Cluster of Excellence
Integrative Production Technology for High-Wage Countries
RWTH Aachen University

Third Platform Event of RIM Plus 2015-2016
Brussels, 21st October 2015
Developing New Skills for Advanced Manufacturing

Denis Özdemir
Students by Discipline WS 14/15

- Natural Sciences: 57%
- Medicine, Dentistry: 7%
- Humanities, Social Sciences and Economics: 13%
- Engineering: 23%

Total: 42,298 Students
German Research Foundation (DFG) Excellence Initiative

Key figures of the second phase (2012-2017)

- Total funding: 2.7 Billion Euros
- Funded projects: 99 projects at 39 universities
  - 11 Institutional Strategies ("Excellent Universities")
  - 43 Clusters of Excellence
  - 45 Graduate Schools

“RWTH 2020: Meeting Global Challenges”

- Clusters of Excellence
  - "Integrative Production Technology for High-Wage Countries"
  - “Tailor-Made Fuels from Biomass" (TMFB)
- Graduate Schools
  - “Aachen Institute of Advanced Study in Computational Engineering Science” (AICES)

Source: DFG
Cluster of Excellence

- Institutions:
  - RWTH Aachen University
  - ACCESS e.V
  - Fraunhofer ILT and IPT
  - Institute of Plastics Processing (IKV)
  - FIR e.V. at the RWTH Aachen University
  - Institute for Management Cybernetics e.V. (IFU)
  - WZLforum

- 5 faculties
- 27 professors
- 82 funded staff
Research Objective of the Cluster
Resolution of the Polylemma of Production

Market-oriented view

Economies of scale
- Synchronized processes
- High-frequency production cycle

Economies of scope
- Flexibility and versatility
- Dynamic and complex product creation chains

Resource-oriented view

Planning orientation
- Centralized knowledge management
- Integration of virtual deterministic models

Value orientation
- Decentralized near-process decision making
- Standardized methods
Exemplary Project: Individualized Production

Direct, Mold-less Production Systems

Mold-based Production Systems

Source: ILT, CATS, GI
Industrial Advisory Board

<table>
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<tr>
<th>Company Name</th>
<th>Location</th>
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<tbody>
<tr>
<td>ABB AG Forschungszentrum</td>
<td>Ladenburg</td>
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<td>Airbus Operations GmbH</td>
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| German Automobile Industry Association (VDA), Frankfurt |}

Cluster of Excellence
Integrative Production Technology for High-Wage Countries
www.production-research.de
The vision: RWTH Aachen Campus as research catalyst and driver of innovation

Research yesterday
- Long development times
- Narrow solution corridors

Research today
- Long development times
- Narrow solution corridors

Research tomorrow
- Shortened development times
- Broader solution corridors
Company Enrollment: Cooperation model to strengthen cooperation between industry and RWTH

**RWTH Aachen Campus**

- Research questions, resources, qualified staff
- Research results, resources, qualified staff
- Advanced (vocational) training
- Lecturers, visiting professors, case studies, resources

**Symbiosis of Science and Industry**

- Holistic and systemic research
- Demand-oriented integration of skills and disciplines
- Consolidation of cooperation
- Attractive service offerings
- Clear assignment of roles and responsibilities
- Access to resources and technology
- Use of synergies effects and economies of scale

**Enrollment**

- Industry
- Research & Development
- Development RWTH
RWTH Aachen Campus: Current developments

- **Sustainable Energy Cluster**
  - E.ON Energy Research Center
  - Completion date: autumn 2015

- **Photonics Cluster**
  - Move-in: December 2014

- **Bilingual day-care center**
  - Move-in: December 2014

- **Heavy-Duty Drives Cluster**
  - CWD – Move-in: spring 2015

- **Logistics Cluster**
  - eLab - Completion date: summer 2015

- **Production Engineering Cluster**
  - Completion date: autumn 2016

- **Bio-Medical Engineering Cluster**
  - CBMS – Start of construction: spring 2015

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Logistics Cluster / Demonstration Factory

Logistics Cluster

Demotstration Factory in the Logistics Cluster

Street Scooter-Space-Frame

MAXeKart

Source: Schuh et al. (2014) „Fabrik des Jahres“
Services for Companies (exemplary)

Industrie 4.0 seminars and trainings

Modular, adaptable Industrie 4.0 seminars and trainings are offered by WZL in cooperation with Demonstration Factory Aachen. Seminars and trainings include:

- workshops and educational games regarding the potential of Industrie 4.0 technologies
- tours of Demonstration Factory Aachen with a chance to experience different use-cases
- expert presentations on smart production planning and control, smart work planning, IT-tools and technologies as enablers for Industrie 4.0 and many more topics

Certificate courses

The new certificate courses Industrie 4.0 for management and Industrie 4.0 for operations are offered starting from April 2016 by RWTH International Academy. The one week-courses communicate content regarding:

- building of expertise in analysis, design and optimisation of processes with Industrie 4.0 technology on the basis of use-cases
- significance and importance of Industrie 4.0
- best and next practices for realisation of Industrie 4.0 projects on a strategic level

offered by RWTH International Academy in cooperation with WZL, FIR and IMA/ZLW & IfU
Hands-On Education – “SmartAutomationLab”

Injection molding process with stem-form

Standard part

Individualized manufacturing

Assembly RFID-Tag

Pre-palletizing

Transport to printer

Component assembly with robot cell

Individual color printing

Cube assembly with FlexPicker

Customer

Product design

Order dispatching

Planning level

ERP

MES

Guidance level

Cell level

Control level

Field level

Process level

Manufacturing / production process

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Services for Companies (exemplary)

- Software Engineer
- Mechanical Engineer

2 Cultures

Communicate Problems
Understand Solutions
Work together
Understand different views

2 Languages

Source: IMA, ZLW & IfU
The Aachen Center for Integrative Lightweight Production (AZL)

AZL Development Center completion in 2016

- Office building
- Machinery hall
- Staffing:
  - Scientists
  - Technicians
  - Designers
- Founded in 2012

Source: AZL

Full Scale Production Equipment for:
- Thermoplastic systems
- Thermoset systems
- Multimaterial systems

Composite Academy
- Education for industrial staff
  - Technicians, lab workers, engineers, managers
- Seminars
- Sales and Marketing Excellence

Consultancy Services
- Market studies
- Technology transfer
- Benchmarking
- Innovation management
Tool Making

Degree of qualification

Seminar
- Module of WBA
- Consisting of:
  - Preparation time
  - 2 x 3 days of attendance
  - Practical application
  - Examination

Graduation
- WBA certificate
- 0 ECTS

Admission criteria
- None

Module
- 4 Modules of WBA
- Consisting of:
  - 2 technical modules (electives)
  - 2 organizational modules (electives)
  - 1 expert thesis of 15 ECTS

Graduation
- Expert (WBA)
- 35 ECTS

Admission criteria
- Professional education
- Professional experience
- Personal aptitude

Expert Tool Making
- 10 modules of WBA
- Consisting of:
  - 8 modules of 5 ECTS
  - 1 expert thesis of 15 ECTS
  - 1 senior expert thesis of 25 ECTS
  - 30 months regular period of study

Graduation
- Senior-Expert (WBA)
- 80 ECTS

Admission criteria
- Professional education
- Professional experience
- Personal aptitude

Senior-Expert Tool Making
- Extra-occupational Master of RWTH Aachen
- Consisting of:
  - 10 modules of 5 ECTS
  - 1 project thesis of 15 ECTS
  - 1 Master thesis of 25 ECTS
  - 36 months regular period of study

Graduation
- Master RWTH Aachen
- 90 ECTS

Admission criteria
- University Entrance Diploma (B.Sc.)
- Professional experience

Master Tool Making

Source: WBA
Strategic Challenges of Academic Education

- Certificate
- Expert Certificate
- University Study
- Master Program
- Seminars / Summer Schools / Conferences / MOOC

Source: International Academy
Outlook

- Challenges:
  - The main potential of Digitalization and cross-linking is not to solve the problems of today’s production
  - Production has to be re-invented

- Objective: Radical productivity increase by new processes, machines, production systems and business models in the digitally networked world

- New methods for human-machine cooperation for engineering and production (Collaboration Productivity)

Analogies:
- Analogy: No significant productivity increase if just the steam engine is replaced by an electric motor
- Analogy: Standard computer and human together beat the supercomputer

Idea of the analogy: Andrew McAfee und Erik Brynjolfsson
Thank you for your attention
Contact

Denis Özdemir

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