

Country Profile European Union

Stand: 17. Dezember 2015



Präambel:

Wir schreiben im Folgenden in der maskulinen Form, und zwar ausschließlich wegen der einfacheren Lesbarkeit: Wenn beispielsweise von Mitarbeitern die Rede ist, meinen wir selbstredend auch Mitarbeiterinnen.

Empfohlene Zitierweise:

GAUSEMEIER, J.; KLOCKE, F.: Industrie 4.0 – Internationaler Benchmark, Zukunftsoption und Handlungsempfehlungen für die Produktionsforschung. Paderborn, Aachen, 2016

Region Profile European Union

Summary

Integration is key. All required competencies exist, but are scattered. Three trends can be observed: **Reindustrialization** (e.g. France, UK), **advancing new technology** and **extending existing strong technology fields** (e.g. Germany, Italy) and **driving innovations** in the area of **digital interconnectivity and business opportunities** (e.g. Sweden, Finland). EU strategy aims at an **integration of production and society**: EU programs are motivated by **increasing productivity and sustainability**. A **high market demand** exists for **sustainable products and process technologies**, due to strict regulations of the European government. **Close collaborations** exist in regional and EU-wide clusters which are strongly **supported by EU funds**. Very good infrastructure, **cultural proximity** and various competences in **industrial IT** and **manufacturing** lead to a **strong position** of companies on **global markets**. Realizing cost-effective **individualization** and **personalization in production** is seen as **priority**.

Highlights



Sustainability

Mindset for sustainable products drives Industrie 4.0. **High market demand** for sustainable products and EU-wide **homogenization of regulations** on **high level** lead to an **emphasis on research** in sustainable manufacturing processes.



Internationality

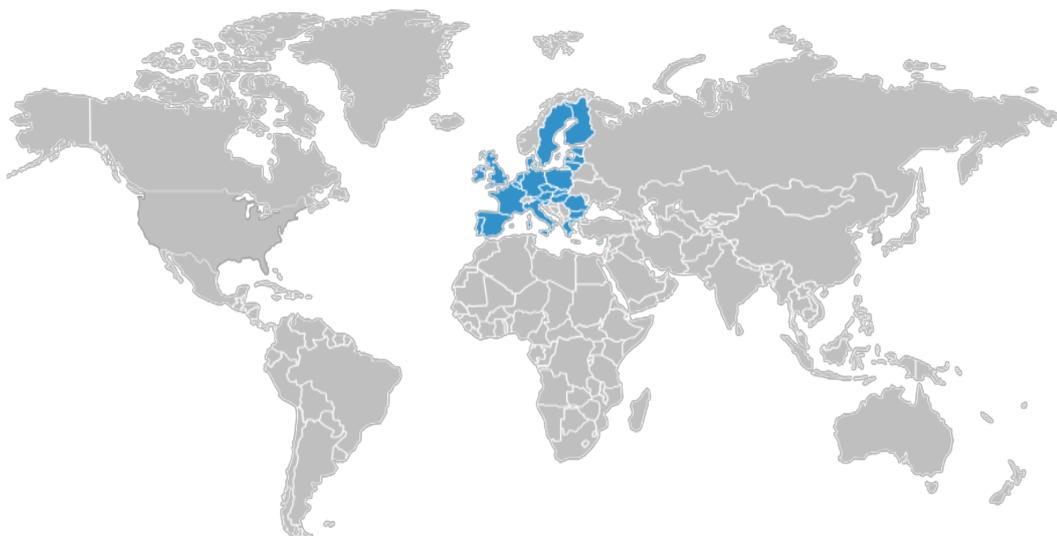
Cultural proximity and **various competences in industrial IT and manufacturing** lead to a **close cooperation and collaboration** of industry, research and politics throughout Europe.



Access to Markets

Regional, national and EU-wide clusters exist. Strong European countries are **lead supplier and lead market** for **advanced technology** in manufacturing; **Supply chains** are short inside Europe due to the high level infrastructure.

Map



Industrie 4.0 in the European Union

Drivers/ Challenges	<p>Drivers</p> <ul style="list-style-type: none"> ▪ Sustainability awareness in society and ambitious regulations of the European Commission push investments in resource efficient production systems ▪ Massive public investments in manufacturing innovations and structural measures as a consequence of the economic crisis in 2009 ▪ Strong and different manufacturing competences and availability of various technologies leverage EU-wide collaboration 	<p>Challenges</p> <ul style="list-style-type: none"> ▪ Existing differences in capabilities of SMEs compared to large companies in most regions ▪ Lacking alignment of political programs at the EU level and at national government level ▪ Wide Gap of technological potentials between countries inside the European Union
Key Stakeholder	<ul style="list-style-type: none"> ▪ European Commission – Executive body of the European Union ▪ European Factories of the Future Research Association (EFFRA) – Industry-driven association promoting the development of new and innovative production technologies (Public-Private Partnership (PPP) of Factories of the Future (FoF) program) 	<ul style="list-style-type: none"> ▪ ManuFuture Technology Platform – Knowledge Community of political and industrial stakeholders to promote sustainable manufacturing in Europe ▪ European Institute of Innovations and Technology (EIT) – Integration of innovation, research and growth across the EU, funding agency for KICs operating across a number of hubs called »co-location centers«
Key Approaches	<p>Factories of the Future (FoF) Public-Private Partnership (PPP) program by the European Commission focusing on high added value manufacturing technologies for future factories, which will be highly performing, clean, environmental friendly and socially sustainable. Digitalization of factories and manufacturing processes are just a part of the PPP activities. Launched under the European Economic Recovery Plan in 2008, PPP activities were first funded under the EU's 7th EU Framework Programme for Research (FP7 - 2007-2013) and continued under the strategy initiative Horizon 2020 with the EU Framework Programme for Research and Innovation (FP8 - 2014-2020).</p> <p>Digital Agenda for Europe Europe 2020 strategy flagship initiative built on seven pillars. Pillars with direct link to Industrie 4.0 related topics are »Enhancing interoperability and standards«, »Promoting fast and ultra-fast internet access for industry and public« and »Investing in research and innovation with main focus on ICT research«.</p> <p>Knowledge and Innovation Communities (KICs) Communities consisting of stakeholders from politics, research and industry that enable the European Institute of Innovations and Technology (EIT) to promote innovation in Europe. Two of five already established KICs are focusing on Industrie 4.0 related topics: EIT Digital – addressing information and communication technologies, EIT Raw Materials – addressing sustainable exploration, extraction, processing, recycling and substitution. In 2016 a further KIC on Added-Value manufacturing centrally in corporation research on Industrie 4.0 concepts is planned.</p> <p>European Technology Platform Industrial Safety (ETPIS) Open cross European Technology Platform (ETP) initiative focusing on industrial safety and risk management research & innovation of infrastructure, energy products and production and transversal issues.</p>	

Technology (1/2)

 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Overview</p>	<p>Existing broad and strong technology and manufacturing competences enable small to large companies to take leading position on global markets. Availability of various competences in industrial IT and manufacturing, high level infrastructure and cultural proximity leverage EU-wide collaboration supplier networks. Various SMEs have strong competences in machine and plant engineering. Strong industrial IT competencies are existing mainly at large companies like Dassault Systèmes or SAP and operating networks for telecommunication (e.g. Vodafone, Telekom, Telefonica etc.). The European Union primarily drives basic technology development by funded Public-Private-Partnerships (PPP) programs.</p>
 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Security</p>	<p>Industrial security is seen as a weak point all over the European Union. Research in industrial security is considered by EU strategy initiative Horizon 2020 and national programs like Industrie 4.0 in Germany or government activities in Finland. The European Industrial Data Space is an Initiative of Fraunhofer Society and industry partners inside and outside Europe supported by Ministries of the German government to establish an international open data space which is open for every company that accepts shared standards. The aim is to have a secure infrastructure for companies to share their data and to develop secure solutions for digitalized products and processes in production and business areas.</p>
 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Standards, Migration and Interoperability</p>	<p>Harmonization of standards is key. Main goal of the European Commission is the harmonization of standards which are used all over the EU countries. Within the Digital Agenda (pillar II: interoperability and standards) the European Commission wants to ensure that new IT devices, applications, data repositories and services interact seamlessly and could be used anywhere. The harmonization of standards and interoperability is to be achieved by improved standard-setting procedures which are identified by actions of the Digital Agenda.</p>

Technology (2/2)



Sustainability

Lead market in sustainable manufacturing. Increased **sustainability awareness in society** and **ambitious regulations of the European Commission** concerning energy consumption, pollutant emissions and recycling **push investments in more resource efficient production systems**. The European Union's funding framework **►Horizon 2020** is a **main driver** for the development of technologies which have an impact on sustainability. European Unions is seen as a **lead market for sustainable products and production technologies**. Due to this leading market position, **regulations are exported outside the EU** due to the fact that EU imports have to fulfil EU requirements.



User friendliness

Demographic changes and ergonomics predominating innovations. The main focus is on development and using user friendly technologies to enable older people to work longer in production environments. One main objective is to shift from physical intensive work to more digital assisted systems. Strong competencies exist in ergonomics concerning research and industry. Strong unions all over Europe pushed the implementation of ergonomic systems in production in the last decades. Further user friendly technologies and interfaces are used to enhance the ability of shop floor worker to take more, faster and better decisions. Increasing the ability to take more independent decisions and more responsibilities is seen as an opportunity to use the potential of already high level qualified shop floor workers.



Collection and Analysis

Competencies in data analysis with special use cases in production are mainly located in the Nordic states. High level of ICT and sensor technology competence and **high value of testing and innovation** lead to application of production technologies with **focus on ICT implementation in local industries** (e.g. in Finland). **Advanced sensor technology is strong**, but primarily based on Germany's competencies in that field. For commercial or non-commercial purposes the **European Union Open Data Portal provides freely available data** from the institutions and other bodies of the European Union (EU). The portal aims at promoting the **innovative use of open data** and the exploitation of the economic potential.



Material and Information Flow

Industrial IT is strong on business process level, but development potentials are seen on the shop floor and ►MES level. Strong suppliers of ►ERP/ ►PLM systems are mainly located in France (e.g. Dassault Systèmes) and Germany (e.g. SAP). **Vertical integration from shop floor to ERP level is seen as priority** rather than horizontal integration of value chains. **Single source of truth and seamless data integration in heterogeneous software environments** are seen as **main challenge**. Level of competence in **material flow** and **automation** in industry is **high**. Big global players exist as well as advanced research. Germany and the Netherlands are leading suppliers for **advanced logistic solutions inside and outside the factory**. **Drivers** are very good **infrastructure** conditions between the European countries and a **large single market**. Due to the **trend of individualization and personalization** industry is **shifting** from **highly automated production systems to more flexible and adaptive production** (e.g. in Italy and Germany).

People

 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Overview</p>	<p>Importance of ethics and values in economy and manufacturing sector is high. Cultural exchange is common and actively promoted and supported by the European Union which leads to a high degree of internationalization of especially young people inside the EU. People have a high acceptance of quality standards and see outstanding quality in manufacturing processes and products as a differentiating factor for supplying products. Importance of health and safety concerns led to high standards of safety and ergonomic systems in production systems.</p>
 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Training and Qualification</p>	<p>Education and qualification systems differ strongly inside the European Union. The European educational system at universities was harmonized to allow students all over the EU countries to change university easily. The European Union actively supports the interdisciplinary exchange in qualification through programs like Erasmus which promotes the easy exchange of students during their studies. Therefore, mainly the young generation inside Europe has grown up with the flexibility and intercultural competence that is needed for jobs in production industry. Industrial training is currently not actively influenced by the European Union. In some EU countries high quality education is concentrated in less expensive private elite universities. In contrast some countries (e.g. Germany, Netherlands, Nordic states) have a broad education system and a well-educated broad basis among the society. Many EU countries see a backlog demand for a more practical education at universities, because graduates are theoretical highly educated, but lacking of using their theoretical knowledge at work.</p>
 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Implementation of » Production«</p>	<p>Increasing importance of the manufacturing industry. The increasing importance of production is based on two different perspectives. Countries which preserve strong competencies in production are aware of the importance of the industry sector and are willing to obtain leading supplying position (e.g. Germany or Northern region of Italy). Countries which mainly focused on the service sector during the past 20 years and lost many competences in the production sector are currently shifting to reindustrializing their industry (e.g. like France, UK and Spain). The reputation and image among the European population of the manufacturing sector is increasing since the financial crisis in 2009, because jobs are recognized as more secure.</p>
 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">» Pioneering Spirit«</p>	<p>Very heterogeneous work culture and pioneering spirit all over Europe. Levels of risk aversion exist between countries like Sweden, Finland or UK which have a more entrepreneurial and risk-taking culture, and other EU countries. Especially Swedes have a distinct pioneering spirit and the environment for start-ups, including the access to venture capital, is good. As a consequence, several very successful start-ups from the software-industry, e.g. Skype, SoundCloud or Spotify, were founded. Other countries are doing well regarding the implementation of more flexible working-time models (e.g. Germany).</p>

Organization

 Overview	<p>Industry associations as well as regional research and industry clusters funded by European and/or national governments are seen as highly important to drive innovation in Industrie 4.0 related topics like digitalization and interconnectivity in manufacturing. Integrating the high number of specialized SMEs is seen as key. Collaboration of competitors on pre-competitive development is common and usually done in consortium projects. Large companies in competitive industries, especially in the automotive industry, started joint ventures for the development of technology platforms to increase cost-effectiveness. Trust for cooperation between organizations exists based on strong rule-law in most European countries, but economic law is not harmonized in the European Union. The ►European Commission currently discusses the establishment of a European contract law.</p>
 Business Model	<p>Companies in the manufacturing sector see high potentials in changing their business models based on the use of aggregated data in production or products. Implementation of new business models in manufacturing industry is done hesitantly, because traditional mindset of technology push oriented strategies is dominating. Best practices in implementing innovative business models exist mainly in European countries with a more entrepreneurial and risk-taking culture (e.g. Finland, Sweden or UK). Rolls Royce (UK) is seen as a best practice, because of transforming their Jet-Engine Business Model by servicing and selling spare parts for engines instead of selling the engine itself. By collecting and analyzing field data the reliability and efficiency of engines can be improved continuously while margins on servicing and spare parts are higher than on sold engines. Also manufacturing supplier see potential to transfer this business model to their machines. The development of exploiting strategies and business models is also required in funded research projects of the ►Horizon 2020 program.</p>
 Corporate Culture and Flexibility	<p>Historically grown, legally independent and often still family-owned large companies and SMEs. Most companies are managed with a long-term perspective. Industries are often supported by government grants to survive even under heavy market conditions. Regional industry clusters within the European Union exist to aggregate competences and to improve competitiveness on global market. Besides several companies of a certain industry, clusters usually include also local research institutes and universities. Collaborative projects are funded by the European Union or national governments between the members of those clusters to enable larger research projects and to promote EU-wide collaboration and knowledge transfer. The corporate culture is dominated by a mindset of social awareness: Companies are aware of their social responsibility. Technology acceptance and affinity in society as well as failure acceptance and readiness to assume economical risk is seen as generally on medium level, but especially the Scandinavian countries are seen outstanding in Europe. Organizational structures of companies are heterogeneous. Countries exist where flexible organizational structures are implemented with a social acceptable manner. Some countries are trying to shift to more flexible structures while other countries do not discuss address this topic.</p>
 Internationality	<p>Internationalization is core idea of European Union. Internationalization is an on-going process in all European companies. Many companies already set up English as corporate language, but progress is different. This process is supported by the opportunity of the European Union to transform the legal status of a company to a Societas Europaea (SE). Companies with SE status can easily transfer to, or merge with companies in, other member states. Internationalization is driven by comparable small domestic markets in each EU country and traditionally high focus on export inside and outside Europe. Driven by collaboration of research and industry between the European countries and the export-oriented industry English skills especially of the young generation are high. Due to the still existing economic problems in the south European countries as a consequence of the economic crisis in 2009, top talents of these countries prefer to apply for jobs in EU countries with a more robust economic situation.</p>

Business Environment



Overview

The European Union sees **advanced manufacturing as core competence field**. Although all **required competencies exist**, **national trends and strategies differ from the European Union's perspective**. Basically **three trends** can be observed throughout the EU: Countries characterized by a **strong manufacturing basis and many specialized SME** are focusing on **advanced high manufacturing technology** with main priority on realizing **individualization and personalization in production at mass production costs** through Industrie 4.0 solutions. Countries with strong competences in **data analytics** and a more **entrepreneurial culture** drive innovations in the area of **digital interconnectivity and business opportunities for Web 2.0 applications** in production. **Few countries** which **neglected the manufacturing industry** in the last decades **lost competences**, but **currently setting up programs for reindustrialization**.



Political Will and Restrictions

Redundancies between political strategy of EU and national governments. Overlaps between national and EU program exist, because **coordination** of national and EU-wide funding program on European political level is **lacking**. EU program primarily lead to an EU-wide high collaboration of research and industry on operational level. The **strategic framework** for ▶Factories of the Future programs coordinated by the European Union is motivated by **increasing productivity and sustainability of manufacturing processes**.



Access to Capital

Large budget for funding exists on European level (e.g. ▶Horizon 2020). Funding is **concentrated on research and SMEs**, but also funding programs for start-ups exist. **Lack of access to risk capital exists** with few exceptions. **Programs for economic growth and structural funds** were set up during the financial crisis in 2009 and afterwards. Programs consider both **short and long-term goals in research and innovation**: Besides advanced material, manufacturing and processing also **long-term research fields, e.g. nanotechnologies, are funded**.



Access to Selling and Procurement Markets

Lead market and supplier for advanced and sustainable manufacturing technologies. Due to the fact that the **single market for machines and plant engineering is very small in every European country** compared to the world market, small to large companies are **highly export-oriented** and the European Union has a **high degree of market integration**. **Competences** in various technology fields to **develop and supply Industrie 4.0 solutions** exist. **Competence clusters** related to Industrie 4.0 topics exists **regional, national or EU-wide** and are actively **supported by European and national governments**. **Distances in supply chains are often short** due to the **high level infrastructure** and regional availability of suppliers. Due to the **European Monetary Union**, the **access to selling and procurement markets inside Europe is straightforward**.