INDUSTRY 4.0 IN THE REGION OF STUTTGART

Third Platform Event of RIM Plus 2015-2016
Developing New Skills for Advanced Manufacturing
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Fraunhofer IAO, Competence Center R&D Management
Profile of Fraunhofer Institute for Industrial engineering and Institute for Human Factors and Technology Management IAT, University of Stuttgart

- Founded:
  IAO – 1981
  IAT – 1991
- Director (acting): Prof. Dr.-Ing. Wilhelm Bauer
- Budget:
  34.3 million euros, of which 34.8% are generated from industry
- Staff:
  some 560 employees

Figures from 2014, including IAT University of Stuttgart

www.iao.fraunhofer.de/lang-en
www.iat.uni-stuttgart.de
People are at the heart of our research

- People & the working environment
- People & innovation
- People & IT
- People & services
- People & organizations
- People & manufacturing
- People & the city
- People & mobility
- People & corporate development
Our Areas of Business and Research

Human factors and technology management

Workplace  Workspace  Human-Computer-Interaction  Information Technology

Humans interacting with their living and working environments within a digitalized society and economy

Smart City  Smart Factory  Smart Services  Innovation

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Digitalization (factory of the future, smart factory, Industry 4.0, smart industry, IoT, ...) is everywhere ...
How to deal with digitalization

»We need to significantly increase the speed of our actions. The digitalization must be a top issue in Germany and Europe. The Revolution itself out faster than many actors in politics and economics wanted to admit it.«

ICT in Germany: 85 billion EUR total revenue, 86,000 companies and over 900,000 employees

German Chancellor Merkel reinforcing the need of intelligent usage of
»Big Data« and Industry 4.0:
»Take chances – avoid risks!«
Manufacturing Industries in the Stuttgart Region, but

- **Leadership in innovation** in numerous manufacturing industries (e.g. machinery, automotive, medicine technology)
- Many **lead factories** for a global manufacturing (pioneering task for product and production technology)
- **Strong manufacturing equipment industry/mechanical engineering** (e.g. leadership in machine tools, measurement instrumentation, image processing, automation)
- **Internationally renowned trade fairs** (e.g. AMB)
- Still very **efficient infrastructure** (e.g. energy, transport, IT)
- **University chairs** for production technology and industrial engineering, **basic knowledge and applied research, dual education**

References:
IW Köln (Productivity), JD Power (Best Cars), IT-Performance TNS Infratest, patents: heise online, Intelligence PIAAC-Test
Mechanical Engineering in the Stuttgart Region
Home of Mechanical Engineering
Mechanical Engineering in the Stuttgart Region
Home of Mechanical Engineering - Facts & Figures

- > 350 companies (many of them are SMEs)
- Turnover 2014: 24.5 bn €
  - 22 % of total Turnover of manufacturing industries
  - 34% of Mechanical Engineering Industry in BW
- Employment: 72,000
  - 22% of total employment in manufacturing industries
  - 7.2% of employment in Germany
- Export quota: 64.8% (individual up to 90%)
- Most important target markets:
  - Largest share: Europe
  - Largest single market: China
  - Highest growth rate: Asia (without Japan), Russia, South America
Mechanical Engineering in the Stuttgart Region
Research and Development Activities in Mechanical Engineering

Forschungs- und Entwicklungsaktivitäten im Maschinenbau in Baden-Württemberg

- Großforschungseinrichtungen: 1
- Forschungszentren der Helmholtz-Gemeinschaft e.V.: 4
- Max-Planck-Institute: 1
- Fraunhofer-Institute: 5
- Vertragsforschungseinrichtungen: 2
- Universitäre Forschungseinrichtungen: 41
- Forschungsinstitute der Fachhochschulen: 7

Symbol steht für ein Institut/Fachbereich/Zentrum

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Mechanical Engineering in the Stuttgart Region
Cluster Mechanical Engineering – Research & Education

- **University of Stuttgart**: 2nd largest department for mechanical engineering in Germany; 2 faculties with 35 specialised institutes

- **Esslingen University**: Faculty of Mechanical Engineering, Faculty of Mechatronics

- **Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)**

- **Fraunhofer Institute for Industrial Engineering (IAO)**

- **Institute for Micro Assembly Technology of the Hahn-Schickard-Gesellschaft e.V. (HSG-IMAT)**

- **Institute for Microelectronics Stuttgart (IMS-CHIPS)**

Mechanical Engineering in the Stuttgart Region
Some trends and challenges

- Shift in demand to the growth markets outside Europe (emerging countries, U.S.): internationalization, local manufacturing and localization of operations, services etc.
- Increasing competitive pressures from machinery industry from China particularly in mid technological segments
- **Increasing relevance of service business** on an international level
- **Increasing demand for customer-specific solutions.** Adaptability and flexibility, but also standardization and modularization („modularization competence“) becoming increasingly important.
- **Digital transformation in machinery sectors (Industry 4.0, Smart Factory, digital business model innovations)**
- **New, IT-based business models of IT companies** especially from the U.S. can be a big challenge for the German machine and plant construction industry (Shared Systems & Economy)
- …
Industry 4.0 at Fraunhofer IAO  
some scientific & industrial requests

Since mid of 2012:
- Industry 4.0 projects (national funded):
  - 1 research project is finished
  - 2 projects are ongoing
  - 2 projects will start Nov. 1st, 2015
- Innovation network: »Production work 4.0« [www.produktionsarbeit.de](http://www.produktionsarbeit.de)
- Numerous industrial projects
- EU proposals in preparation
- Industry 4.0 based business models
- …
Industry 4.0 at Fraunhofer IAO

Surveys, Seminars, Workshops

Research & industrial projects

Implementation
Industry 4.0 - MetamoFAB Project
Transformation to CPS Factories

Research in the field of
- Rules, methods and tools for decision-making in CPS production environments
- New flexible organizational structures in CPS factories
- **Qualification measures**: products, machinery, **employee**, ICT
- Method for easy handling of transformation
- Assessment of CPS based business models

Transformation of “Brown Fields” to networked and intelligent CPS (Cyber Physical Systems) Factories
Industry 4.0 - MetamoFAB Project
Festo – Demonstrator Technology factory Scharnhausen

Objectives:
- Presentation of a networked overall system based on sensors, distributed network and decentralized control
- Design of staff, organization and competence development closely connected with technology development

Challenges:
- Consumption measurements, continuous condition monitoring and superior control possibilities of machines
- Visualization of decentralized energy control console
- Continuous improvement process for the resource energy
Industry 4.0 – JUMP 4.0 Project
Processes management on shop floor level for SME

Start: 11/2015 Duration: 36 months

Dynamic process management system on shop floor level for the master & worker

Objectives
- real-time transparency
- dynamic routing
- technology and skill-oriented decisions

Interactive model based guidelines

Mobile and dynamic job scheduling support on shop floor level for the master/worker within a Industry 4.0 production
Main risks of an »Industry 4.0«:
- Data security
- Process and work organization
- Standardization
- Labor resources
- Professional development
- Research activities
- Regulatory framework
- Available products
- New business models

Impact on production work
Big discussions between experts

Experiences on employment cannot be foreseen (quantified) yet – »old« jobs are threatened; »new« jobs will develop!

Development of the skills of employees is a crucial topics!
Thank you for your attention!

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