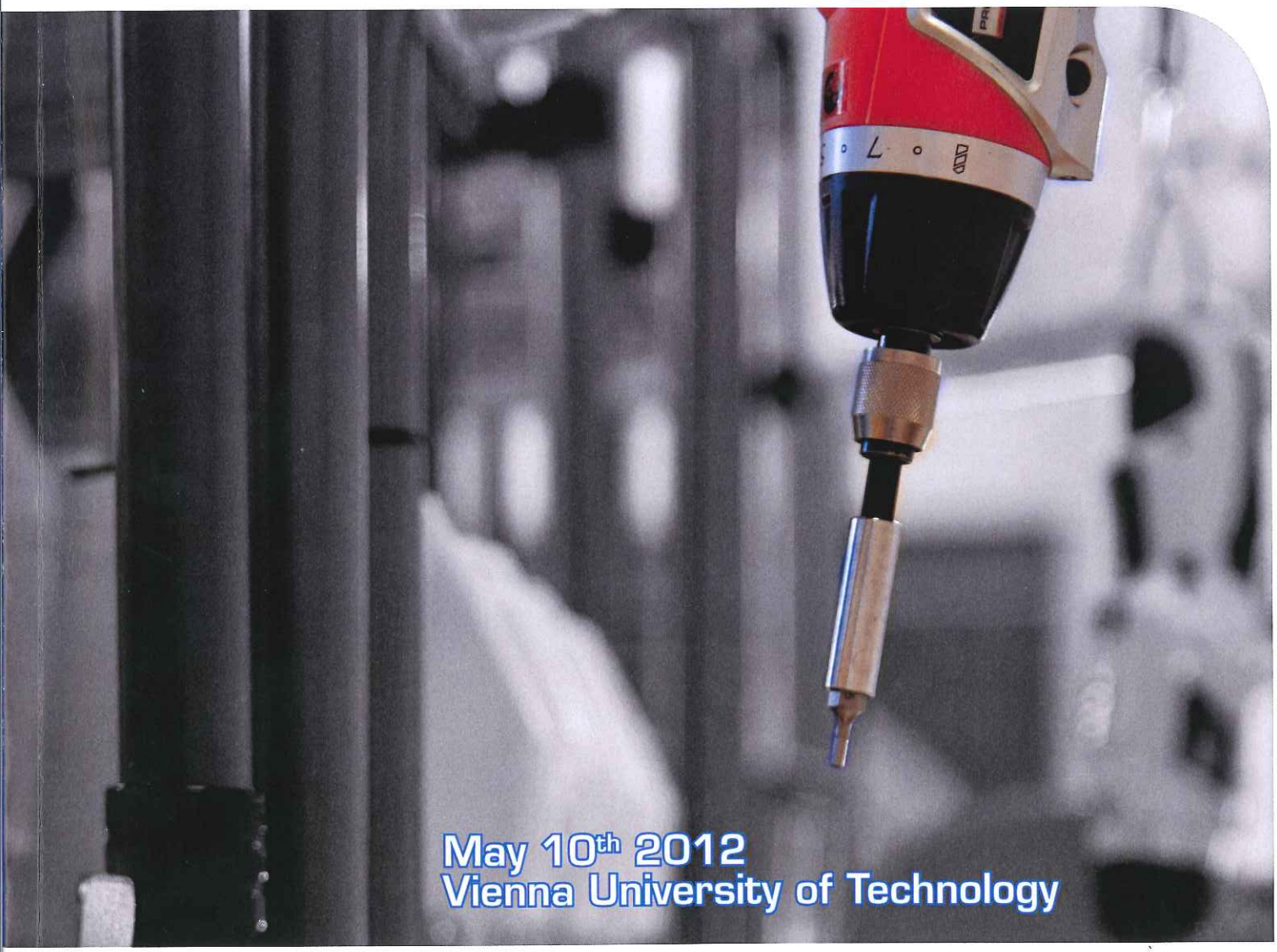
2nd Conference on Learning Factories

Competitive production in Europe through education and training



TU WIEN IFT MIVP imw Fraunhofer AUSTRIA

Content

Agenda

09:00	Opening of the conference Rector of the Vienna University of Technology, Prof. Sabine Seidler Chairman: Vice president of the "Initiative on European Learning Factories" Prof. Wilfried Sihn (Vienna University of Technology)	
Block I	**Universities**	
09:15	Session 1:	Potential of Learning Factories as education and innovation centres for universities and the production industry Speaker: Prof. Kurt Matyas (TU Vienna)
09:45	Session 2:	Hands-on Training Center for Industrial Engineering in Higher Education Speaker: Prof. Jochen Deuse (TU Dortmund)
10:15	Session 3:	5 years Process Learning Factory CiP at TU Darmstadt - Concept, Results,Experiences and still new Challenges Speaker: President of the "Initiative on European Learning Factories" Prof. Eberhard Abele (TU Darmstadt)
10:45	Coffee break	
11:15	Session 4:	Green Factories Bavaria Speaker: Prof. Gunther Reinhart (TU Munich)
Block II	**Industry**	
11:45	Session 5:	Multi-Dimensional Networked Learning within the ESB Logistics Learning Factory – Innovative approach, teaching-learning concept and engineering project games Speaker: Prof. Vera Hummel, Prof. Harald Augustin (Reutlingen University)
12:15	Lunch	
13:15	Session 6:	Learning shopfloor – continuous improvement Speaker: DI Rudolf Hamp (Opel Wien GmbH)
13:45	Session 7:	Excellent Qualified and Trained Employees - The Key for the successfull implementation of Lean Production Speaker: DI (FH) Frank Werz, MBA
14:15	Coffee break	
14:45	Session 8:	Sometimes cold or wide, sometimes fast or dark - boosting changeability by learning factories Speaker: Klaus Zimmermann (Festo Didactic GmbH)
Block III	**TU Vienna Learning Factory**	
15:15	Session 9:	Education for the 21st century - impacts for teaching and learning Speaker:Dr. Markus Tomaschitz (Magna International Europe AG)
15:45	Session 10:	Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology Speaker: Prof. Wilfried Sihn, Prof. Friedrich Bleicher, Prof. Detlef Gerhard (TU Vienna)
16:10	Closing of the conference	
16:20	Transport to the Institute for Production Engineering and Laser Technology	
17:00	Visit and inspection of the Learning and Innovation Factory of the TU Vienna	
18:00	Transport back to the Vienna University of Technology	
19:30	Dinner event at the Vienna city hall	

Impressum

Offenlegung gemäß § 25 Mediengesetz:

Institut für Managementwissenschaften, Bereich Betriebstechnik und Systemplanung, an der TU Wien, 1040 Wien

Leiter des Bereiches Betriebstechnik und Systemplanung

Univ.-Prof. Dr. Wilfried Sihn

Andreas Jäger MSc., MBA

Theresianumgasse 27

A-1040 Wien

Tel.: +43 1 58801 33040

Fax: +43 1 58801 33094

Univ.-Prof. Prof. eh. Dr.-Ing. Dr.h.c.Dipl.-Wirtsch.-Ing. Wilfried Sihn

Wilfried Sihn, Univ.-Prof. Prof. eh. Dr.-Ing. Dr. h.c. Dipl.-Wirtsch.-Ing., is Professor at the IMW since 2004 and Head of the Institute since March 2009. Before starting his career at the TU Wien, he was Deputy Director of the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in Stuttgart, and is Director of Fraunhofer Austria since December 2008. He has been active in the field of applied research and consulting services for more than 25 years now. His areas of expertise include production management, corporate organization, enterprise logistics, factory planning, order management, and business process reengineering. Prof. Sihn was instrumental in developing concepts as the Fractal Company. As well, he is Vice-President of the "International Society of Agile Manufacturing" and International Editor of the journal „Agility and Global Competition", as well as Guest Editor of the „International Journal of Technology Management (IJTM)". He holds lectures on the above-mentioned topics at national and international conferences. His more than 200 publications also include several books, making him an active player in scientific and practice-related discussions.

Fraunhofer Austria Research GmbH is performing applied and industry oriented research. Projects are dealing with the planning and optimization of the structure, organization and management of industrial and service enterprises or their logistics networks and is specialised in structuring and optimisation of production and logistics processes in a high-tech and highly automated environment. Special emphasis is given to the matching of IT systems with the requirements of operational domains in particular with respect to the organisation of socio-technological systems. FhA is co-operating with the Institute of Management Science of the Vienna University of Technology and maintains numerous contacts to industry, academia and research institutions in Western, Eastern and South-Eastern Europe.

Founded in 1815, the Vienna University of Technology is renowned for its long tradition. It finds high international and domestic recognition in teaching and research and as partner of innovation oriented enterprises. The Institute of Management Science / Department for Industrial Engineering and System Design (IMW) can offer expertise in the main areas such as Production Management & Logistics Management as well as Quality-, Process- and Product Management. Research concentrates on the processing of scientific findings for practical applications. Numerous positive results both in application-oriented research projects as well as industry projects proof the reliable methodological background of the department and form a broad basis of satisfied partners and customers.

Fraunhofer AUSTRIA

INSTITUTE OF MANAGEMENT SCIENCE

Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology

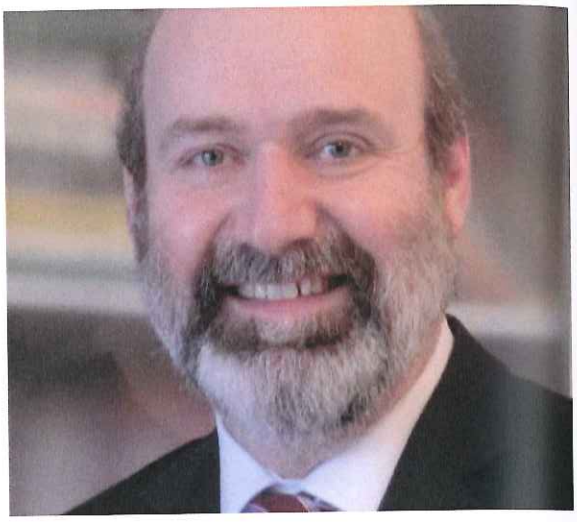
Univ.-Prof Dr.-Ing. Detlef Gerhard

Univ.-Prof Dr.-Ing. Detlef Gerhard (born 1969) studied mechanical engineering with a focus on Computer Integrated Manufacturing at the University of Paderborn (Germany). He received his PhD in 2000 after five years as a research assistant at the Department of Information Technology in Mechanical Engineering at the Ruhr-University Bochum (Germany). In February 2006 he was appointed professor at the Vienna University of Technology (Austria) and leads the Mechanical engineering Informatics and Virtual Product development (MIVP) research group at the Institute of Engineering Design and Logistics Engineering. Previously, he was in industry in senior positions in the field of IT consulting, project leading and development of enterprise-wide software solutions. In his latest industry position, he served as overall responsible for the technical and business IT at a worldwide operating manufacturer of conveyor systems and special purpose machinery. Prof Gerhard is elected member of the WiGeP (Wissenschaftliche Gesellschaft für Produktentwicklung) Scientific Society for Product Development based in Germany. His main research interests are methods and IT tools for information management in product creation processes with special focus on semantics.

Our Research group is part of the institute of Engineering Design and Logistics Engineering at Vienna University of Technology and focusses on Virtual Product Development which in our understanding can be defined as complete description and illustration of real products and their characteristics in form of computer models with the aim to validate and verify designs and characteristics by simulation and digital prototyping. This is our core competence area and comprises management of data, processes and IT tools within the complete product lifecycle (PLM). Our research focusses on the application of information technologies and informatics methods in the creation processes of machinery, vehicles and equipment. The central objective is to explore new technologies, processes and methods with a significant added value for applications in the context of co-operation and multi-disciplinary engineering processes in industrial environments. Within all research projects which are preferably conducted with partners from industry aspects of process and organisation are looked at alongside the modelling and software implementation.

Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology

Univ. Prof. Dipl.-Ing. Dr.techn. Friedrich Bleicher



After studying Mechanical Engineering he started as a scientific assistant at the Institute of Production Engineering, Vienna University of Technology.
"Doktor technicae" in Mechanical Engineering in 1996 and habilitation for Production Engineering in 2001; since 2001 Associate Professor at the Institute for Production Engineering. In 2009 he gets the professorship for Machining Technology and is head of the Institute of Production Engineering and Laser Technology at Vienna University of Technology.
The main topics of research are covering machining processes with geometrically defined and undefined cutting edges, process automation, development and optimization of machine tools,ECM-technologies and rapid manufacturing.

Institute of Production Engineering and Laser Technology

The Institute of Production Engineering and Laser Technology (IFT) of the Vienna University of Technology covers a wide range of production processes, machine tool techniques and automation in the field of production engineering.

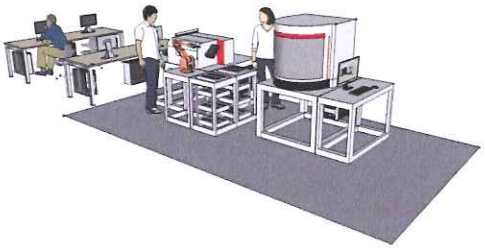
The spectrum of working activities is covering production planning and manufacturing execution systems, process automation and NC-control technology, development and optimization of machine tools including innovative machine tool concepts like parallel kinematics, machining processes, particularly cutting with geometrically defined and undefined cutting edges or laser technology as well as ECM-technologies and rapid manufacturing.

Results of research work are directly fed into academic education, which allows a practically orientated training and guarantees a comprehensive insight into production engineering.

Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology

VIENNA UNIVERSITY OF TECHNOLOGY

Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology



Department for Management Science / Fraunhofer Austria
Univ.-Prof. Dipl.-Wirtsch.-Ing. Dr.-Ing. Prof. eh. Dr. h.c. Wilfried Sihn

Department for Production Engineering and Laser Technology
Univ.-Prof. Dipl.-Ing. Dr. techn. Friedrich Bleicher

Department for Engineering Design and Logistics Engineering
Univ.-Prof. Dipl.-Ing. Dr.-Ing Detlef Gerhard

TU WIEN Fraunhofer AUSTRIA

Introduction

Learning & Innovation Factory for Integrative Production Education

Learning and Innovation Factory of the Vienna University of Technology

Vision

Learning Factory		Innovation Factory	
Higher education	Advanced training	Innovation	Service
"Integrative product manufacturing" Lecture, practical course (Bachelor Mechanical Engineering - Management	Methods focus: Lean Assembly, Lean Production & Logistics Technology focus: RFID and pick-by-voice assembly support	e.g. process evaluation and optimization of Lean Assembly, development of innovative factory planning methods, etc.	e.g. use of innovative research and development facilities as high application and demo center

Students

Industry

TU WIEN Fraunhofer AUSTRIA

Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology

FACULTY-WIDE LEARNING FACTORY AS PART OF THE CURRICULUM

Higher Education
„Integrative Product Creation"

Learning & Innovation Factory for Integrative Production Education

- Lecture name: Integrative Product Creation
- Parts: Engineering Design – Manufacturing - Assembly
- Students: Bachelor Program (Mechanical Engineering - Management)
- Lecture: Theoretical preperation
  2 ECTS (5 days a 3 hours + exam)
- Practical course: Project implementation (analysis, planning and manufacturing)
  5 ECTS (10 days a 8 hours + final presentation)
- Targets: Holistic consideration of product creation process
  Understanding of inter-divisional coherences
  Impact of design based decisions for the production process

Integrated knowledge transfer and practice by the Factulty of Mechanical and Industrial Engineering

Faculty-wide learning factory through cooperation of:

Learning & Innovation Factory for Integrative Production Education

Industrial Engineering

Industrial and Systems Engineering in cooperation with Fraunhofer Austria

imw | Fraunhofer AUSTRIA

Product Development

Institute for Engineering Design and Logistics Engineering

MIVP

Production Technology

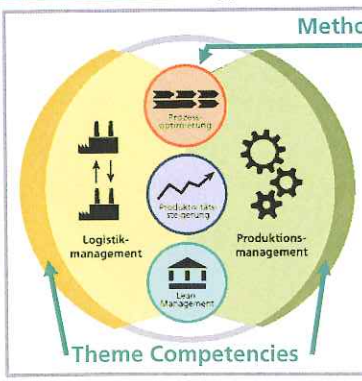
Institute for Production Engineering and Laser Technology

IFT

TU WIEN | Fraunhofer AUSTRIA

Institute for Management Science/Industrial and Systems Engineering & Fraunhofer Austria Research GmbH Business area Production- und Logistics Management

- Production Management
- Logistics/SCM
- Quality- and Process Mgmt
- Project Management
- Plant Design
- Maintenance/Reliability
- System Planning
- Product-Management
- Business-Games



Industry Competences

- Automotive
- Vehicle- und Agriculturemachinery producers
- Engineering and Plant Construction
- Electronics Industry
- Metall Industry
- Energy Suppliers

TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna University of Technology | imw

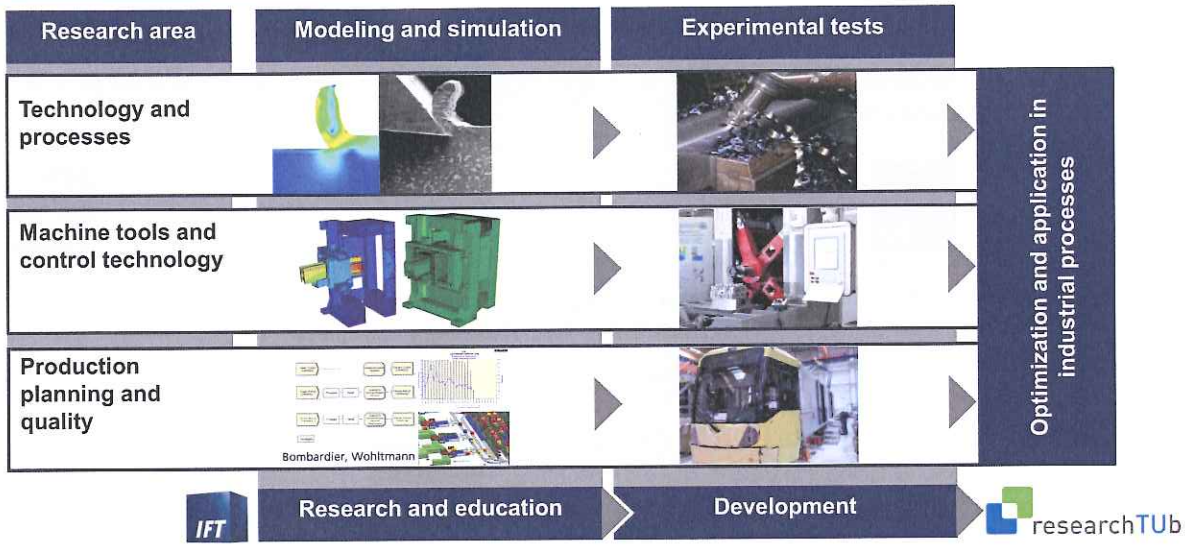
Fraunhofer AUSTRIA

Commerce and Industry

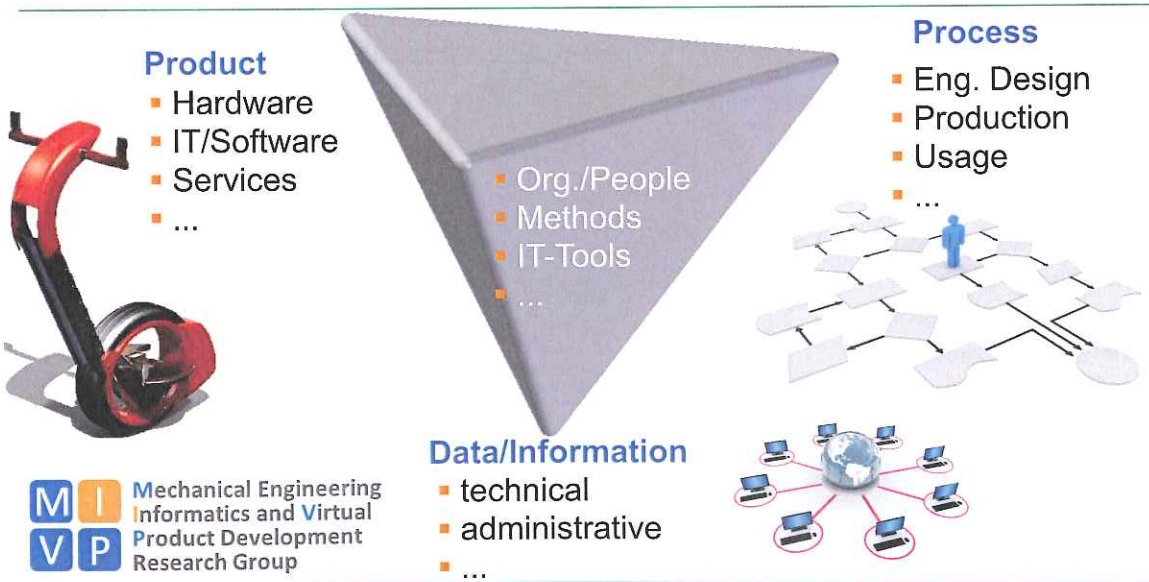
Higher education → Research → Development → Realization → Application

TU WIEN | Fraunhofer AUSTRIA

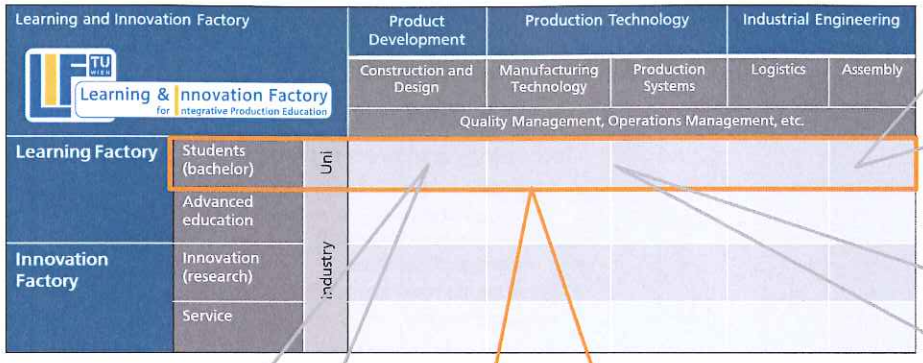
Institute for Production Engineering and Laser Technology



Institute for Engineering Design and Logistics Engineering Virtual Product Development Research Group



Higher Education
„Integrative Product Creation"



Focus 3
- Industrial Engineering
- Design for Assembly
- Time Management
- Calculation of manufacturing costs

Focus 2
- Production engineering
- Manufacturing processes
- Quality inspection
- Rapid prototyping

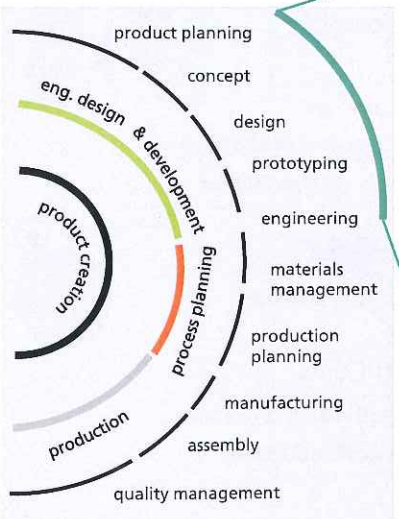
Focus 1
- Product design
- Design for X
- Fixture construction
- Product Data Management (PDM)

Integrative Product Creation
- Module with 7 ECTS
- Practical course in the learning and innovation factory TU Vienna

Higher Education
„Integrative Product Creation" – Focus 1

Learning & Innovation Factory for Integrative Production Education

Process of product design



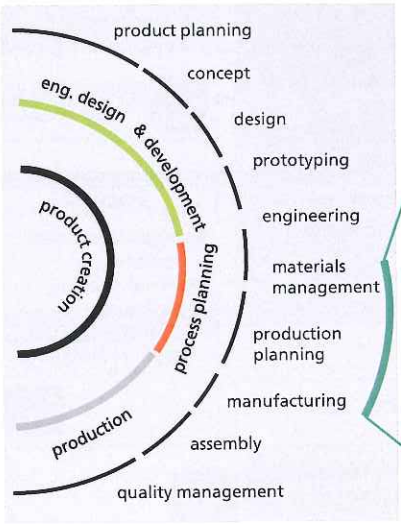
Focus 1 - Content of teaching

- **Engineering Design**
  - Structuring of the product
  - Evaluation of design alternatives
  - Design for X approaches
- **Fixture Development**
  - Engineering Design of Assembly fixtures
  - Rapid Manufacturing with 3D Printer
- **Product Data Management**
  - 3D models, drawings
  - Operation and assembly plans
  - IT Tools handling

Higher Education
„Integrative Product Creation" – Focus 2

Learning & Innovation Factory for Integrative Production Education

Process of product design



Focus 2 - Content of teaching

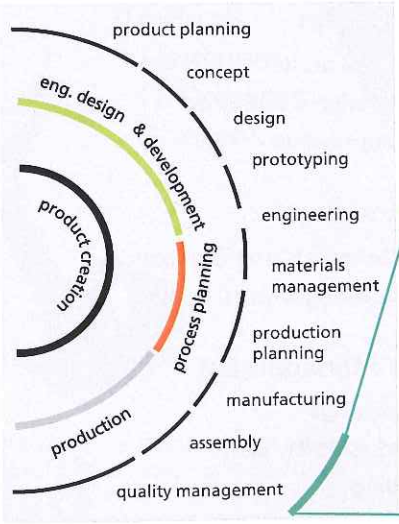
- Production Engineering
  - Design for manufacturability
  - Technology and process planning
    - Selection of processes, equipment and tooling
    - Definition of machining parameters, set-up instructions and quality assurance checkpoints
    - sequencing of operations
    - creation of Manufacturing BoMs and Routings
    - NC-programming
- Production Planning
  - Material requirements planning
  - Scheduling
- Machining
- Quality inspection

TU WIEN Fraunhofer AUSTRIA

Higher Education
„Integrative Product Creation" – Focus 3

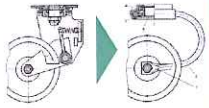
Learning & Innovation Factory for Integrative Production Education

Process of product design



Focus 3 – content of teaching

- Design for Assembly
  - Approaches
  - Product structure
  - Assembly process and operations
  - Implementation with examples



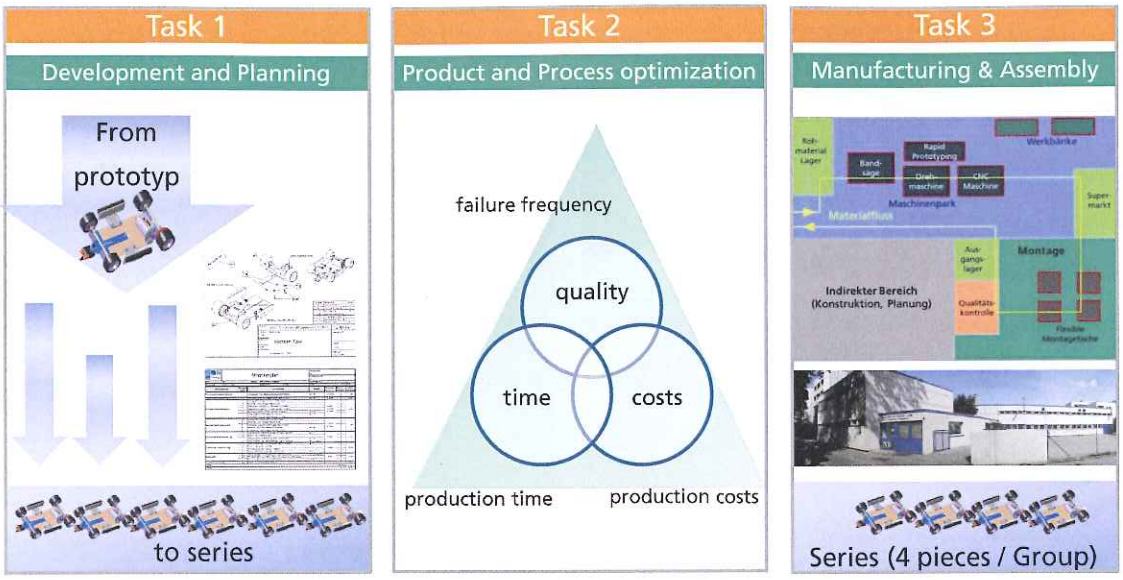
- Time Management
  - Time observation vs. MTM

- Manufacturig Costs
  - Calculation methods and practice
  - Potentials for cost reduction

TU WIEN Fraunhofer AUSTRIA

Higher Education
„Integrative Product Creation" - Tasks

Learning & Innovation Factory for Integrative Production Education

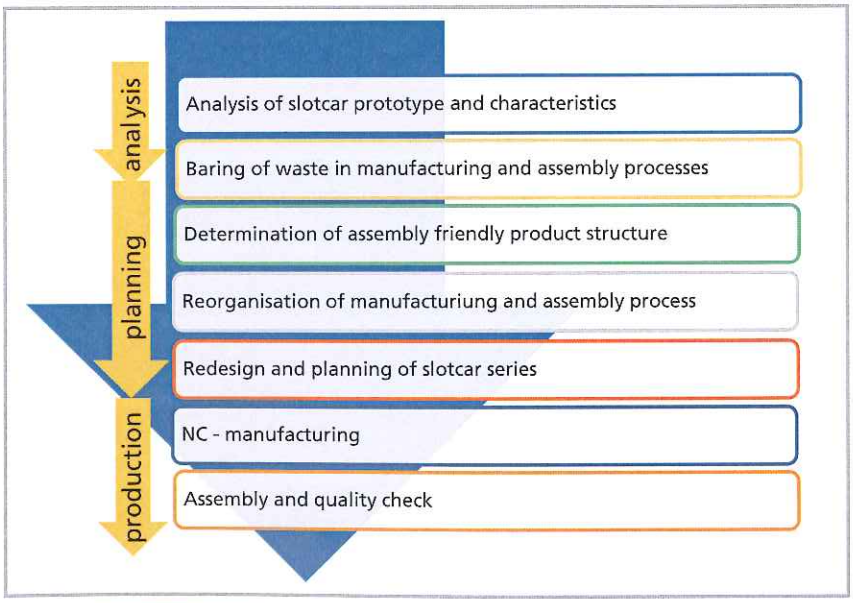


TU WIEN Fraunhofer AUSTRIA

Higher Education
„Integrative Product Creation" - Tasks

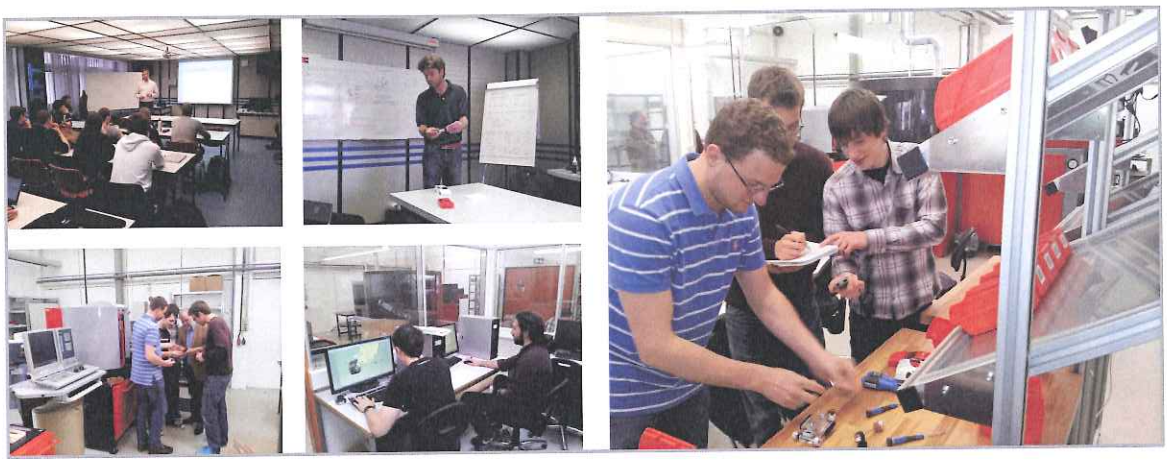
Learning & Innovation Factory for Integrative Production Education

Student's tasks



TU WIEN Fraunhofer AUSTRIA

Higher Education
„Integrative Product Creation“



Vision and implementation of the Learning and Innovation Factory of the Vienna University of Technology

LEARNING FACTORY AS ADVANCED EDUCATION TOOL FOR INDUSTRY

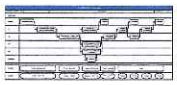
Advanced Education for Industry

Training with following project monitoring

Theory — Implementation

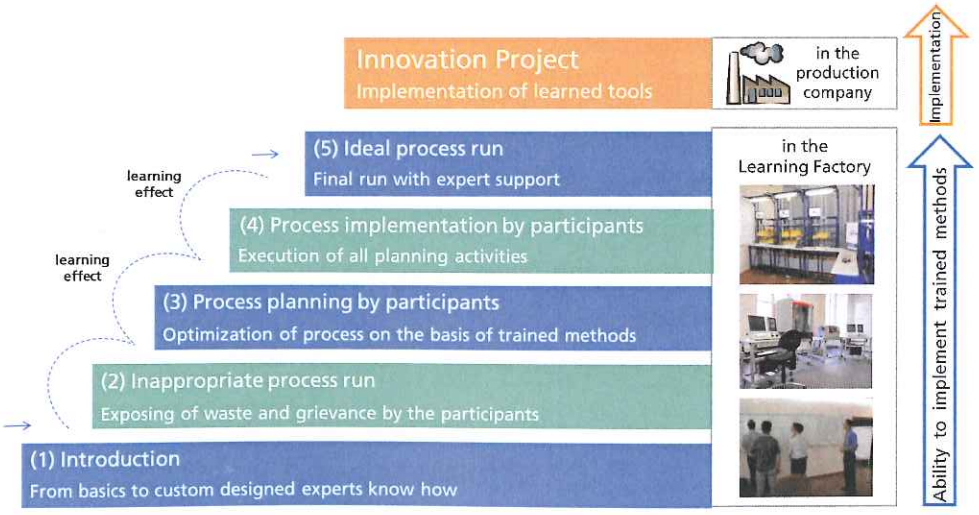
Thematically Introduction	Hands-on Training	Innovation Project
in the production company or the learning factory	in the learning factory of the Vienna University of Technology	in the production company
■ Seminar / workshops ■ Theoretically Background ■ Basics to custom designed experts know-how ■ Business and managements games	■ Demonstration of the ideal situation ■ Holistic approach ■ Interactive explanation and application of methods	■ Implementation of learned tools ■ Optimization of operation values by trained employees ■ Support by FhA experts

Training model



Training Model: Industry

5 + 1 steps



Advanced Education

Focus

Learning and Innovation Factory			Product Development	Production Technology		Industrial Engineering	
			Construction and Design	Manufacturing Technology	Production Systems	Logistics	Assembly
			Quality Management, Operations Management, etc.				
Learning Factory	Students (bachelor)	Uni					
	Advanced education						
Innovation Factory	Innovation (research)	Industry					
	Service						

Focus Lean Assembly

- Lean Basics
- RFID
- Assembly by voice

Fraunhofer lean assembly

Focus Lean Logistics

- Pull material supply
- Operations planning
- Pick by voice

Innovation / Services

- Vision (5 years)
- Research infrastructure
- Interactive demonstration center
- Company based development

Custom-designed Training

- Company related topics
- Alternative training methods with interactive participation
- Hands-on training with real experience

Lean Assembly

Advanced hands-on training

- Training of expertise in methods for optimization of assembly and logistics processes in a **„labour for lean methods"**
- Existing content of teaching (modular):
  - Assembly and process planning
  - Time management and capacity planning
  - Time device / frequency
  - One Piece Flow, continuous flow production
  - 5S, SMED, Poka-Joke
  - Lean factory layout planning
- Current development:
  - RFID time tracking
- Preview:
  - Assembly / pick by voice

Fraunhofer lean assembly

Common planning of assembly and material flow

Separation of assembly and logistics tasks

Lean Assembly
Advanced hands-on training

Contact Persons

Department for Management Science / Fraunhofer Austria
Univ.-Prof. Dipl.-Wirtsch.-Ing. Dr.-Ing. Prof. eh. Dr. h.c. Wilfried Sihn
Wilfried.sihn@fraunhofer.at, Tel: +43 1 58801 33040

Department for Production Engineering and Laser Technology
Univ.-Prof. Dipl.-Ing. Dr. techn. Friedrich Bleicher
friedrich.bleicher@tuwien.ac.at Tel: +43 1 58801 31150

Department for Engineering Design and Logistics Engineering
Univ.-Prof. Dipl.-Ing. Dr.-Ing Detlef Gerhard
detlef.gerhard@tuwien.ac.at Tel: +43 1 58801 30722