of concern over disruptive technologies. A potential reason for the relative lack of concern over the skills shortage is that companies regard the issue as beyond their control and in the hands of policy makers. Disruptive technology has not been at the top of the national agenda in Denmark in recent years (unlike in Germany), which probably explains the relatively low ranking of that trend. However, both issues will likely shape the competitive landscape going forward.¹⁵

Action areas emerge in the interaction between success patterns and trends



SOURCE: Dansk Industri (Fremstillingsindustrien) and McKinsey survey 2015; Team analysis

EXHIBIT 30

Each action area is explored in detail below, encompassing strategies for companies and policy makers to consider.

The guidelines are based on multiple interviews with industry experts together with the extensive knowledge and different perspectives of The Confederation of Danish Industry, The Tuborg Research Centre for Globalization and Firms at Aarhus University, and the McKinsey Global Institute.

1. Targeted internationalization with an emphasis on premium products

The most internationalized Danish manufacturing companies are more profitable and exhibit stronger growth. As companies go through the process of internationalization, they are recommended to take a granular and gradual approach and to target and/or protect the premium segments in their categories. Policy makers can support companies by backing export-driven growth and attracting FDI and qualified foreign labor.

Actions for companies:

- **Granular prioritization of geographical areas.** Successful internationalization requires a focused prioritization of target markets. A granular approach is important because prioritization is not just about national borders. For example, megacities¹⁶ will dramatically increase in importance, and the world's 600 largest cities are expected to account for more than 60 percent of global GDP growth over the next decade.¹⁷ In order to prioritize geographical opportunities, companies must evaluate a number of key criteria. Market growth is relevant because it is easier to expand in a growing market than by acquiring market share from competitors.



A granular approach is important because prioritization is not just about national borders.

16 Cities with a nominal GDP over DKK 1 trillion.

17 McKinsey CityScope research.



For Western Europe, it makes sense to invest in local sales and service networks due to a high share of medium and premium offerings, uniform cost structures, and low restrictions on imports.

Other important criteria include expected market share, barriers to entry (such as the need for production modifications), political stability, and legal framework.

- **Internationalize gradually and choose a method depending on the market.** Given a clear prioritization of markets, successful internationalization is usually driven through gradual development. Naturally, the preferred entry mode will differ by company size and importance of the market. For Western Europe, it makes sense to invest in local sales and service networks due to a high share of medium and premium offerings, uniform cost structures, and low restrictions on imports. In markets with significantly different product and price requirements, production costs, and regulatory hurdles, it might make more sense to invest in a full local value chain.
- **Target and/or protect premium markets.** Internationalization is particularly important for premium players, which can reach critical scale by gaining access to global niche markets. Furthermore, with increased competition in volume markets, and growing demand for high-end solutions, particularly from emerging markets, manufacturing companies should consider moving towards international premium segments, which often require more knowledge-based solutions. This means mapping out what is required, for example, an extensive offering, a network of maintenance and aftersales services, and preparedness to offer tailored solutions. Companies must then translate those high-level considerations into operational requirements for products, marketing, and services for each city/country.
- **Danish manufacturing should position itself for growth in emerging markets.** Emerging markets will become increasingly important over the next decade. Of the 600 largest cities in 2025, 440 are predicted to be in emerging markets. For those 440 cities, annual consumption is set to rise by USD 10 trillion over the period. Danish manufacturers should position themselves to take advantage of this fact and build links to companies serving customers in those locations.

Although many of the current global leaders are based in European countries, production may increasingly migrate to mirror the shift in demand. The 440 megacities in emerging markets are expected to contribute 47 percent of global GDP growth in 2025. Furthermore, global corporate profit pools¹⁸ are expected to shift towards emerging markets, which will account for 38 percent of global profits by 2025, compared with 32 percent today (trend B2).¹⁹ As a result, companies relevant to Danish manufacturing will increasingly be located in emerging markets. Competition is also expected to decrease the global corporate profit pool's share of GDP, emphasizing the need for Danish manufacturing firms to develop their relationships. Danish subcontractors, which produce about two-thirds of total manufacturing exports, should also aim to build relationships in due course.

¹⁸ Worldwide aggregated corporate profits.

¹⁹ *Playing to Win*, McKinsey Global Institute, September 2015.

Targeted internationalization strategy with an emphasis on premium markets

	Don't	Do
Companies	Develop prioritization only on a nationwide level	Granularly prioritize geographical areas by paying attention to evolving mega cities
	Skip development stages when entering markets	Internationalize gradually from exporting to a global value chain – tailoring intermediate steps to each specific market
	Try to compete internationally solely in low-margin volume markets	Protect or move towards premium markets by mapping customer requirements for offering, service, etc.
Policy makers	Disregard the potential in attracting foreign investments and omit initiatives to help companies attract foreign labor	Attract foreign direct investment and qualified labor to boost productivity and ease the internationalization process
	Think that internationalization will happen automatically and scale down on supporting initiatives	Continue drive to support export growth by, e.g., expanding the policy toolbox to support export of systems and solutions

SOURCE: Team analysis

EXHIBIT 31

Actions for policy makers:

- Continue to support export-driven growth.** Policy makers should continue to support export-driven growth and internationalization by, for example, expanding export support to system solutions (that is, the ability to offer export financing to *projektselskaber* as suggested by *Produktionspanelet*) and ensuring the implementation of initiatives through *Regeringens strategi for eksportfremme og økonomisk diplomati* or similar.
- Attract foreign direct investment and qualified foreign labor.** Foreign investors and employees contribute to a more international environment, easing a subsequent internationalization process. Furthermore, research shows that foreign labor in sectors with a large amount of foreign trade, and FDI in general, supports performance.²⁰ Foreign-controlled enterprises in Denmark showed a positive employment CAGR of 1.7 percent from 2004 to 2012, while employment in Danish-controlled enterprises showed a negative CAGR of 0.9 percent in the same period. In light of this, it is unfortunate that Denmark's inbound FDI flows still lag its outbound FDI flows,²¹ partly explained by the fact that Denmark is more restrictive with respect to inbound FDI than, for example, Germany or Finland.²² In the coming years, Danish policy makers will play a crucial role in attracting FDI and qualified foreign labor.
- Ensure sufficient growth capital.** Entrepreneurs and smaller companies in the manufacturing industry need capital to invest and grow internationally, but find it more difficult to raise finances than their larger counterparts. As highlighted by *Produktionspanelet*, it is key that enough growth capital and guarantees continue to be available, e.g., through *Vækstfonden*.



Foreign investors and employees contribute to a more international environment, easing a subsequent internationalization process.

20 See, for example, *Konkurrence, Internationalisering og Regulering* from The Danish Productivity Commission.

21 Statistics Denmark.

22 OECD Index 2012.

2. Investment in disruptive technologies to drive innovation and boost productivity

Being an innovation leader is key for profitability among Danish manufacturing companies as it allows firms to charge a premium and cuts costs through productivity improvements. Surprisingly, Danish manufacturing does not seem to be overly concerned by emerging disruptive technologies. This report finds that companies should take notice of the potential of technology to deliver benefits, including the digitization of operations and products, new manufacturing processes and product features, insights from big data, the industrial Internet, and additive manufacturing. Policy makers can support companies aspiring to exploit technology by putting Industry 4.0²³ on the national agenda, improving the absorption of knowledge generated by universities, and driving entrepreneurship.



In general, Danish manufacturers invest a smaller fraction of revenue in R&D compared to European peers such as Germany, Sweden and United Kingdom.

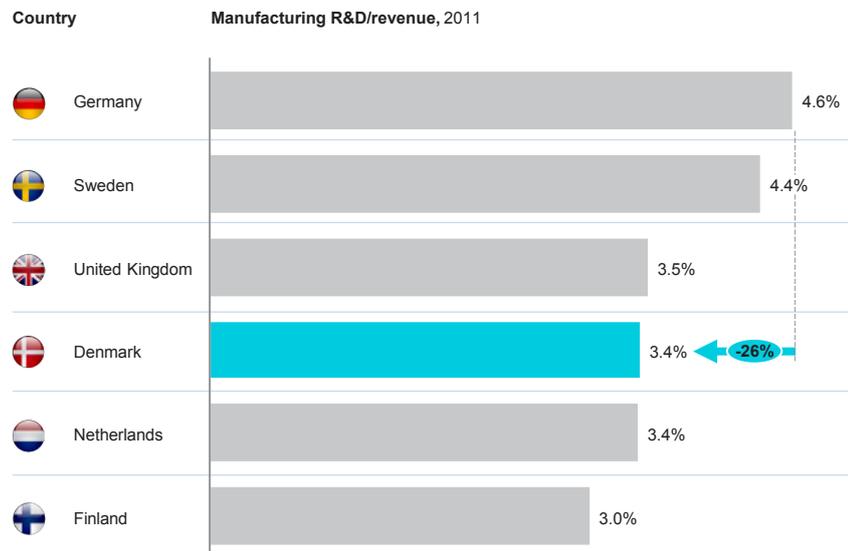
Actions for companies:

- Develop a clear innovation strategy, considering the R&D spend of European peers.**
 In general, Danish manufacturers invest a smaller fraction of revenue in R&D compared to European peers such as Germany, Sweden, and the United Kingdom (Exhibit 32). Looking at the number of patents granted to manufacturers in each country (a measure of R&D output), the pattern is the same.²⁴

To avoid long-term consequences on competitiveness, Danish manufacturers in general should therefore develop a clear innovation strategy. As evident from success pattern A4, simply increasing R&D spending might not be the optimal solution. Instead, an effective innovation strategy might entail increasing focus on disruptive technologies, leveraging digitization opportunities, restructuring current innovation processes around customer needs, and/or reviewing the entire business model. Each of these is described in detail below.



Manufacturing R&D spending by country



SOURCE: OECD Statistics

EXHIBIT 32

23 A collective term for a number of technologies and concepts targeted the fourth industrial revolution.

24 OECD Statistics.

- **Monitor the potential of disruptive technologies.** Just 16 percent of the companies analyzed prioritize the awareness of disruptive technological innovations. The companies that have acknowledged the trend have some distinct characteristics. They are on average approximately 1 percentage point more profitable, almost twice as big (measured by annual revenue), have a ratio of international sales that is approximately 20 percentage points higher, and invest approximately 3.5 percentage points more of their annual revenue in R&D.

Larger companies should enable their own R&D teams to do the monitoring by, for example, hiring skilled employees and/or collaborating to gain access to expertise. Smaller companies can keep up with developments through knowledge networks in Denmark.²⁵ What should manufacturing companies look out for? There are four broad enabling clusters:

- I. Data, computational power, and connectivity – for example, low power, wide-area networks
- II. Analytics and intelligence
- III. Human-machine interaction, comprising, for instance, touch interfaces and augmented reality
- IV. Digital-to-physical conversion, including advanced robotics and 3-D printing.

These enablers are at a tipping point and now is the time for manufacturing companies to decide how to respond.

- **Own the platforms of the future.** As it is clear from section B, future demand will lead to an increasing shift towards solutions. Such solutions are often based on both products and services, often through the collaboration of more than one provider – as seen in, e.g., smart homes and smart cities. For these products and services to interlink, the underlying platform becomes the critical factor. As it is already evident in the markets of, e.g., accommodation, travel, and even transportation, owning the platform may turn out to be tremendously more profitable than delivering the embedded services and products. The head of the German Academy of Science and Engineering (acatech), Henning Kagermann, put it like this: “Whoever controls the platforms will rule the future”.²⁶ Disruptive technologies such as digitization ease the information flow between products and thus pave the way for companies to become first movers on the new platforms of the future. Danish manufactures could and should exploit these opportunities to establish platform ownership and thereby enhance opportunities to market products, exploit new sources of revenue from adjacent services, and preempt competition from, e.g., emerging market players and technology companies. Examples of existing initiatives in this direction include General Electric’s Predix platform, Bosch’s IoT Suite, and Trumpf’s Axiom platform.
- **Drive productivity improvements through, for example, digitization.** Investment in disruptive technology and innovation can boost productivity, if related technological advances are continuously incorporated in key processes and operations. A recent analysis showed a productivity gain of 18 percent by implementing all economically feasible production automations within two years.²⁷ The inner circle in Exhibit 33 shows eight key value drivers that will significantly impact the productivity of manufacturing companies and should guide the continuous improvement effort.

Digitization is an important example of how continuous productivity improvements can be realized through technology. The outer circle on Exhibit 33 shows digitization levers for each of the eight value drivers, based on McKinsey research.²⁸



Digitization is an important example of how continuous productivity improvements can be realized through technology.

²⁵ One example of this is MADE – Manufacturing Academy of Denmark.

²⁶ *The Economist* – Does Deutschland do digital?, November 21, 2015.

²⁷ *Automatisering i industrien*, IDA 2014.

²⁸ *Industry 4.0: How to navigate digitization of the manufacturing sector*, McKinsey Digital, April 2015.



In general, productivity improvements that are continuously incorporated and broadly applied over long time horizons can help companies attain a pivotal competitive edge.

In one example, companies can boost asset utilization by using data and advanced analytics to increase routing and machine flexibility. In another, remote monitoring and control, alongside tools for predictive maintenance and augmented reality, can help drive operational asset efficiency.

Optimization approaches vary between brownfield and greenfield sites. At the former, value lies in end-to-end optimization of the “digital thread” (that is, making better use of information not captured/made available/used today) and in eliminating inefficiencies caused by information loss at the interface of functions, sites, and companies. Companies can invest in “plants-of-the-future” ranging from fully digitized and automated production centers for large scale production to “E-plants in a box” geared to niche and remote markets. These small-scale, low-capex, mobile plants are designed to produce a limited range of products at a competitive cost.

Productivity improvements go beyond what may be harvested through digitization. In general, productivity improvements that are continuously incorporated and broadly applied over long time horizons can help companies attain a pivotal competitive edge (as shown in section A10). Striving for continuous productivity improvements is thus a key driver of long-term success.

➔ Eight value drivers from digitization for manufacturing companies

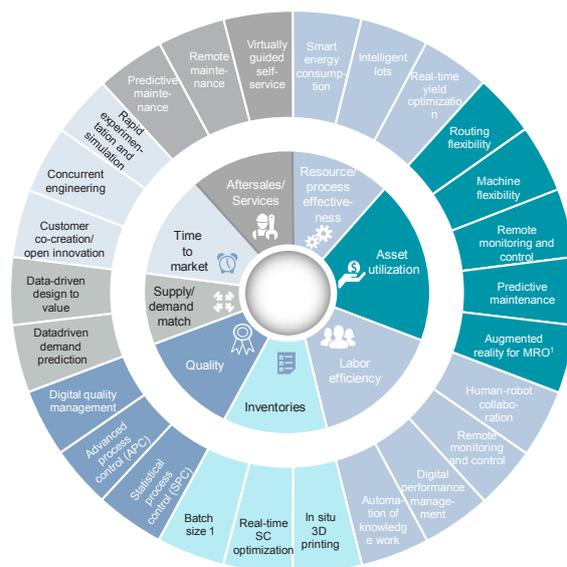


EXHIBIT 33

SOURCE: McKinsey Industry 4.0 Knowledge Investment Project; Team analysis

- Look externally when developing products and sourcing technology.** To remain competitive in the premium segment, new technology may be necessary in both products and services. However, in adopting technology, companies should always ensure that the value as perceived by the customer is greater than the cost of the investment. One way to do that is to collaborate with customers during the development process. For companies new to the idea of including customers in product development, it makes sense to initially involve them in product adaptations before drawing them into larger and more complex development processes. When internationalizing, it can be helpful to involve local core customers to ensure the fulfillment of local needs. When sourcing technology, companies should consider licensing agreements, as well as partnerships and in some cases acquisitions, rather than developing in-house.

- **Adapt business models to capture shifting value pools.** Disruptive technologies will drive change in business models across industries and business types. For Danish manufacturing companies, this implies reviewing current assets and deciding which areas of the value chain they need to control and which areas are being commoditized, and may be ignored. Companies should explore the opportunities presented by new business models, including as-a-service offerings (for example, pay-by-usage or subscription, turning manufacturing from capex to opex for manufacturers), the monetization of platforms (for example, technology or broker platforms), the licensing of intellectual property rights, consulting services, and data-related businesses.

 **Investment in disruptive technologies to drive innovation and boost productivity**

	Don't	Do
Companies	Underestimate the long-term potential of disruptive technologies	Monitor development and evaluate potential in disruptive technologies
	Use a piecemeal approach to driving operational efficiency through disruptive technologies	Drive the next horizon of operational effectiveness with a systematic approach utilizing benefits from digitization
	Strive towards technologically superior products without reflecting customer requirements ("overengineering")	Collaborate closely with customers to test technologies and business models
Policy makers	Think that protectionist measures will benefit Danish companies' long-term survival prospects	Take proactive measures to attract global innovational leaders to Denmark to insure an innovational spillover to Danish companies
	Excuse lack of ambitious innovation initiatives with the relative size of the Danish economy compared to, e.g., Germany	Put Industry 4.0 at the front of the national agenda with inspiration from Germany

SOURCE: Team analysis

EXHIBIT 34

Actions for policy makers:

- **Put Industry 4.0 on the national agenda.** For Denmark to be at the frontier of the ongoing fourth industrial revolution, Industry 4.0 initiatives²⁹ need to be moved to the forefront of the national agenda. Even with the establishment of *Innovationsfonden* and recent proposals to invest DKK 100 million in advanced production, Denmark is still lagging some countries. The German Federal Government recently launched a nationwide high-tech strategy with initiatives in areas such as strengthening collaboration between universities, companies, and research institutions, simplifying innovation funding for SMEs, and increasing government participation in coordinating a framework for Industry 4.0 initiatives. As part of this strategy, EUR 200 million (approximately DKK 1.5 billion) has been set aside specifically for Industry 4.0 initiatives, in areas including intracompany production logistics, human-machine interaction, and the use of 3-D in industrial applications.³⁰ For Denmark to sustain or improve its current innovation position, policy makers must be equally as ambitious.



For Denmark to be at the frontier of the ongoing fourth industrial revolution, Industry 4.0 initiatives need to be moved to the forefront of the national agenda.

29 A collective term for a number of technologies and concepts targeted the fourth industrial revolution

30 Federal Ministry of Education and Research, Germany



It is recommended that Denmark aims to educate more students from both 'Erhvervskoler' and higher education with broad skills in the natural sciences, as well as university graduates, with a particular focus on production development.

- **Increase knowledge generation by focusing on education and R&D.** Despite being the second most innovative European country according to the latest EU analysis,³¹ Denmark performs modestly in terms of human resources (ranking 12th out of 28).³² Upper secondary level education and non-EU doctorate training are two of four areas in which Denmark is lagging its European peers. A recent survey revealed that only 25 percent of companies utilize robotics, with a major barrier being a lack of skilled labor.³³ It is recommended that Denmark aims to educate more students from both *Erhvervskoler* and higher education with broad skills in the natural sciences, as well as university graduates, with a particular focus on production development.

Furthermore, Denmark needs to increase investment in R&D to foster innovation. In 2013, Denmark invested 3.08 percent of GDP in R&D, which just meets the EU's Barcelona objective of investing 3 percent of GDP in R&D. Of total public R&D spending, technical sciences received 15 percent, compared to 37 percent for health sciences in the same year.³⁴ A more ambitious R&D agenda could be pursued by increasing public investment in technical research, and in particular by boosting funding for research in production technology, materials, and digitization. Policy makers could also incentivize SMEs to invest more in R&D.

- **Improve the absorption of university-generated knowledge into companies.** Given the pace of innovation, companies need to make more effort to leverage human capital in universities. Students pursuing a master's degree or PhD can help companies understand and take advantage of the latest research. Currently only 20 percent of employees in Danish companies have a higher education qualification – significantly below Sweden (25 percent), Finland (30 percent), and Belgium (35 percent). In addition, ongoing skills development among employees by, for example, collaborating with knowledge institutions, could help keep companies at the innovation frontier.

Another lever backed by the OECD is more recognition of researchers participating in the commercialization of knowledge. Other initiatives, backed by the Danish Energy Agency (DEA),³⁵ include a national TTO³⁶ that complements local TTOs, special staff in the researcher community focused on guiding research aimed at commercialization, and greater inclusion of students in collaborating with the business community.

- **Drive entrepreneurship in the manufacturing industry.** Entrepreneurship must be stimulated in the manufacturing industry, with the aim of exploiting disruptive innovation. For *Vækstfonden*, *Innovationsfonden* and the four innovation environments³⁷ offered by the Ministry of Higher Education and Science, only about 9 percent of investment is focused on industrial technologies and production.
- **Take proactive measures to attract global innovation leaders to Denmark.** Policy makers should endeavor to make Denmark an attractive location for disruptive pilot projects, aiming to attract global innovational leaders. Policy makers must work against protectionism by avoiding rigid regulation that creates inertia.

31 Innovation Union Scoreboard 2015, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf

32 Measured by number of new doctorate students, population aged 30-34 with tertiary education and youth with at least upper secondary education

33 "Robotter I global kamp", Danish Technological Institute 2015

34 Statistics Denmark.

35 From research to invoice, 2013.

36 Technology Transfer Office.

37 Pre-Seed Innovation A/S, Syddansk Teknologisk Innovation A/S, CAPNOVA A/S, and Borean Innovation A/S.

3. Customized solutions based on modularization

Danish manufacturing companies agree that the demand for customized systems and integrated solutions will be the most important trend going forward, particularly in emerging markets, where local players are gaining market share in commoditized components. Companies should root their approach in a solid understanding of the solutions that customers in their segment require. Thereafter, standardization and modularization can be applied to deliver customization through a less complex portfolio, with lower variance and cost. Policy makers can support manufacturing by encouraging knowledge development and dissemination and working for the mutual recognition of standards across Europe.

Actions for companies:

- **Design solutions rooted in customer needs.** It all starts with the customer. As underlined in action area 2, companies should prioritize technological solutions that cater to the needs of customers in their target geographies and segments, involving customers in the development process. Additionally a product management team connecting sales and development can help meet customer needs through technological solutions. To avoid drowning in complexity, product design should be based on a tailored modularization strategy.
- **Find the right level of standardization.** Standardization should be implemented on a selective basis, with companies choosing a suitable standardization level for each component. This can be achieved using a platform strategy, meaning a large number of identical parts form a “platform” onto which individual product designs can be bolted. The high number of common parts creates synergies in purchasing, production, development, and tool use, while product quality and response times also improve.
- **Drive the overall concept across the value chain.** Companies often give in to the temptation to standardize incrementally. However, modularization only realizes full cost and complexity reduction potential when applied across the value chain. In this case, the number of customized variants is reduced, which means less time spent on product development and sales. Furthermore, a more modular product structure allows for greater scale in purchasing, simplified production, lower inventories, and higher overall quality.
- **Price nonstandard solutions transparently.** When companies accept every development request from a customer, it drives development costs. Using standard modules can offset those costs. With modules, variants can be developed rather cheaply, due to standardized interfaces. New modules should be priced transparently, which also means that the price of standard offerings will tend to be higher because customers do not need to factor in subsequent small tweaks.
- **Stringently manage the delivery of customized solutions.** One of the central challenges in customizing solutions is managing project delivery. Companies can address the issue through a stringent and risk-differentiated approach to project management. This might entail:
 - Prioritizing projects by (technical) complexity and business relevance
 - Assigning project managers according to their skill sets and the nature of the project
 - Using standard processes with clear responsibilities and milestones
 - Keeping management informed of progress and costs
 - Using “freeze dates” beyond which change requests from customers are not accommodated.



Companies often give in to the temptation to standardize incrementally. However, modularization only realizes full cost and complexity reduction when applied across the value chain.

 Customized solutions based on standardization and modularization

	Don't	Do
Companies	Believe that customized solutions and standardization are opposites	Create modular offerings deeply rooted in customer needs , e.g., via central product management
	Implement selective modularization and standardization of individual products and process steps	Implement modularization as part of overall concept for the entire value chain
	Believe that standardization is not feasible for solutions business	Establish the necessary organization and processes , e.g., via platform leads
Policy makers	Think that knowledge development in companies will happen automatically and scale down on supporting initiatives	Stimulate knowledge development by building expert capabilities in knowledge-supporting institutions
	Disregard the adverse impact of local standards on companies' growth opportunities	Ensure mutual recognition of standards in Europe while eliminating incompatible standards in Denmark

SOURCE: Team analysis

EXHIBIT 35

Actions for policy makers:

- **Stimulate knowledge development.** Policy makers can support manufacturers by stimulating knowledge development and dissemination. This could comprise, for example, building expert capabilities in selected institutions so they are able to advise companies on solution development, standardization, and modularization.
- **Ensure mutual recognition of standards across Europe.** Policy makers can push for mutual recognition of standards across Europe, while eliminating incompatible standards in Denmark. This will ensure growth opportunities for Danish companies as they expand to other European markets. In the eventual case of a transatlantic trade agreement, similar agreements can be incorporated.

4. Expanded aftersales/service offering

Danish manufacturers regard aftersales/service as of increasing importance. For companies to capture the opportunity, they must root their offering and pricing in customer needs and invest in the required infrastructure and organizational setup. Policy makers can assist by supporting knowledge development, establishing minimum requirements for aftersales/service content in public tenders, and improving European service directives.

Actions for companies:

- **Create a customized aftersales/service offering.** To identify the right aftersales/service package for each segment, companies must assess how they differ with respect to product reliability (for example, cost if a machine fails or safety risks), value, size, global presence, and other factors related to service. Based on this assessment, the offering for each segment can be shaped by adjusting parameters including international availability, response time, price, and/or quality. When crafting the offering, it is particularly important to consider some of the disruptive technologies mentioned in action area 2. Operational data can be analyzed to increase yield or reduce downtime and maintenance costs. To successfully market a more comprehensive aftersales/service offering, it is important to emphasize customer benefits by, for example, explaining lower lifecycle costs and by using alternative business and pricing models such as performance-based pricing or subscriptions.
- **Establish a cost-effective service network.** Mastering the fundamentals of aftersales operations creates the foundation for expanding the business. However, this is particularly challenging for small companies and firms in the process of internationalization. When developing an international service network, companies should consider low-cost alternatives to a fully fledged in-house service network. Such alternatives include collaborating with other manufacturing companies and specialized service providers and mobile service stations.
- **Excel at spare parts management.** There are opportunities for manufacturers to increase efficiency in spare parts management. The fundamental principle for success is to handle spare parts according to volume and predictability of demand, yielding four segments. Low- and high-volume parts with predictable demand should be handled through regular production. Low-volume parts with unpredictable demand should be handled by establishing minimum holding stocks in warehouses. High-volume parts where demand is hard to predict may be best assembled-to-order and shipped. Finally, some manufacturing companies have third-party providers for their spare parts business, which can be managed through the destandardization of key parts or by offering cheaper parts via a multibrand strategy.
- **Run a professional aftersales/service business unit.** If manufacturing companies wish to succeed in increasing aftersales/service revenue, they must dedicate the necessary attention, resources, and management. For medium and large businesses, this is likely to imply running a separate aftersales/service business unit on par with other business units. The unit should have professional processes, trained specialists, a cockpit with targets, and KPIs for items including delivery reliability, utilization, stock turnover, and gross margin. Sales staff should be properly incentivized and trained to communicate key messages, for example, lifecycle savings (see action area 3 as well). Collaboration between hardware sales teams and aftersales/service sales teams is essential. The optimal solution is to sell an aftersales/service agreement along with every piece of hardware. Aftersales/service employees can also drive value by identifying leads for hardware sales and extending sales conversations with customer decision makers.



Mastering the fundamentals of aftersales operations creates the foundation for growing the business.

Expand aftersales/service offering

	Don't	Do
Companies	Offer only spare parts and maintenance services	Provide a broad aftersales/service offering that clearly adds value for the customer
	Disregard the need for a reliable service network, even in new markets	Use low-investment measures to increase service network density in markets where presence is otherwise challenging to build
	Consider aftersales/service only as a way to support sales	Maintain a separate aftersales/service business unit with resources, qualifications, and its own target system
Policy makers	Think that manufacturing companies will automatically develop knowledge within aftersales/service	Minimum content of aftersales/services in some public tenders to stimulate demand
	Think that impacting EU directives is out of scope	Improve European service directives that affect manufacturing companies

SOURCE: Team analysis

EXHIBIT 36



In manufacturing, services are often closely tied to products. Thus, with the large amount of foreign trade in Danish manufacturing goods, international service mobility becomes a major determinant of service level.

Actions for policy makers:

- Stipulate a minimum amount of aftersales/service in public tenders.** Policy makers can push for public tenders in certain areas to include a certain amount of aftersales/service, stimulating demand and incentivizing companies to increase efforts in providing excellent aftersales/service.
- Improve European service directives.**³⁸ In manufacturing, services are often closely tied to products. Thus, with the large amount of foreign trade in Danish manufacturing goods, international service mobility becomes a major determinant of service level. The barriers to trade for services are higher than those for goods in Denmark and comparable countries. Barriers are especially high in the kind of services that require temporary residence. The European Union passed a new service directive in 2006, and despite already realizing an estimated positive impact of 0.8 percent on GDP, productivity improvements of 1.6 percent are expected to follow by eliminating the remaining restrictions.
- Support knowledge development.** As with developing customized yet modular solutions, policy makers can be of further assistance by supporting knowledge development and dissemination. Section B4 describes the numerous challenges facing companies seeking to expand aftersales/service, highlighting the need for government support in this area.

³⁸ For general information, see *Konkurrence, Internationalisering and Regulering* from The Danish Productivity Commission.

5. Circular products and business models

More volatile commodity prices and an increased focus on environmental matters are key trends for the manufacturing industry. One possible answer to capturing the potential in the two trends lies in the notion of the circular economy.³⁹ For Danish manufacturing, the potential offered by circularity will amount to EUR 150 million to EUR 250 million (DKK 1,100 to DKK 1,850 million) annually by 2035, according to a recent report by the Ellen MacArthur Foundation in collaboration with McKinsey & Company.⁴⁰ The report outlines three key elements companies must master to succeed with circular strategies. These are product design and technology, business models, and reverse cycle skills. Policy makers can support the process by removing regulations that put remanufactured products at a disadvantage and by funding capability building among companies.

Actions for companies:

- **Design circular products by building on standardization and modularization.** Improving design is at the heart of circular products, so as many components as possible can be reused elsewhere. This means component standardization and modularization, products that are easy to disassemble, and materials that retain their structural integrity. The design strategy poses significant challenges where products have long lifecycles or where efficiency gains rely largely on hardware upgrades. In the latter case, it might become more feasible to design circular products as efficiency gains shift towards software. Until this happens, refurbishing products and selling them in the secondhand market is an option.
- **Use business models that retain ownership.** To realize the value in reusing material flows, it is critical for companies to shift from customers owning products to performance-based payment models. In this case, the manufacturer can reclaim the product and reuse parts, reducing costs and potentially improving the customer proposition.
- **Build reverse-cycle capabilities and infrastructure.** Manufacturing companies must invest in establishing cost-effective take-back and treatment systems to disassemble and reuse products as well as employee training. It is critical that the take-back scheme is easy for customers or resellers to use and that they are incentivized to do so. The operation can be carried out in-house or be outsourced. Logistics can be challenging, as products may be large (for example, wind mills) and/or widely dispersed, and parts may be worn.



The design strategy poses significant challenges where products have long lifecycles or where efficiency gains rely largely on hardware upgrades.

³⁹ A circular economy is one that is restorative and regenerative by design, and which aims to keep products, components, and materials at their highest utility and value at all times.

⁴⁰ Ellen MacArthur Foundation: "Delivering the circular economy – a toolkit for policy makers," 2015.

 **Circular products and business models**

	Don't	Do
Companies	Design components only for optimized in-use efficiency during one lifecycle	Design standardized and modular products that are easy to disassemble and remanufacture
	Use a traditional sales model with warranty	Retain ownership and sell solutions with optimization, repair, and product upgrade included
	Ignore the importance of investing in reverse cycle skills	Incentivize users and third-party installers to return old products, and build remanufacturing capabilities and infrastructure
Policy makers	Think that companies will automatically develop capabilities within circular products and omit supporting actions	Fund capability building within circular products among companies
	Preserve current regulation that prohibits sale of products with remanufactured parts as new	Correct regulation incentives that currently put remanufactured products at a disadvantage

SOURCE: Team analysis

EXHIBIT 37

Actions for policy makers:

Given circular products and business represent a more significant break with the existing industrial model than other action areas, it is natural that policy makers and official players have a larger role to play. Support can be provided in the following three broad areas:

- **Invest in capability building.** Fund capability building for circular products (particularly for SMEs) through, for example, remanufacturing pilot projects or training programs for manufacturing, procurement, and design.
- **Correct regulation and incentives.** Danish policy makers can help address rules at national, EU and international levels that put remanufactured products at a disadvantage, for example, laws prohibiting products with remanufactured parts from being sold with the label “new products”.
- **Support research.** Policy makers should support research into remanufacturing technology and techniques.

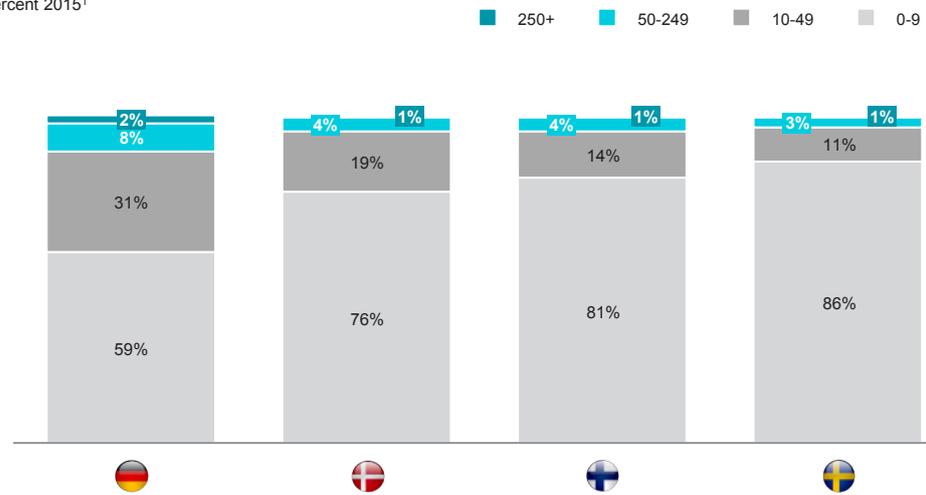
APPENDIX





Industry structure by country

Share of companies by number of employees,
Percent 2015¹



¹ Estimated based on data from 2008-2011
SOURCE: Eurostat SBS database

APPENDIX 1

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