



cutting through complexity

Study

INDUSTRIAL MANUFACTURING






Megatrends Research



Introduction

As a consequence of the recent economic turbulence, manufacturers have been forced to increasingly review their financial management processes – especially focusing on risk management and the financial exposure during crisis situations. This should, however, not lead to companies disregarding the importance of a sustainable growth strategy. Even in times of volatile and uncertain economic conditions, the world still continues to change around us: Markets, business models, manufacturing processes and other challenges along the value chain are all changing at an increasing speed in an increasingly interconnected world where new opportunities and threats appear constantly. Some of the drivers behind these changes are so-called megatrends, which result in far-reaching processes of transformation across regions and industries. The manufacturer of the future must take these megatrends into account in order to remain competitive, create value for its investors and secure its position as a partner of choice for its customers and other stakeholders.

Our KPMG “Industrial Manufacturing” (IM) Experts Panel has identified and analysed ten overall megatrends, which are seen as most important in today’s manufacturing world for the purpose of answering the following **five key questions**:

-  What are the obvious and possible drivers of these developments?
-  What are the direct and indirect impacts of these transformation processes?
-  How can companies create value from these megatrends?
-  What have been our experiences with these topics and how might these megatrends develop over time?
-  Which corporate actions should manufacturers consider taking today to prepare for these megatrends?

In order to put the findings and insights into practice, KPMG has developed a conceptual framework and a range of possible options for improving a manufacturer’s future-oriented strategy.

We invite you to engage with us in discussing the future implications of such megatrends for the manufacturing industry.

Hoping that our megatrend research provides you with an informative overview of our expertise, we wish you pleasant reading.



Dr. Gerhard Dauner

Partner

Head of Industrial Manufacturing
Europe, Middle East and Africa

Overview

Ten trends – ten positions

FACTORY OF THE FUTURE

1

- Automation may be even more cost effective than outsourcing manufacturing to developing economies.
- Within an interconnected manufacturing value chain, companies will face increasing industrial IT security risks.
- Increase in legal provisions, regulations and industry standards.

TALENT CHALLENGE

6

- Demand for MINT* talents (machinists, tool makers and machine programmers) is on the rise.
- Adding to the economic pressures will be a steady increase in wages for “rare” specialists.

*MINT: mathematics, informatics, natural sciences and engineering

NEAR-SHORING

2

- Manufacturing companies look to externalize back office services to focus on core operations.
- Wages in offshore locations are increasing.
- Eastern Europe is expected to witness significant manufacturing inward investment in the near future.

NANOTECHNOLOGY / NANOMANUFACTURING

7

- Nanotechnology is expected to have a big impact on sustainability in the near future.
- Unknown environmental, health and safety (EHS) implications arising from nanoparticles during their lifecycle present research-based industries with significant challenges and opportunities in risk management.

DEMAND SHIFT TO THE EAST

3

- Asia’s economic influence on the global landscape is growing.
- Increasing importance for local R&D, production and assembling facilities, regional supply chains and adapting products to meet the needs of local markets.

SERVICE DRIVEN BUSINESS MODELS

8

- Manufacturers should find ways to sell ongoing services to their customers by taking a holistic view of customers’ needs.
- The challenge for manufacturers is to commercialise scientific and technological innovation into a marketable product and service combination.

CLUSTER MANUFACTURING

4

- Clusters will become a key pillar for strengthening the manufacturing industry in terms of innovation and efficiency.
- It will be important to remain in close physical proximity to the engineering centres of major customers, as well as to scientific research institutes in Europe.

SOURCING GOVERNANCE

9

- Companies need a highly skilled procurement organization engaged at appropriate levels of the value chain employing disciplined, rigorous world-class processes.
- The sourcing governance approach focuses on the complete external supply chain of the company – suppliers and pre-suppliers are therefore a part of corporate responsibility.

ENERGY / RESOURCE EFFICIENCY

5

- Commodity prices, energy usage and logistics management will become more crucial to maintain competitiveness.
- Automated manufacturing and new production technologies (e.g. additive manufacturing) are expected to play a key role in reducing materials and energy usage, and reducing waste.

ADDITIVE MANUFACTURING / 3D PRINTING

10

- Additive manufacturing or 3D printing will set up new business models with effects on industries, companies and society.
- Increasing importance of a company’s value-chain structure to be successful in a “disrupted new supply chain world”.



Trend 1

Factory of the Future

Manufacturing companies are adapting more and more digital technologies to network and transform their manufacturing processes. The “factory of the future” can be broadly defined as a future view of an interconnected manufacturing value chain, involving information and communications technology (ICT) and automation technologies: Software will holistically interconnect and manage distributed factory assets. Embedded data collectors in processing centers will be linked to cross-functional enterprise systems, enabling real-time two-way data exchange and full production quality control. In the “factory of the future”, the adaption of various digital technologies will also enable the data exchange from R&D (CAD, virtual simulation tools, rapid prototyping) to the factory floor (automation/robotics, control technologies, product lifecycle management (PLM), additive manufacturing) to distribution partners (analytical applications) and back, from suppliers to OEMs to customers, and vice versa.

“Through IT information systems that are fully-integrated from customers to suppliers, future factories and their supply chain will be directly driven by the customer. Transparent measurement of all significant process steps will allow a fast reaction to all deviations. The factory has to deliver reliable processes and highly skilled people who are able to follow the fast-changing demands of customers and markets.”

Michael Bremicker
Partner, Consulting –
Supply Chain Management &
Procurement



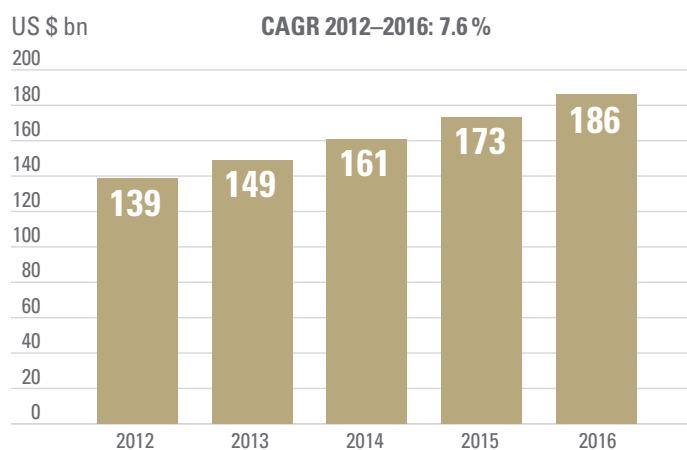
Drivers

- Expectations of a significant boost in efficiency, safety and resource sustainability in production and logistics.
- Optimised consumption of resources through the use of energy and material efficient processes and machinery.
- Increasing labour costs (e.g. China) are leading to a broader automation push.
- Reduction of design errors and “time to market”; optimisation of production processes through digital factory modelling.
- Flexible machinery and tools (adaptability/ re-configurability), while ensuring an easy process maintainability.
- Increasing processing power of ICT and more sophisticated analytical software enables real-time performance analysis.
- Steady and stable product quality through increased process robustness and accuracy.

Impact and consequences for companies

- Rapid technology innovations, cost efficiency and customer requirements push manufacturers to manage product lifecycle costs, increase product variability and continuously change production volumes.
- ICT-enabled intelligent manufacturing may require special product design; new manufacturing technologies may require new materials.
- Additive manufacturing is a substitution for reductive/ subtractive processes (CNC machining like cutting or drilling, or primary shaping processes like electroforming, casting, foundry processes and powder metallurgy processes).
- Increasing cost for implementation, service and maintenance of IT systems; increasing cost for software development for special applications; new requirements for human-machine interface to handle increased complexity of systems.
- Increasing need for security of internal-external networks.
- Automation and (plant) engineering companies have to adapt components and software solutions (interfaces) to support the interconnectivity of their product portfolios.

Industrial control and factory automation market



Source: MarketsandMarkets, April 2012

KPMG point of view

It is predicted that the industrial automation market will grow to more than US\$200 billion by 2015, driven by energy efficiency, advanced technology and emerging economies. The demand for 3D printing technology is expected to increase in industrial markets in the near future. Significant investments or acquisitions may be seen in additive manufacturing in the near future.

The increasing demand for powerful real-time analytics engines will enable companies to gather, store and analyse data. This is becoming known under the term of Big Data. Companies will be confronted with growing industrial IT security risks as well as increases in legal provisions, regulations and industry standards.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Implementation of suitable security measures
- Evaluation of plant security and the design of appropriate solutions to system care
- Training of process plant staff
- Stronger emphasis on uptime, availability, and reliability
- Improved handling of immense quantities of information
- Implementation of strategy for skills development

2

Trend 2 Near-shoring

Sourcing closer to end markets or “Near-shoring” is emerging as a megatrend. This sourcing trend refers to moving a business function to a country that is closer in either geography, time zone, cultural characteristics and empathy, quality of work, or economic structure to the company’s home country as a means of cutting costs and improving services. North America and Eastern Europe are some of the key regions experiencing this shift. Manufacturers are rethinking more often their overseas manufacturing positions because the offshore advantage of labour arbitrage is decreasing. And a growing number of manufacturers are now realizing that the physical location of supply and manufacturing operations can have a significant impact on the overall competitiveness. Near-shoring offers the opportunity to maintain a high level of control while mitigating the cost of doing business.

“Supply chain risk management continues to be a key issue at board level for manufacturing companies. Many of them are already using near-shoring as a strategy to manage aspects of that risk. However, in our experience, very few companies have a fully integrated supply chain risk management process addressing all the elements of supply chain risk: supplier failure; continuity of supply; counterparty risk and regulatory risk.”

Volker Zieske
Partner, Assurance Services



Drivers

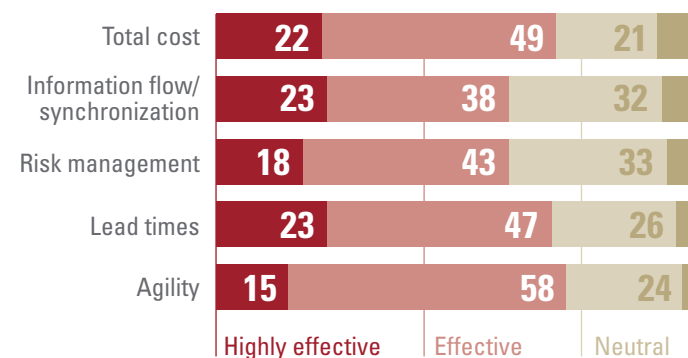
- Manufacturing companies look to externalise back office services to focus on core operations.
- Risks associated with supply chain management are increasing in low-cost countries.
- Labour wage rates in offshore locations in emerging economies like China, Indonesia, Thailand and Malaysia are increasing, as workers are demanding higher wages.
- Cost of shipping goods around the world is rising due to higher fuel prices.
- Eastern Europe has emerged as a location for near-shoring operations, backed by favourable factors like highly skilled talent, especially technical talent and close proximity to end markets like the UK. Other factors include cultural similarities, time zone and strong data protection laws.
- Tax incentives are usually not the main driver of the decision, but they could tip the balance just as higher taxes may make a country less attractive.

Impact and consequences for companies

- Rising energy costs are impacting the supply chain of manufacturers operating in low-cost countries.
- Some of the global automotive, engineering and industrial products companies have started to move production back to the Americas.
- Also, some companies are moving or expanding their presence in Eastern European countries like Hungary and Poland to take advantage of factors like robust business environments, skilled talent and connectivity with end markets.
- Attractive cost to quality ratio and further development of the supply chain are encouraging manufacturing companies to expand or near-shore their operations.
- Some shore locations may be limited by slow bureaucracy and regulatory obstacles or by the limited size of their labour pools. Workers do not always share the same language, cultural values or even the same time zone.

KPMG’s global manufacturing outlook survey

Responses on impact of near-shoring on supply chain, for the following characteristics (in per cent)



Source: KPMG Global Manufacturing Outlook, 2012

KPMG point of view

According to KPMG’s Global Manufacturing Outlook 2013, over a third (37 per cent) of Europe’s manufacturing companies are focusing more on risk, reliability and flexibility in their supply chain – which continues to be one of their biggest challenges. In addition, just under half (46 per cent) believe that the trend for near-shoring will increase in the manufacturing sector over the next twelve to 24 months.

The Eastern European region is expected to witness significant manufacturing inward investment in the near future. Recent events such as natural disasters and higher wage demands in the Far East are expected to change sourcing dynamics.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Effective corporate governance systems with internal control systems and enterprise resource management
 - Ongoing analysis and monitoring of production facilities, location, delivery quality and reliability as well as sourcing risks
 - Regular monitoring of measurements
- Tying and bundling strategies for product (-design) and procurement/sourcing
- Increase organisational flexibility
- Identify potential sanctions breaches (“Dodd Frank Act”)

3

Trend 3 Demand Shift to the East

The global manufacturing sector is undergoing a change as major shifts in demand can be noticed. The accelerating shift of powers from West to East has moved the engine for growth in the global economy from developed to emerging countries. Large and growing populations, a rising middle-class consumer society as well as increased urbanization will drive demand in Asia. Major established Asian economies (e.g. China, India) and new upcoming markets (e.g. Indonesia, Vietnam, etc.) are driving global growth. Over the past few years, the share of these economies in the global "Gross Domestic Product" (GDP) has been increasing rapidly while mature markets like the US and Europe continue to witness slower recovery.

"New customers often require very different products to meet their needs, with different features and price ranges, forcing manufacturers to offer a wider range of products and services. This will also drive the growth of both production as well as research in Asia."

Tim Löbig
Partner, Consulting –
Strategy & Operations



Drivers

- Key driving forces for demand shifts to the East are economic growth, demographics and rising incomes in emerging markets, in particular in Asia. Further major factors driving this trend are:
 - Localisation of products to address local mid market
 - Proximity to demand and regional raw materials/resources
 - Vast scale of operations and flexibility
 - Diligence and industrial skills of workers
 - Better “time to market” and reduction of logistics costs
- Asian economies have emerged as major sourcing destination for global companies.
- Growth of the employable population and increased investments in the region.
- National/Regional regulatory effects (safety standards, etc.) and free trade agreements.
- Within Asia itself, a shift can be noticed as rising wages and higher costs in China are making manufacturers consider other locations in Southeast Asia.
- ASEAN countries like Cambodia, Laos, Thailand and Vietnam provide a dynamic talent pool with highly educated and young people as well as lower wage costs.

Impact and consequences for companies

- Stronger focus on local R&D, production and assembling facilities, regional supply chains and adapting products to meet the needs of local markets.
- Labour intensive industries are targeting Southeast Asian countries like Indonesia and the Philippines, which have stable governments and policies favouring investors.
- Automotive companies are expanding their presence in China to benefit from the growing demand and to counterbalance the weakness in Europe’s automobile market. (Machinery) suppliers have to follow.
- Manufacturing companies investing in countries like Indonesia take advantage of manufacturing costs that are 40 per cent lower than those in China.
- Some of the top company executives of global manufacturing companies have recently relocated to areas such as Hong Kong and Singapore to better understand and serve growth markets like China and Southeast Asia.

Country attractiveness / Key initiatives



Vietnam

Low property and labour costs, young population. Focus on a greater airport capacity and developing new deepwater ports.



India

The Indian government is trying to push for legislation on corporate income tax rates in 2013. If approved, the rate would decline from currently 40 to 30 per cent for western manufacturers.



Indonesia

Political and currency stability makes the country an attractive location for expansion projects.



China

China is investing heavily in inland ports and other infrastructure projects to facilitate easier transfer of goods from inland areas for export.

KPMG point of view

As a consequence of rising production costs in China manufacturers are relocating to cheaper countries in Southeast Asia. This may lead to the end of China as the most “sought after” manufacturing location in the next five to ten years.

Southeast Asian countries are expected to overtake China in the near future as a result of lower labour costs, favourable demographics and liberalisation of economies in these countries.

Manufacturers in the US and Europe have taken note of the growth potential of Southeast Asian countries and are focusing on catering to the stable demand in the region rather than exporting to other developed countries.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Development of a holistic strategy for Asia
- Alignment of the product and service portfolio to meet local requirements and maximise revenues
- Localisation of R&D and manufacturing for operational hedging as well as reduction of product costs
- Development of sufficient location strategy and site selection especially for Southeast Asian region
- Careful consideration of IP issues
- Selection of appropriate entry mode considering strategy and capabilities

4 Trend 4

Cluster Manufacturing

Cluster manufacturing relates to the regional concentration of inter-related companies operating along an entire value chain, including manufacturers, service providers, suppliers, key customers, research institutes, universities and trade associations. These business clusters are often established in a particular geography to network and benefit from physical proximity, core competencies, skilled workforce and specialists, activity base, specialized (physical, and knowledge) infrastructure, and industrial organisation. The geographic concentration of a cluster provides a unique environment for accelerating technological innovation, stimulating new start-up firms and attracting investments. The critical mass effect often attracts further companies, investors, services and suppliers, as well as creating a pool of skilled labour and increasing innovation through the exchange of ideas.

“When business partners are located close to each other, it becomes easier for companies to exchange information, communicate and share input and/or output and to achieve a mutual benefit (joint development, alliances, joint ventures, etc.). The more links and networks spanned between companies, the more innovative and effective they become.”

Thomas Hillek
Partner, Consulting –
Strategy & Operations



Drivers

- Key factors driving economic activity around clusters in a particular region are:
 - Efficiency: improved operating costs, incl. logistics costs
 - Productivity: shared resources, knowledge and infrastructure
 - Flexibility: high mobility of labour and other resources
 - Innovation: knowledge spill-overs, inventions and cooperation
- Companies gain competitive advantages due to a specialised, innovative and efficient supplier base
- Low business costs and favourable corporate tax levels prompting manufacturers across the value chain to set up base in a particular region (in particular in emerging markets).
- Clusters are set up in close proximity to engineering colleges, universities and R&D centres, as this helps companies to gain access to new ideas and a well-educated labour force.

Impact and consequences for companies

- Key benefits experienced by companies operating in industrial clusters across the globe are:
 - Agile supply chains and reduced operating costs
 - Ability to quickly address gaps in products or services.
- Involving academic institutions helps companies to improve quality, solve technical and design problems. In return, companies are providing universities with access to equipment and data, internship and job opportunities.
- Real estate costs are higher within these established clusters and are becoming less competitive as they reach maximum capacity.
- Existing clusters are challenged by new locations with different sets of advantages like preferential access to raw materials, prospering sales markets, modern facilities to better capitalise on economies of scale, future expansion capability and/or aggressive government support.

Cluster strategy: Key steps for companies

1. Mobilisation <ul style="list-style-type: none"> • Leaders to encourage broader participation • Rallying around a common, tangible goal 	2. Diagnosis <ul style="list-style-type: none"> • Use of data analysis tools to identify the strengths, weaknesses and challenges for clusters
4. Implementation <ul style="list-style-type: none"> • Assign a body to manage the cluster initiative • Identify sources of financing • Implement monitoring systems 	3. Collaboration <ul style="list-style-type: none"> • Form cluster working groups with members from small and large firms • Create action plans

KPMG point of view

Clusters are expected to become a key component in strengthening the manufacturing industry in the near future, especially as companies move away from vertical integration and increasingly outsource functions and stages of production.

Training, R&D and supporting services will become key areas where clusters seek to further expand their range of services.

Advanced manufacturing clusters are now being developed with the objective of attracting manufacturers as a consequence of the closer proximity to customers, a strong infrastructure, a favourable business climate, a competitive cost structure and improved human networks.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Development of a global footprint strategy
- Capture advantages from global competencies and different cost structures
- Selection of locations and potential clusters based on fact-driven decision making and long-term scenarios



Trend 5

Energy/Resource Efficiency

Manufacturing firms across the globe rely on the efficiency of their manufacturing processes to remain competitive in the market. Companies are actively researching, testing and implementing new energy sources, materials, processing technologies and logistics strategies to become more energy efficient and also reduce their carbon footprint and cost of materials. Manufacturers constantly seeking ways to counteract effects from the rising demand and the drastically increasing competition for energy and raw materials. With continuous incremental improvements and extensive investments, companies are also reducing their environmental impact to meet legal requirements. The introduction of energy saving technologies and processes and the optimized relationship between resource input and product output should enable efficiency and sustainability at every stage of a product's lifecycle, from production to operation to recycling.

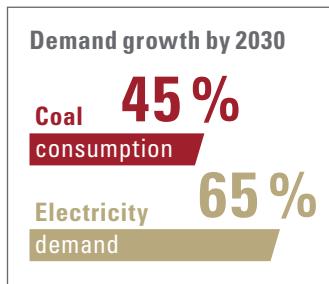
“Commodity prices, energy usage and logistics management are already important for manufacturers to maintain their competitiveness today. However, these factors will become even more crucial in the future given the challenges of the energy market all over the globe and uncertainties about the energy supply as well as customer expectations associated with it.”

Dr. Götz Wehberg
Partner, Consulting –
Strategy & Operations



Drivers

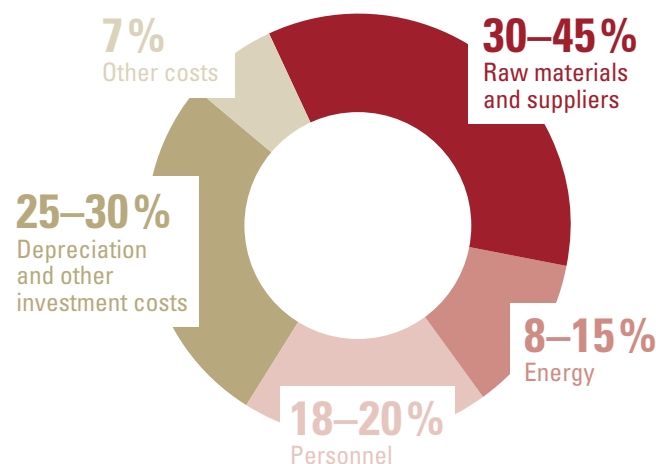
- Energy and resource efficient manufacturing is gaining importance, driven by factors like global warming, scarcity of resources, volatile energy prices and tighter legislation.
- Energy prices will continue to rise due to higher demand, renewables are also expected to develop steadily. In 2030 installed renewables capacity will account for more than 50 per cent of the world's total installed generation capacity.
- Transportation and fuel costs as well as the costs associated with complex logistics processes continue to increase.
- Natural resources and critical raw materials are becoming scarce and more expensive.
- Reduction of costs related to emissions (air, water, noise, etc).
- Rising concern of customers and increasingly demanding legislation worldwide.



Impact and consequences for companies

- To manage the industrial energy consumption, lower the costs and deliver high quality products, companies are focusing on:
 - Revision/Improvement of the mechanical design (product design, manufacturing and processing design)
 - Integration of virtual prototyping, 3D-simulation and analytics
 - Replacing outdated/end-of-life components (motors, pumps, bearings, etc.), integrating controls and regulating elements
- Need for smart maintenance approaches that increase the lifetime and energy efficiency of the production equipment.
- Industrial companies have started to track energy consumption by incorporating energy intelligence measures like data monitoring and analysis into their production processes.
- Government grants: In the US (e.g. EECBG program), several companies have received grants, which are aimed at improving energy efficiency of advanced manufacturing technologies.

Average manufacturing spend in Europe



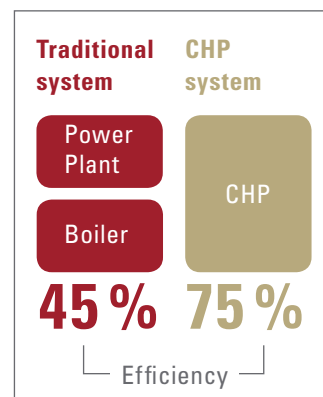
Source: Greenovate, May 2012

KPMG point of view

As companies begin to integrate smart technologies into their production processes, a reduction in energy intensity is expected in the mid to long term.

Digital manufacturing and more specifically additive manufacturing techniques like 3D printing are expected to play a key role in minimising materials and energy usage, and to reduce waste.

Combined heat and power (CHP) has, for instance, the potential to provide clean, reliable, cost-efficient energy services to manufacturing industries. It can help in reducing energy costs, reduce the risk of electric grid disruptions and help in improving the competitiveness of manufacturing firms.



KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Examine manufacturing processes as well as potential for savings and define measures for the efficient use of energy and costs associated with.
- Turn strategic plans into ambitious targets and actions for energy and resource efficiency, sustainable supply chain management, innovation and access to new markets for greener products and services.
- Explore tax incentives tailored to alternative energy, energy efficiency and other areas related to sustainability.

6 Trend 6 Talent Challenge

The global manufacturing landscape continues to evolve, driven by factors like globalisation, technological advancements and demographic shifts. These factors are in turn driving the demand for higher skills in the manufacturing sector. Both mature and emerging economies are facing talent shortages. In mature markets, despite the high unemployment rate, companies are struggling to fill manufacturing jobs with the right talent. Whereas, in the emerging markets, availability of a skilled talent pool is low. Know-how is a competitive advantage and innovation is a growth driver. The lack of a highly skilled, flexible workforce is impacting on the competitiveness of manufacturing firms and preventing them from delivering innovation.

“Attracting and retaining appropriately qualified and motivated staff remains a top-of-mind issue for manufacturing companies. Many fear that labour shortages will retard long-term business growth.”

Dr. Michael Geke
Partner, Consulting –
Strategy & Operations



Drivers

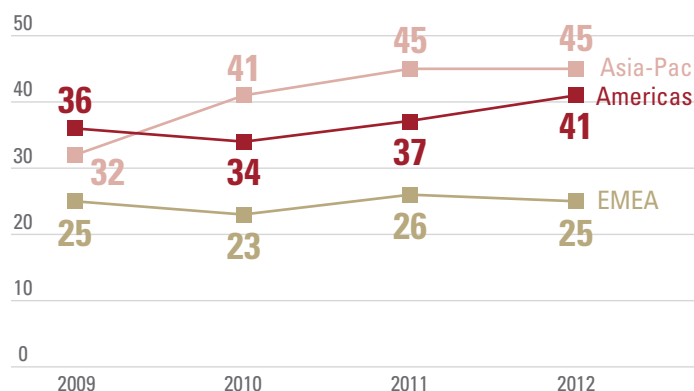
- Talent management is becoming a key strategic imperative.
- New requirements for talents due to globalisation, entry in new markets, volatile market conditions and the expanded use of increasingly sophisticated and rapidly changing technologies.
- Manufacturers across the globe are finding it difficult to source highly-skilled talent, like technicians, engineers or programmers.
- Demographic trends like aging workforce and low birth rates in countries like the US, China and Japan have led to a talent shortage in these markets.
- Workers in Asian countries, particularly in China, are demanding higher wages.
- Many manufacturing firms had scaled down or eliminated the traditional apprenticeship model, i.e. not providing job-specific training to save on training costs, resulting in a shortage of skilled manufacturing labour to meet the demand for highly-skilled jobs.

Impact and consequences for companies

- Demand for machinists, toolmakers and machine programmers is on the rise. The shortage of a highly skilled workforce is prompting manufacturers to further internationalise their HR strategy and rely on foreign workers to fill some of these technical skill gaps.
- A steady increase in wages for skilled workers, in particular for “rare” specialists, will add to the economic pressures.
- Rising labour costs in China and other Southeast Asian countries, is prompting global manufacturers to consider near-shoring their operations closer to the end markets.
- Manufacturing companies in mature markets are actively collaborating with local community colleges and universities to launch specialized certification programs. They are also rolling out initiatives like accelerated skill training programmes.
- Companies have to develop new engagement models taking into account the generational differences (shift in values, work-life balance, non-monetary remuneration, sabbatical leave, etc.)

2012 talent shortage survey: ManpowerGroup

% of survey respondents having difficulty filling jobs



Source: ManpowerGroup, 2012

KPMG point of view

Currently, there is a shortage of MINT (mathematics, informatics, natural sciences and engineering) talent. This could have a negative impact on the future of manufacturing, as achieving efficiency in manufacturing processes through engineering becomes critical.

The importance of employer branding is increasing for the:

- Manifestation and communication of company values (both internally and externally)
- Improvement of loyalty and identification with the company for existing employees as well as the attractiveness for future employees.

Adaptation of HR processes and tools are necessary to ensure employers promise is fulfilled. Companies have to refine their talent management programs to take emerging trends into account as part of their capacity and demand planning.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Develop efficient and effective HR management, the key success factor of prosperous and competitive companies.
- Implement a talent lifecycle management
- Establish a talent development, a retention program and build a local management
- Identify existing infrastructure tools to manage data on talent and the culture and governance in place to encourage and enable career moves and secondments.



Trend 7

Nanotechnology/Nanomanufacturing

Nanotechnology is defined as the combination of material science and technology for manipulating the structure of matter at the molecular level. Nanomanufacturing is the production of materials and manufacturing of parts either from the “bottom up” from nano-scaled materials or “top down” in nano steps for high precision. Both nanotechnology and nanomanufacturing are providing new capabilities and products to industries like automotive, aerospace, electronics, power, chemical, biomedical and health. Advancements in nanomanufacturing are helping to create new markets for nanoparticles, nanostructures and nanodevices. Scientists and engineers will develop materials at the nanoscale to take advantage of their enhanced properties such as lighter weight, higher strength, increased control of light spectrum and greater chemical reactivity than their larger-scale counterparts. A key understanding of nanotechnology is that it offers not just better products, but a vastly improved manufacturing process.

“Nanotechnology presents the research-based industries with significant challenges and opportunities in risk management. Central to these are the relatively unknown environmental, health and safety exposures arising from nanomaterials through their lifecycle.”

Andreas Bartels
Director,
Transactions & Restructuring



Drivers

- Increased focus on energy efficiency, cleaner environment and improvements needed in the manufacturing processes are some of the driving factors for wider adoption of nanotechnology.
 - Use of carbon nanotubes to save power
 - Nanotech sensors to measure electricity flow
 - Using nanocomposites in windmills and solar cells for higher performance
- Demand for efficient, lighter and cost-effective products is on the rise. In the aerospace sector, desire for developing lighter planes continues to drive the demand for advanced materials like composite materials.
- Demand for tools that can operate at an atomic level.
- Extracting more value from the fixed amount of resources by working at a smaller scale.
- Creation of extra functionality within a product – such as the ability to clean or repair itself or even change shape and form.

Impact and consequences for companies

- Nanomanufacturing and nanomaterials are increasingly being employed in advanced energy storage and conservation projects, as they are helping the products in becoming more energy efficient in both production and use.
- Nanotech solution providers are working with companies, universities and institutes to develop technologies which are more energy efficient.
- New materials like nanocomposites are already being used in the automotive industry and are helping in achieving ten to 15 per cent weight and strength improvements, with a promise of 20 to 25 per cent.
- Nanotechnology also has the potential to make significant contributions to the problems associated with the aging civilian and military, aircraft and rotorcraft fleets.

Nanotechnology: Transforming manufacturing

Areas of Impact	Impacted industries
Materials (graphene, nanocomposites)	Aerospace and defense, transportation
Coatings (nanocoatings)	Automotive, defense, construction
Energy collection and storage (nanoparticles)	Solar panels
Lighting (quantum dot – nanoparticles)	LED lighting
Manufacturing processes (self-assembly – branch of nanotechnology)	Computer chips, potential benefits for alternate energy and medicine.

KPMG point of view

Nanotechnology is expected to have a major impact on sustainability in the near future. The most affected sectors are expected to be in areas of transportation (efficient and lighter materials for cars and aircraft, requiring less fuel) and in other areas such as lighting, photovoltaic and energy storage. Carbon nanotube manufacturing technology is expected to become more viable as significant advancements will aid in controlling the purity and structure and in reducing costs.

Nanomanufacturing automation is expected to become another very important field of activity in this area. Companies and institutions are establishing nanotech programmes and they will require improved tools and equipment designed specifically for nanomanufacturing processes.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Consideration of any potential legal implications. The growing demands of the legislative and supervisory authorities provide a framework for the ongoing alignment of the guidelines that must be unconditionally adopted by the company.
- Implementation of nanotechnology risk and safety analysis standards.
- Ongoing uptake of environmental, health and safety (EHS) hazards research results.
- Development and implementation of a proprietary risk assessment.



Trend 8 Service Driven Business Models

In particular companies from the developed markets respond to the challenge to extend or redeploy the initial core competency of a firm to increase their return with a shift in their business model. These companies expand their role in the value chain and start to offer advanced services or complete solutions which are closely coupled to the manufacturer's products. They evolve their product-focused business model to a client-centric model. Therefore, they have to deploy competencies and solutions that address their clients' engineering and product lifecycle needs. To deliver more tailored solutions and services, manufacturers aim for a closer ongoing collaboration with customers. To get closer to the customer, companies are taking control of activities in the outbound supply chain which are otherwise carried out directly by customers or third parties.

"Insights into your customer needs will be the most critical success factor in the service arena."

Markus Deutsch
Senior Manager, Consulting –
Strategy & Operations



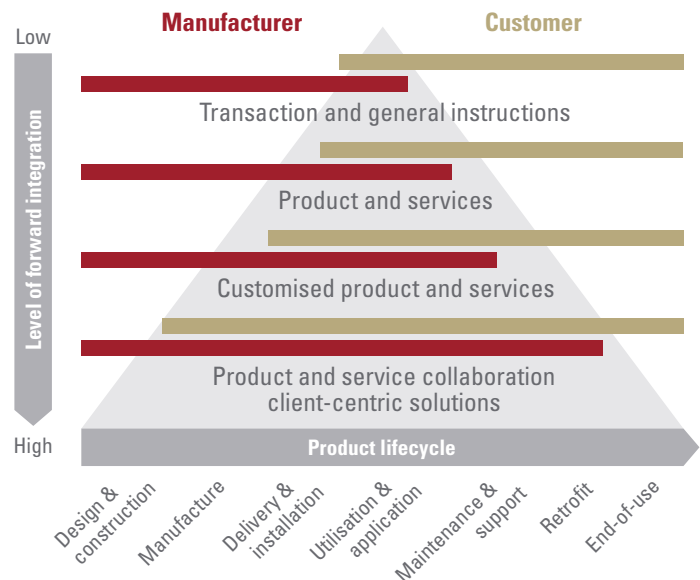
Drivers

- Saturation and a lack of differentiation in mature economies drive development of new services and solutions.
- Key driving forces for “service driven business models” are the growing global competition, increasing price pressure and new growth opportunities.
- Customers demanding more added-value from their suppliers (contracting for capability). Manufacturers offer more client-centric services to enhance the performance of core products.
- Increases in the level of differentiation and competitive advantage for manufacturers.
- Manufacturers in a low-growth environment expect that the development of new service offerings involves lower risks and costs than the development of new products or markets.
- Lock-in effect: To sell the original equipment at cost, realise profit on spare parts and supplies. The strategy of locking customers in to a longer arrangement while reducing opportunities for competitors.
- In some cases, “service driven business models” can help companies to reduce costs and improve efficiency by decreasing transportation expenses and reducing their turnaround time.

Impact and consequences for companies

- Managing organisational changes that take place as a manufacturer shifts to client-centric solution provider.
- Companies have to invest more money and develop expertise in more than one business function.
- Increasing external expectations to fulfil contractual obligations to customers, coupled with increasing internal specifications to deliver these as economically as possible.
- Managing new cost structures to ensure that the costs linked with this shift do not conflict with other lines of business.
- Managing and performing multi-year partnerships. Identifying, managing, mitigating and controlling new risks and exposures.
- Managing changes of the company’s corporate culture and philosophy (customer-centric culture).
- Consistent leveraging of customer knowledge (wants and needs).
- Transformation of sales force from a product centric towards solution and consultative selling approach.

Service driven business models



Source: 2013 KPMG, Germany

KPMG point of view

The revenue-generating power of selling a service contract at the beginning of a product’s lifecycle can increase new service rates by approximately 25 per cent by avoiding the reselling of support services at a later date. According to KPMG’s Global Manufacturing Outlook 2013, almost 50 per cent of respondents expect to make significant changes to their business model over the next twelve to 24 months. Added-value arrangements such as maintenance services and new/enhanced customer services were mentioned most frequently.

The challenge for manufacturers is to commercialise scientific and technological innovation into a marketable product and service combination. “Manufacturers should find ways to sell on-going services to their customers by taking a holistic view of customers’ needs.”

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Transform sales approach towards solution and consultative selling.
- Develop new service driven business models and establish service culture.
- Build up comprehensive customer intelligence capabilities to continuously innovate customer services.
- Develop standardised and efficient processes to launch and commercialise new service offers.

9 Trend 9 Sourcing Governance

Traditional compliance focuses on the internal corporate governance, but tangentially more and more of added-value takes place outside the company. Sourcing governance is the responsible management and controlling of the company's external value chain. It is intended to achieve the leadership of the company's value network in order to minimise possible risks. A manufacturer's risk management has the task of safeguarding the competitive environment and guaranteeing the security of supply. It implies the identification and control of risks in terms of suppliers, commodity groups and regions within global markets. The sourcing governance approach focuses on the company's entire external supply chain – suppliers and pre-suppliers are therefore a part of corporate responsibility. This approach provides a global control matrix for sustainable supply chain management.

"Sourcing governance ensures the alignment of purchasing activities within the company's strategy. The visibility of a multi-tier supply chain will be the cutting edge for the future."

Dr. Lars Immerthal
Director, Consulting –
Supply Chain Management &
Procurement



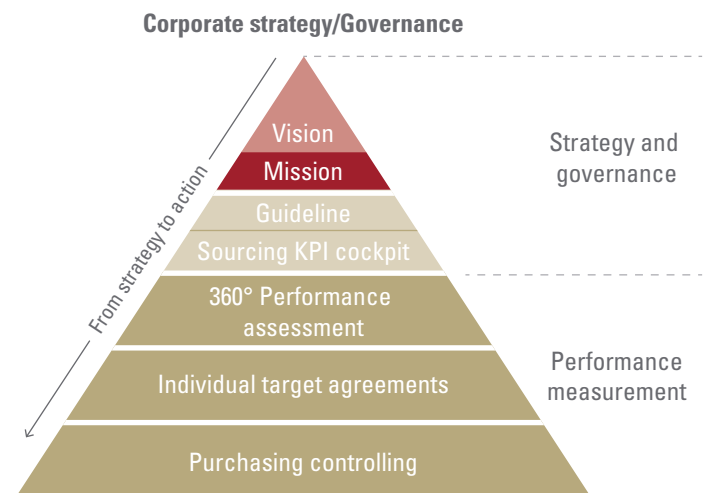
Drivers

- The increasing amount of parts and components from suppliers (vendor parts) is a result of decreasing vertical backward integration and a reduced production depth.
- Need for sustainable reduction of costs, optimisation of working capital or guaranteeing supply security in times of increasing shortages, price volatility and geopolitically instable raw material markets.
- Growing impact of sustainability issues and risks along the supply chain, rising sustainability requirements and new local or international standards.
- Increasing availability of information and industry insights (knowledge about the industry, competitors, suppliers, technologies, materials, etc.).
- Changes along the value chain (new service provider/supplier, new materials/substitutes, new production methods and processing technologies, etc.).
- Development of international standards, precisely defined interfaces and uniform methods.

Impact and consequences for companies

- Focusing on supply chain management to optimise the comprehensive planning along the value chain. Thinking and acting in supply chains (outsourcing, module sourcing, innovation scouting, etc.).
- All relevant procurement processes have to be benchmarked and optimised based on best practices.
- Development of a corporate-wide, uniform transparency base on commodity groups, suppliers and contracts.
- High cost of specialized skills.
- The increase in numbers of strategic vendors/partners underline the need for efficient sourcing governance structures.
- The involved parties of an outsourcing project have to identify effective governance as a fundamental requirement for successful outsourcing arrangements.
- Increasing regulatory risks require adequate compliance.

Purchasing activities and company strategy



Source: 2013 KPMG, Germany

KPMG point of view

Procurement within an international environment needs a systematic engagement of the organisation, not merely a local presence. Companies need a highly skilled procurement organization engaged at appropriate levels of the value chain employing disciplined, rigorous world-class processes.

The key success factors of sourcing governance are a sourcing efficiency cockpit, a global sourcing governance code of conduct and continuous risk and compliance monitoring. Implementation of tools can help bring oversight and transparency to sourcing governance.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Companies must embrace supply chain excellence as a core competency at all levels throughout the company and recognise that supply chain management is executed in many areas, not just the functional supply chain organisation.
- Perform continuous risk and compliance monitoring.
- Conduct vendor assessments and selection.
- Perform strategic training and qualification of purchasing employees.



Trend 10 Additive Manufacturing/3D Printing

Additive manufacturing (3D printing) describes the technologies of making a three-dimensional solid object of virtually any shape from a digital model. This production method is achieved using an additive process, where successive layers of material (e.g. plastic, metal, ceramics) are laid down in different shapes. Parts are built up from a large number of very thin two-dimensional cross sections (layers). The layer's particles are bound by heat or chemicals. 3D printing is considered distinct from traditional machining techniques, which primarily rely on the removal of material by methods such as cutting or drilling (subtractive processes). This layered manufacturing process is moving from an expensive niche tool for rapid prototyping to rapid manufacturing for a wide range of industries (e.g. aerospace and defence, automotive, medical technology). Industrial and consumer 3D printing will become one of the next revolutions along the entire supply and value chain.

“Additive or 3D manufacturing is a new kind of production. This technology can significantly change the way we produce. Companies should foster this challenge.”

Wolfgang F. Grassl
Partner, Consulting –
Supply Chain Management
& Procurement



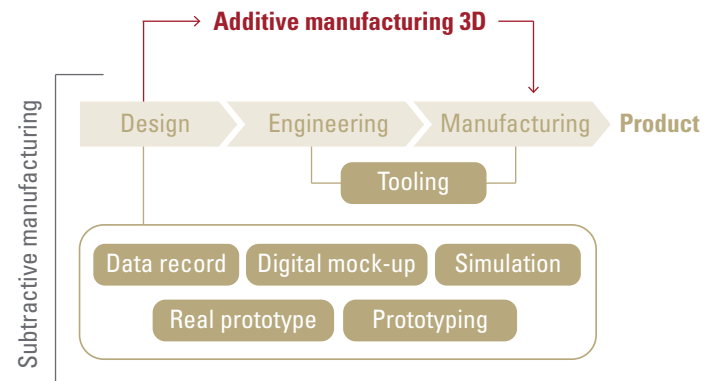
Drivers

- The challenge is to improve the “time to market” and to reduce lead time as well as material input.
- Individualism, tailor-made products, small lot sizes and regional availability are definitely great benefits of the new technology.
- Lower unit cost due to reduced tooling, labour costs and expensive logistic networks.
- Decreasing logistics of spare parts and basic commodities will lead to environmental advantages.
- Availability of robust and affordable hardware.
- Competitiveness of materials with traditional technologies like plastic moulding.

Impact and consequences for companies

- Additive processes will substitute to a certain degree other processing technologies and lead to a redesign of the entire supply and value chains of certain industries.
- New business models: Small, flexible and specialised 3D manufacturing units, so called “fabbing companies” will enter the market as part of established manufacturing companies (in-house) or as new competitors to traditional industries.
- Due to decentralisation, customer proximity and optimised lead times, the overall and “just in time” availability of 3D printed objects will change today's complex and expensive logistic chains.
- With the development of local and regional “fabbing shops”, the global logistics industry will be confronted with a major decline in this specific business. The spare part logistics for certain products will be reduced dramatically in certain industries.
- Low-volume, high-value, tool-free production and a low fixed cost risk lowers the market entry risk of new competitors.
- Labour will account for a smaller proportion of manufacturing costs: Cost advantages in low cost countries will decrease and repatriate production to countries of origin (back-sourcing).
- Division of labour will be redefined: Design and production will move to the customer.

Process steps in additive manufacturing



“Traditional” production processes are more time consuming and cost intensive due to multiple process steps

Source: 2013 KPMG, Germany

KPMG point of view

Additive manufacturing represents not only a new type of technology along the lines of the inkjet or laser printing, with their impact on copy and print shops in the 80's. It will result in new business models with dramatic effects on industries, companies and society. Companies will seek security with respect to intellectual property (Who has the right to “print”? What about royalties?). Companies have to know which legal requirements are needed in the future to avoid distortion of competition. Management will need to identify and discuss the appropriate business model for its industry and market environment. Management has to redesign the company's value chain to be successful in a “disrupted new supply chain world”.

KPMG recommendations

In view of these aspects, KPMG recommends the following actions be considered:

- Accept the challenge and consider this as an opportunity for your company, like CAD, the Internet and the Web.
- Revise existing strategy and analyse the threats and benefits of the new technology. Manufacturing companies should be able to grasp the opportunities offered by this technology and to master the paradigm shift of the existing business model in the future.
- Start now to integrate additive manufacturing to the existing supply chain to be ready to compete with new players in the market in future.

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