2nd Conference on Learning Factories

Competitive production in Europe through education and training

May 10th 2012
Vienna University of Technology
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Hosting Institutes

Institute for Management Science
Industrial and Systems Engineering
Fraunhofer Austria Research GmbH
Prof. Dr. Wilfried Sihn

Institute for Production Engineering and Laser Technology
Prof. Dr. Friedrich Bleicher

Institute for Engineering Design and Logistics Engineering
Prof. Dr. Detlef Gerhard
DEAR LADIES and GENTLEMEN,
DEAR COLLEAGUES,

How can competitive production be secured in Europe? Which role does education or training play in this context?

The 2nd conference on Learning Factories helps to answer these questions. It provides the possibility to exchange experiences and to discuss individual criteria as well as potential and outcomes of Learning Factories.

Therefore, it is a great pleasure welcoming you to Vienna!

Kind regards

W. Sihn
Agenda

08:00   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

08:15   Session 1: Potential of Learning Factories as education and innovation centres
        for universities and the production industry
        Speaker: Prof. Kurt Matyas [TU Vienna]

08:45   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 successful
        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
About TU Vienna
Our mission is "technology for people". Through our research we "develop scientific excellence", through our teaching we "enhance comprehensive competence". TU Vienna has eight faculties lead by deans: Architecture and Planning, Civil Engineering, Electrical Engineering and Information Technology, Informatics, Mathematics and Geoinformation, Mechanical and Industrial Engineering, Physics and Technical Chemistry. The University is led by the Rector and four Vice Rectors (responsible for Research, Academic Affairs, Finances and Controlling as well as Human Resources and Gender). The Senate has 26 members. The University Council, consisting of seven members, acts as a supervisory board.

Opening of the Conference

O.Univ.Prof. Dipl.-Ing Dr.techn. Sabine Seidler
Block I
Universities

Block II
Industry

Block III
Learning and Innovation Factory
of the Vienna University of Technology
Ao.Univ.Prof. Dipl.-Ing. Dr.techn. Kurt Matyas

Univ.-Prof. Dipl.-Ing. Dr. Kurt Matyas, born in 1963 is professor at the Institute of Management Science – Division of Industrial- and Systems Engineering of the Vienna University of Technology since 2001. His research and teaching topics cover production management, logistics and maintenance. Kurt Matyas published more than 60 scientific articles and 4 books.

In addition to his teaching and research activities, Prof. Matyas is managing numerous research projects at the Vienna University of Technology and together with Fraunhofer Austria, he supervised applied research projects and consultancy projects with manufacturing companies.

He is dean for academic affairs at the Faculty of Mechanical and Industrial Engineering since 2008. He is also Vice President of the Austrian Association of Industrial Engineering & Management since 2006.

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 optimization 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 prove the reliable methodological background of the department and form a broad basis of satisfied partners and customers.

Potential of Learning Factories as education and innovation centres for universities and the production industry
Potential of Learning Factories as education and innovation centers for universities and production industry

Prof. Dr. Kurt Matyas
Vienna University of Technology
Institute of Management Science
Industrial and Systems Engineering
Fraunhofer Austria Research GmbH
Division Production and Logistics Management

The great aim of education is not knowledge but action.

Herbert Spencer
(1820-1903)
British philosopher and sociologist
Potential of Learning Factories as education and innovation centers for universities and production industry

CURRENT REQUIREMENTS TO HIGHER AND ADVANCED EDUCATION

Higher and Advanced Education Requirements

<table>
<thead>
<tr>
<th>After 2 weeks:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>90% recall of what we say and DO</td>
<td>Doing the real thing</td>
</tr>
<tr>
<td>70% recall of what we say</td>
<td>Simulating the real experience</td>
</tr>
<tr>
<td>50% recall of what we hear and see</td>
<td>Practice doing</td>
</tr>
<tr>
<td>30% recall of what we see</td>
<td>Participating in a discussion</td>
</tr>
<tr>
<td>20% recall of what we hear</td>
<td>Seeing it done on location</td>
</tr>
<tr>
<td>10% recall of what we read</td>
<td>Demonstration</td>
</tr>
</tbody>
</table>

Active Receiving

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing</td>
</tr>
<tr>
<td>Reading</td>
</tr>
</tbody>
</table>

Passive Receiving

Higher and Advanced Education Requirements

From economic point of view

Knowledge as 4th production factor

- Knowledge covering through enterprise knowledge management
- Knowledge development through training and advanced education

Knowledge as:
- useful resource
- innovation factor
- competitive advantage
- core competence in a fast moving time

Knowledge:
- implicit
- explicit

Methodological expertise
- professional competence

Higher and Advanced Education Requirements

Current trends

- Working & Learning as origin for ability to innovate
- Qualification related to a specific field instead of diversified education

Location:
- Workers: in-house training
- Management: extern via experts

Production industry:
- Practical training already during the advanced education
- Mapping of real production processes

Almost 20% of consumed classes concern subjects of technics and production

Classes and subjects
COMMON UNDERSTANDING OF A LEARNING FACTORY

Potential of Learning Factories as education and innovation centers for universities and production industry

Learning Factory
Common Understanding

contemporary manufacturing demonstration center
leading education tool
innovation
training for industry

competence
continuous improvement
labour situation
alternative training methods
research
discover
technical, analytic, planning skills
Interpersonal ability
education for students

state-of-the-art equipment, modern facilities - similar to an industrial setting
flexible, versatile, re-configurable
interdisciplinary, multi-purpose

Learning Factory

OPPORTUNITIES OF LEARNING FACTORIES

Potential of Learning Factories as education and innovation centers for universities and production industry
University - Industry Partnership
Win-Win Situation

Universities
- Higher Education
- Industry Projects
- Technology
- Financial Support
- Potential Employer

Industry
- Advanced Education
- Access to Science
- Science Center
- Science Marketing
- Recruiting

Cooperation

Curriculum based on direct linkage of theoretical studies with practice-based project for students
- Learning Factory as an integral part of the syllabus
- Targets:
  - Strong foundation in engineering science fundamentals
  - Manufacturing and project related design process and business realities
  - Knowledge of latest technologies or methods
  - Management and application to solve problems
  - Creativity, Communication, ability to work in a team
- Practice-oriented through cooperation projects with companies

University - Industry Partnership
Win-Win Situation

Holistic approach instead of limited perspective
- Motivation of employees
- Exploitation of employee’s methods expertise
- Increase of innovation potential
- Practice in an ideal training infrastructure
- Ability to implement learned tasks in the own company

Infrastructure for involving industry actively in the educational process
- Technology transfer between universities and companies
- Common technology development
- Aspiration to technology leadership

Universities
- Higher Education
- Industry Projects
- Technology
- Financial Support
- Potential Employer

Industry
- Advanced Education
- Access to Science
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- Science Marketing
- Recruiting
University - Industry Partnership
Win-Win Situation

**Industry**
- Advanced Education
- Access to Science
- Science Center
- Science Marketing
- Recruiting

**Universities**
- Higher Education
- Industry Projects
- Technology
- Financial Support
- Potential Employer

RESULT:
- Top qualified staff

Cooperation

Potential of Learning Factories as education and innovation centers for universities and production industry

Prof. Dr. Kurt Matyas

Questions
Univ.-Prof. Dr.-Ing. Jochen Deuse was born in 1967 and studied Mechanical Engineering at the University of Dortmund.

Jochen Deuse received his doctoral degree at RWTH Aachen University, Laboratory for Machine Tools and Production Engineering (WZL), in 1998.

For seven years, he has held senior management positions in the Bosch Group in Germany and Australia. Since 2005, Jochen Deuse is head of Chair of Industrial Engineering, TU Dortmund University, Germany.

The Chair of Industrial Engineering is concerned in teachings and research with planning and organisation of enterprise processes in production, logistics and service with the main focus on:

- Work System Design
- Digital Manufacturing
- Production Systems
- Group Technology
- Time and Motion Studies

Hands-on Training Center for Industrial Engineering in Higher Education
Hands-on Training Centre for Industrial Engineering
What is Industrial Engineering (IE)?

F. W. Taylor

“Replacement of rules of thumb by precise procedures developed after careful time and motion studies”

Interdisciplinary work

Work in the area of human, organisation and technology

Design of industrialised processes

Stable processes as prerequisite for efficient use of resources

Professional IE competences

IE combines

- System,
- Methodological and
- Problem solving competence
Hands-on Training Centre for Industrial Engineering
IE Competence Profile

System competence
- Understanding „what do we need to do“

Methodological competence
- Mastering state of the art methods
- Line balancing
- Time studies
- Lean tools
- ...

Problem solving competence
- Systematic problem solving w/ the Scientific Method

Additional key competences
- Enhancing professional acting
- Personal
- Activity
- Social and communication competence

Hands-on Training Centre for Industrial Engineering
Environment for Experiential Learning

Two shift gearbox
- Bolted connections
- Tight joints, undercuts
- Complex precedence graph
- Heavy parts > 1kg
- Likelihood of confusion
- Different product variants

Materials for fixtures
- Flexible work places
- Different containers

Hands-on Training Centre for Industrial Engineering
Theories of Learning and Competence Development

„Information assimilation“
- Recalling information through a medium
- Acting according to understanding
- Organizing information generalization
- Inferring a particular application
- Low time consuming
- Easy to give knowledge a structure
- Low taxonomy level
- Low learning retention

„Experiential learning“
- Concrete experience
- Active experimentation
- Reflective observation
- Abstract conceptualization
- High taxonomy level
- High learning retention
- Time consuming
- Knowledge needs a structure

Combination

Hands-on Training Centre for Industrial Engineering
„Work System Design“

Students of:
- Industrial Engineering,
- Mechanical Engineering and
- Logistics

Learning environment:
- 1 week theoretical knowledge
- 1 week practice in IE Training Centre
- Groups of 6-8 students

Contents:
- Product, operating sequence analysis
- Time and motion study
- Calculation of customer takt and pc/t
- Line balancing
- Ergonomic work place design
- Work system design
- Principles of Lean Production
- ...

Step 1:
- Screen documents, set up project plan

Step 2:
- Design work system
  - Group A: Experiments w/ PDCA
  - Group B: Planning w/ sheet and pencil

Step 3:
- Tests, detailed planning

Step 4:
- Presentation and feedback
Hands-on Training Centre for Industrial Engineering

Development of “System and Methodological Competence”

System competence

Methodological competence

<table>
<thead>
<tr>
<th>Process</th>
<th>Target</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve</td>
<td>Condition</td>
<td>Do</td>
</tr>
<tr>
<td>Do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>Act</td>
<td></td>
</tr>
</tbody>
</table>

- Screwing necessary, unfavourable body position
- Further improvement

PDCA Enables Experimental Learning

- Hypotheses need to be falsifiable in order to enable the Scientific Method and to generate new learning opportunities
- It is commonly accepted that suggested solutions to problems might fail
- Experimenting via “Trial and Error”

PDCA Cycle

Hypothesis

- Hypothesis confirmed
- Expectations are met
- Potential for new insights
- Learning opportunity

Hypothesis refuted

- [Suzaki] [Rother]

Hands-on Training Centre for Industrial Engineering

Experiments conducted in the Training Centre

- Experiments w/ apportionment of an order
- Experiments w/ division of work by type
- Experiments w/ milk run
- Experiments w/ fixtures
Hands-on Training Centre for Industrial Engineering
Students' Feedback

- “The high practical relevance of the course was the main reason to choose the subject Industrial Engineering.”
- “I like the combination of professional competence development and Soft Skills.”
- “I feel better prepared to start my professional life and gained more insight into the working methods of IEs.”
- “I had plenty of fun and knowledge will sustain much longer than knowledge gained in lectures.”

Thank You for Your Kind Attention!
Prof. Dr.-Ing. Eberhard Abele

The Institute Director Professor Dr.Ing. Eberhard Abele studied mechanical engineering at the Stuttgart University of Technology. He was a researcher and department leader at the Fraunhofer Institute for manufacturing engineering and automation (IPA) in Stuttgart, Germany. In the past he was holding several management functions in a German automotive supply company as head of production planning and head of special purpose machine tool. In the same company he was head of production technology and a technical director. Since 2000 he is director of the Institute for Production Management, Technology and Machine Tools (PTW) at the Technische Universität Darmstadt. Professor Abele is chairman of the team “production research 2020” (Produktionsforschung 2020) of the German Ministry of Education and Research, fellow of the International Academy for Production Engineering (CiRP) and a member of the German Academy of Science and Engineering (acatech). He published about 200 international research publications in the fields of cutting, automation, robotics, machine tools, and production management.

The Institute of Production Management, Technology and Machine Tools (PTW) is one of the leading research institutes in production technology. Currently about 35 research associates work with different focuses along the machining process chain. This includes the development of machine-components and energy efficient machine tools, technologies for high speed machining and production management. In the last mentioned area the PTW achieved a pioneering role in 2007 with opening the process learning factory CiP, a nationwide, industry oriented facility for education and advanced training, which conduces as a pilot factory in the context of mediating methodological skills for production optimization. Since the opening of the process learning factory “CiP” continuous development has been reached by the research group, at the moment consisting of eight engineers. The CiP displays on about 500 square meters the entire value stream from order intake to the final product.

5 years Process Learning Factory CiP at TU Darmstadt - Concept, Results, Experiences and still new Challenges
Sven Bechtloff studied Mechanical Engineering at Technische Universität Darmstadt and gained work experience in that period by internships at EvoBus Portugal S.A., Siemens VDO Automotive AG or Deutz Power Systems GmbH & Co. KG. Since 2008 he works as a research associate at Center for Industrial Productivity (CiP) at PTW where he became Team Leader in 2011. At process learning factory CiP he is trainer for lean production and concentrates his activities on a comprehensive expansion of the machining area with focus on cellular manufacturing. In 2012 Sven Bechtloff became chief engineer.

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5 years Process Learning Factory CiP at TU Darmstadt - Concept, Results, Experiences and still new Challenges
Vienna, Austria | 10.05.2012

5 years Process Learning Factory CiP at Technische Universität Darmstadt

Concept, Results, Experiences and still new Challenges

Prof. Dr.-Ing. E. Abele
Dipl.-Ing. S. Bechtloff

Content

- Future challenges require new approaches for efficient learning
- Process learning factory CiP – Our former vision became reality
- Education of students
- Vocational training of industry employees
- Statistical flashback
- Current research topics
- Next steps, new challenges and our vision
Initial situation for a new approach

Survey among 50 staff managers and directors:
- In what are alumni of Technische Universität Darmstadt good at?
- Where is a need for improvements?

Results

- 70% of the students are going to work within the departments of production, development or quality assurance
- As future employees in production, the alumni lack of:
  - Knowledge about processes and Lean methods
  - Skills in the establishment and adaption of production systems
  - Perception of ideal workflows in manufacturing and enthusiasm for continuous improvement

Future capabilities have to be geared to process-oriented organisations

<table>
<thead>
<tr>
<th>function-oriented</th>
<th>process-oriented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation manages itself autonomously in vertical processes</td>
<td></td>
</tr>
<tr>
<td>• Knowledge</td>
<td></td>
</tr>
<tr>
<td>• Careers</td>
<td></td>
</tr>
<tr>
<td>• Abilities</td>
<td></td>
</tr>
<tr>
<td>• Perceptions</td>
<td></td>
</tr>
<tr>
<td>Value add as a result of horizontal processes</td>
<td></td>
</tr>
<tr>
<td>• Short innovation cycles</td>
<td></td>
</tr>
<tr>
<td>• Clear competences</td>
<td></td>
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<tr>
<td>• Short lead times</td>
<td></td>
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<tr>
<td>• High adherence to delivery dates</td>
<td></td>
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</tbody>
</table>

Growing innovation speed and decreasing period of employment are future challenges in production techniques

Period of employment
- Average period of employment in production planning
  - 1980: 8 years
  - 2000: 6 years
  - 2010: 4 years

Product life cycle
- Example of a high-pressure cleaner
- • 1980: 7 years
  - 2000: 5 years
  - 2010: 3 years

Learning by experience on the shopfloor gains lasting knowledge and skills

We keep in mind only a part of the things we perceive:
Our former vision became reality: A learning factory on the campus

Properties and probable application ranges of learning factories

Process learning factory CIP at TU Darmstadt: Current milestones

First steps: Questions considered from idea to realisation
The hardware in the learning factory represents a midsize factory in series production. By various configurations of a flexible machining cell, an economic valuation of several production setups is possible. The integration of indirect processes enables the transfer at interfaces of production and planning. Realised departments with indirect processes:

- Sales
- Purchase
- Development
- Production planning and control
- Idea management

Questions regarded in workshops:

- Lean Office with SS
- Integration of administrative and technical IT-Systems
- Integration of parameter-changes in planning processes to consider early production innovation stages
Video Experience Tour

Integration of the process learning factory in the education of mechanical engineering students

The CIP curriculum addresses employees who are involved in the implementation of Lean methods

Phase 1: Lean understanding

Lean Basics
- Basics and diagnosis**
- Value stream design**
- Quality techniques**

Lean Basics
- Pull principle
- Flow production
- In-lab production
- Value stream design

Quality techniques**
- Lean quality assurance
- Poka Yoke
- Problem solving
- Jidoka

Workshop Quick change-over (SMED)

Theory
- Optimisation process understood

Method applied in practice

60% Shopfloor ratio
Examples for the structure of learning modules:
Workshop Lean Basics – Shopfloor Management

Daily performance dialogue

- Which key performance indicators (KPI) are necessary?
- How can these KPI be determined and visualised?
- Which actions can be taken immediately?

Development of a shopfloor management board
Realisation of a performance dialogue

In the past 4 years a range of managers and professionals have been educated at process learning factory CiP

Previous cooperation partners in research and education

Research and vocational education with partner companies
Management Training

Vocational education with regional SME

Current research topics of the CiP staff

Competence Development for Continuous Improvement Processes
- Methods for the institutionalization of continuous improvement processes at the shopfloor
- Capability building for the staff’s empowerment in improvement processes

Flexible Parts Productions
- Holistic approach for flexible parts productions in Germany, especially by Cellular Manufacturing
- Increase of productivity in machining by Low-Cost-Automation gadgets

Lean-IT: Supporting Lean Production with IT-Solutions
- Simulation-based planning of lean material and information flows
- Dynamic adjustment of Kanban-loops based on leveled Production

Production Logistics for Lean Production
- Flexible assembly and logistics systems
- Configuration of optimized value streams under consideration of logistics and traffic
Target of the research project Dynamo PLV is to consider the interactions between production, logistics and traffic.

- Production
  - Machining
  - Assembly
- Logistics
  - Distribution
  - Traffic
- Traffic
- Logistics
- Demand Fulfillment
  - Distribution
  - Traffic
- Customer 1
- Traffic
- Customer 2
- Traffic
- Customer n

- Machining
  - Assembly
  - Quality Assurance

- High rack warehouse
- Temporary storage
- Temporary storage
- Shipping warehouse

- Global sourcing / Traffic
  - Local vs. global procurement?
  - Influence of traffic for supplier selection?
- Flexibilisation strategies?
- Choice of location?
- One-piece-flow or batch production?
- Local vs. global procurement?
- Influence of traffic for delivery date?
- …

Logistics

Scarcity of resources
- Dynamisation of product life cycles
- Globalisation
- Mobility

Process learning factory CiP at TU Darmstadt: Awards

- Selected Location
  by federal government of Germany, July 2008
- Excellence in Education
  by state government of Hesse, December 2011

5 years Process Learning factory CiP…

- “Right-sized” Learning Factory? (theory, simulation, shopfloor vs. budget)
- Generalization vs. Specialization? (industries, products, processes)
- Business model (costs and continuity of partners and staff: research associates, student workforce, technical support)
Establishment of the initiative on European Learning Factories under the aegis of TU Darmstadt / PTW on May 20th 2011

- Technical University Munich, Germany
- Business School Reutlingen, Germany
- University Bochum, Germany
- Technical University Vienna, Austria
- KTH Stockholm, Sweden
- University of Split, Croatia
- Hungarian Academy of Science
- University of Patras, Greece
- IPS, Setubal, Portugal

European universities in cooperation with PTW/CiP within the initiative (extract)

Targets of the initiative on European Learning Factories

- Establishment of an European cooperation between universities / institutes working being pioneers in this field
- Exchange of knowledge and learning modules between partners
- Training of students, industry experts and managers
- Setting standards for trainings to gain efficiency in training
- Building competence centers for specific topics

Our vision for the year 2020:
„Research Campus“ with focus on „Urban Value Added“

- Process Learning Factory „CiP“
  established in 2007
- Energy Efficiency Factory „Eta“
  planned and requested
- Logistics Learning Factory
  planned and requested
- Center of methodological competencies
  planned

Ongoing expansion by network activities and collaborative research

Targets:
- Enlargement of current education offer for students and industry employees
- Research in comprehensive processes
- Integration and cooperation of several departments in a common object
- Motivation for multidisciplinary research activities

Targets learned so far: How to build up a Learning Factory

Be sure to have…

- a clear focus on target groups (industries, students, …)
- enough resources (money, staff, building, infrastructure, machine shop for daily improvement)
- experience, know-how
- partners, networking

and finally…

- good luck! (support, ”business angels“)
Your contact persons at Process Learning Factory CiP

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Prof. Dr. Gunther Reinhart is full professor for Industrial Management and Assembly Technology and director of iwb (Institute for Machine Tools and Industrial Management) at Technische Universität München (TUM). After studying mechanical engineering, he was research assistant at iwb from 1982 to 1988 with Prof. Dr. Joachim Milberg. After receiving the Ph.D. from TUM he started his industrial career with BMW Group, initially as head of the handling and welding engineering department and subsequently as director of the body paint shop. In 1993 he turned back to university to become professor and director of iwb.

From 2002 to 2007 Professor Reinhart took a sabbatical from university to become a member of the executive board of IWKA Corporation, a large German supplier with 13,000 employees worldwide. There he was in charge of Technology and Marketing. 2007 Professor Reinhart turned back to university and has served with Professor Michael F. Zaeh as co-director of iwb with more than 100 employees.

He is also the chairman of the Bavarian Cluster for Mechatronics and Automation and since 2009 head of the Fraunhofer IWU research-department for Resource-Efficient Converting Machines (RMV). Gunther Reinhart is member of multiple scientific societies and associations like acatech, WGP, WLT, CIRP and AIM. He has approximately 300 publications to his credit and is author or editor of ten books and two series. He has supervised doctoral theses of some 100 research associates.

Green Factories Bavaria

The Institute for Machine Tools and Industrial Management (iwb) of Technische Universität München is one of the major production technological institutes in Germany and consists of two chairs of the Faculty of Mechanical Engineering in Garching near Munich as well as a user centre in the area of production engineering in Augsburg. The two ordinariates, Institute for Industrial Management and Assembly Technologies and Institute for Machine Tools and Manufacturing Technology, define the focus of the research topics of iwb.

These are manufacturing processes, machine tools, handling, assembling and joining technology, control technology, robotics as well as industrial management, factory planning and logistics.

The staff of iwb dedicates itself to those fields in its research, teaching, and industrial exchange.
Agenda

- Introduction to iwb
- Initial Situation
- Green Factory Bavaria
- Enhancement of "Training Factory for Energy Productivity" (LEP)
- Conclusion and Outlook
Agenda

- Introduction to iwb
- Initial Situation
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- Conclusion and Outlook

Introduction to iwb

Infrastructure

- Largest institute within the Department of Mechanical Engineering
- 5,100 m² office space
- 3,650 m² laboratory
- Approx. 130 employees
- Approx. 10 Mio. € budget

Research Areas of iwb

- Production Organization and Logistics
- Mechatronic Manufacturing Systems
- Manufacturing and Assembly Technologies

Agenda

- Introduction to iwb
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- Conclusion and Outlook
Initial Situation

Situation in Bavaria

- High Share of Nuclear Energy in Bavaria
  Nuclear power plants will be shut down by 2022, though it covers 2/3 of Bavarian energy consumption.

- Bavaria as a Popular Holiday Destination
  Tourism accounts for approx. 8% of Bavarian GDP (turnover: 27 bn €).

Bavaria needs to fill the gap caused by the pull out from nuclear energy and to maintain its environment and landscape.

Initial Situation

Reduction of Energy Consumption in Manufacturing

- Bavaria as a Strong Industrial Site
  Manufacturing sector accounts for approx. 28% of gross value and 35% of energy consumption.

- Reduction of Energy Consumption
  Reduction of energy consumption is a powerful possibility to fill the gap caused by the pull out. A reduction of 30% (10 TWh/a) could obsolete an average plant.

- Further Advantages for Companies and Bavaria
  - Reduction of production costs
  - Increase of competitiveness
  - Securing of jobs
  - Protection of the region
  - ...

Knowledge about energy saving potentials and possibilities needs to be transferred to Bavarian companies, especially to small and medium-sized enterprises.

Initial Situation

Agenda

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- Conclusion and Outlook
Green Factory Bavaria

Foci of Green Factories
- Factory building and equipment
- Additive manufacturing processes
- Machining processes (e.g., machine tools)
- Laser cutting and welding
- Production logistics and service engineering
- Primary shaping
- Disassembling and cleaning
- Technical planning and control of production systems
- El. Engineering
- Electronic and mechatronic production

Interdisciplinary Topics
- Measuring technology
- Simulation
- Certification
- Standardization
- Technology transfer
- Energy monitoring
- Etc.

Corporate Activities
- Green Services
- Conferences
- Workshops
- Etc.

Green Factory at Augsburg (RMV)
- Assembly processes
- Painting processes
- Handling of flexible parts (e.g., CFK)
- Combination to a cohere production process

Green Factory Building
- Depiction of an energy-efficient factory building and infrastructure
- Construction of a sustainable factory building
- Implementation of building equipment (e.g., compressed air, air conditioning)

Green PPC
- Long term planning aspects (e.g., green and brown-field planning, interactions with LEAN)
- Short term planning aspects (e.g., smoothing of energy pikes, energy flexibility to react to energy fluctuations)

Combination to a new demonstration platform to show interactions between machines, planning, factory building and infrastructure

Green Factory at Bayreuth (PPI)
- Processes
  - Primary shaping
  - Separating
  - Disassembly
  - Cleaning
  - Different forms of energy (electric, potential, thermal)

Installation of Different Demonstration Platforms
- Primary shaping (CFK in an autoclave)
- Disassembly of forms / CFK-parts
- Cleaning of forms
- Intra-logistics and warehouse
- Green Services (e.g., retrofitting, measuring of energy consumption, energy recovery)

Technical Planning and Control of Production Systems
- Reduction of energy consumption of IT-systems in production
- Integration of local intelligence in sensors and actors
- Decreasing of tact times in not fully loaded phases
- Adapted controls

Engineering of Electrical Systems
- Integration of new materials and connecting technologies in power electronics
- Design of illumination systems

Manufacturing of Electronic and Mechatronic Products
- Analysis and demonstration of processes with minimal energy expenses (e.g., brazing and soldering, handling)

Integration of the topics into a demonstration line along the value adding chain of mechatronic products or engines

Green Factory at Nuremberg (FAPS)
- Analysis and demonstration of processes with minimal energy expenses (e.g., brazing and soldering, handling)

Integration of the topics into a demonstration line along the value adding chain of mechatronic products or engines

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Green Factory Bavaria

Green Factory at Munich (iwb)

Displaying of Various Manufacturing Processes

- Additive manufacturing processes
- Metal-cutting manufacturing processes
- Laser cutting and welding
- Processes at the existing Training Factory for Energy Productivity (LEP)

Existing Training Factory for Energy Productivity (LEP)*

- Displaying various manufacturing processes
- Manufacturing of a gear box
- Methodological improvement over the training


Agenda

- Introduction to iwb
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- Enhancement of “Training Factory for Energy Productivity” (LEP)
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Enhancement of LEP

Integration of Further Aspects in LEP

Displaying of PPC Aspects (Production Planning and Control)

- Potentials to reduce energy consumption through planning
- Possibilities for energy flexibility (energy consumption depending on availability)

Integration of Additional Machines and Infrastructure, e.g.

- Energy storages to buffer energy
- Redundant and alternative machines and processes to display interactions between lead time and energy consumption

Enlargement of Measurement and Visualization Equipment

- Installation of additional measuring points
- Extension of visualization devices (e.g. on machine level)
- Implementation of energy forecasting

Build up of a Machine Tool Laboratory

Build up of a Competence Center for Energy Efficiency at Machine Tools

- Demonstration, research, teaching and laboratory platform to holistically examine machine tool behavior (interactions between dynamics, temperature and energy consumption)

Transfer of Measures

- Possibilities to increase energy efficiency at new and existing machines
- Direct experience and visualization of effects of single measures on machine behavior

Analysis of Energy Efficiency

- Potential of low weight materials in components (e.g. CFK)
- Influences on energy consumption
- Interactions between energy efficiency and dynamic as well as thermal behavior
**Agenda**
- Introduction to *iwb*
- Initial Situation
- Green Factory Bavaria
- Enhancement of “Training Factory for Energy Productivity” (LEP)
- Conclusion and Outlook

**Conclusion and Outlook**

**Conclusion**
- Arising gap in Bavarian’s energy supply due to German pull out from nuclear power
- Need for Bavarian companies to reduce energy consumption in production
- Technical and methodological knowledge has to be transferred to companies

**Outlook**
- Build up of four Green Factories in Bavaria at different sites
- Demonstration of different topics at each location
- Transfer of knowledge through seminars, green services, trainings, …

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Vera Hummel, Prof. Dr. Dipl.-Ing., is a professor at the ESB Business School, Reutlingen University since 2010 for logistic network design and planning. Before she worked for Mercedes-Benz in Switzerland and in South Africa as well as for Fraunhofer IPA and the University of Stuttgart. Currently she is leading the expert group of logistics at HSRT. She also is the initiator - Construction of a ESB logistics learning factory, on the campus for education, research and training. Her research, consulting and trainings topics cover process management, logistics, industrial engineering, quality management and business excellence.

Multi-Dimensional Networked Learning within the ESB Logistics Learning Factory – Innovative approach, teaching-learning concept and engineering project games
Prof. Dr.-Ing. Harald Augustin, Deputy Dean at the ESB Business School at the Reutlingen University, studied mechanical engineering at the Technical University Karlsruhe, Germany, in France, Australia and Canada and finalized his PhD (Dr.-Ing.) at the Technical University Kaiserslautern.

His fields of research, teaching and training are factory and logistics systems, specialised in factory and warehouse planning, Digital Factory, Green Warehousing and Lean Warehousing. A main field of expertise are information and communication systems for the Virtual Collaborative Engineering.

In this subject he is head of the Virtual Engineering and Training Center VETC at the ESB Business School.

Multi-Dimensional Networked Learning within the ESB Logistics Learning Factory – Innovative approach, teaching-learning concept and engineering project games

ESB Business School, Reutlingen University
We are one of Germany’s leading international business schools, and one of the first state institutions to offer integrated international degrees, which ESB Business School has awarded for almost 40 years now. ESB Business School is part of Reutlingen University, a state-owned university in Baden-Württemberg. With nearly 60 professors and around 2,200 students, ESB Business School is one of the biggest business schools in Germany. For many years, ESB Business School has consistently been at the top of all league tables in the university rankings carried out by specialist journals and rating agencies. Reutlingen University offers international academic programmes with close ties to industry and commerce. Thanks to its living international dimension, values-based teaching and close collaboration with the business world, we enjoy an excellent reputation both within Germany and abroad.
Multi-Dimensional Networked Learning within the ESB Logistics Learning Factory

2nd CONFERENCE ON LEARNING FACTORIES
Competitive production in Europe through education and training

May 10th 2012
Vienna University of Technology

Prof. Dr.-Ing. Vera Hummel
Prof. Dr.-Ing. Harald Augustin
ESB Business School
Reutlingen University

Overview

- Initial situation
- ESB Logistics Learning Factory Structure
- Innovative approach
- Teaching-learning concept
- Engineering project games
- Conclusion
ESB Logistics Learning Factory

- Change of the job profile -> beside the classic tasks focused on logistics functions, more and more problem-oriented projects appear across the whole value chain.

- Shortly after getting their bachelor and master certificates, graduates are already positioned in the role of a project engineer

- Provision of connected learning contents of the logistics from theory and practice - on the scale of the project, factory- and the network planning and design - are, according to industrial partners and advisory board, necessary for the accomplishment of future challenges.

- Via professional business competence, knowledge and action can be linked with regards to technical competence, method competence, social competence and individual competence, to ensure top rankings for ESB and to increase the attractiveness of the study programs.

- Requirement of an integrated factory to cover an innovative learning environment for students, a training infrastructure for the industry, as well as a research centre for the advancement of technology, management and workflow in logistics to extent research activities.

ESB Logistics Learning Factory

Integrated content:

- Marketing and Sales
- Product / Service Development
- Procurement
- Information Systems
- Process Engineering and Material Flow
- Industrial Engineering / Work Science
- Intake
- Storage
- Planning and Scheduling
- (light) Assembly
- Picking up the consignments
- Packing Area
- Distribution
- Yard Management
- Human Resource
- Finance and Controlling

Cityroller Scooter HUDORA L205 with light(14599)

- final / light assembly
- flexible creation of different models
- single and small batch series
- commissioning, packaging and distribution

Logistics services (ramp up)

Conceptualization of:
- Consignment stock
- Replacement part logistics with 24/7 service
- Recall Logistics
- Packaging logistics
- Assembly and installation
- Product finalization
- Supply warehouse
- Reprocessing treatment

ESB Logistics Learning Factory

Process and Infrastructure Maturity model

- Input
- Learning goals
- Processes
- Instruments
- Know-How
- Output

Maturity Model

ML 1 old fashioned, chaotic
ML 2 partial optimized
ML 3 lean, robust and sustainable automated (were applicable)

Source: http://www.lgi.de/branchen/electronics.html

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Prof. Dr. ing. Dipl. Ing. FH Vera Hummel, Logistiknetzwerkplanung und -gestaltung, Hochschule Reutlingen, Wartungstrasse 350, 72762 Reutlingen, www.reutlingen-university.de, +49 (0)7121 271-3031, Vera.Hummel@reutlingen-university.de

10.000,00 €

50.000,00 €

270.000,00 €

20.000,00 €
ESB Logistics Learning Factory
Multidimensional Networked Studying in the ESB LLF

Integrated Learning Scenarios for Professional Business Competence

ML 1: Chaotic Areas and Processes
ML 2: Lean Logistics Systems and Networks
ML 3: Lean, robust & sustainable Processes
ML 4: Lean Logistics Systems and -Networks

Integrated Learning Scenarios for Professional Business Competence

Qualification Strategy

1 Basic Knowledge:
- Lecturing, online-learning, self studying
- Product development
- Industrial engineering
- Work science
- Cost calculation

2 Knowledge transfer for required methods and instruments
- Project management
- CAD & product documentation
- Part lists & working plan
- Time determination
- Costing

2.1 Theoretical knowledge
- Lecturing, presentation

2.2 Best practice examples
- Presentation

2.3 Self-Application on predefined examples

2.4 Self-Application projects

3 Engineering Project Games
- Self applying in groups
- for a defined group of parts of the city scooter

- Factory planning
- Factory planning
- Factory planning
- Product change management, factory planning
- Warehouse & factory planning
- Transportation, warehouse & factory planning, QM

Implementation
- 1994
- 1995-1998
- 1998-2003
- 2004
- 2009
- 2011

Products
- Truck axles
- Truck axles
- Pneumatic Valve
- Printers & Plotters
- Laptops
- Laptops

Content
- Factory planning
- Factory planning
- Factory planning
- Product change management, factory planning
- Warehouse & factory planning
- Transportation, warehouse & factory planning, QM

Location
- Local
- International
- International
- International
- International
- International

ESB Logistics Learning Factory
Interdisciplinary Learning Module

ESB Logistics Learning Factory
Interdisciplinary Learning Module

ESB Logistics Learning Factory
Interdisciplinary Learning Module
**Conclusion**

- ESB LLL is an initiative of 10 Professors (Fachgruppe Logistik)
- Core team of 3 Professors: lead Prof. V. Hummel, Prof. H. Augustin, Prof. W. Echelmeyer, ESB LLF is integrated in the SEP (strategy development plan)  
  ➔ Vision: the New Factory will be established by 2014 on the campus
- Building, infrastructure and business modell are worked out. Financial requirements are identified.
- Sponsoring concept for the factory building is available (Platin, Gold and Silver sponsor)
- Different sources for financing the infrastructure as well as for the development of learning modules and scenarios are identified and are applied for.
- The master study programmes will be from 2013 a „project oriented program“ (3 semesters) Projects will be run with industry & necessary theoretical and methodological Know-How will be provided by the professors
- The bachelor study programmes are under investigation and will be project oriented as from 2014 onwards
Block I
Universities

Block II
Industry

Block III
Learning and Innovation Factory
of the Vienna University of Technology
Rudolf Hamp studied mechanical engineering in Vienna and after his graduation he worked as teacher and consultant. In 1981 he started his career in the engine and transmission plant in Vienna-Aspern and soon he managed the material and production control. In 1988 he took an assignment in Rüsselsheim. Hamp returned to Vienna as manager manufacturing services and in this function – and later on as plant manager – he implemented the lean manufacturing concept. Aspern took over a leading role in lean manufacturing and thus he founded the reputation of the plant as a benchmark powertrain plant of the world. During his direction the first important plant expansion of the 5-speed transmission plant and the cylinder head production was carried out.

In 2000 Rudolf Hamp was assigned as plant manager in Szentgotthard, Hungary, and developed the plant to a measure of production processes to increase quality and productivity. The plant was honored with the JIPM Award of the Japan Institute for Plant Maintenance in 2004 and the Quality Award of the European Foundation for Quality Management in 2006.

From October 2005 to August 2011 Rudolf Hamp was general manager of Opel Wien. He led the ramp-up of the newly built 6-speed transmission and the start of production of the third generation of the ECOTEC engines (2009) and the turbo engines (2010). As of December 2011 Hamp is member of the Advisory Board of Opel Wien GmbH.

Every second powertrain, the heart of Opel or Vauxhall vehicles, comes from Vienna. In the three decades since start of production, Opel Vienna has continuously set standards in quality, reliability and productivity and, through its consistent implementation of downsizing technology, shows that its product portfolio is more than trendy. Opel Wien GmbH has 1,950 employees and with its annual production of 1.55 million units, it is the largest General Motors Powertrain plant in the world. From start of production in 1982 up to now about 32 million engines and transmissions were produced. The main customers are still the Opel plants in Europe. However, because globalization is ever progressing, customers now are situated in Brazil, Mexico, the USA, China, South Korea and Australia and, as of 2012, also in South Africa and India.

Dipl.Ing. Rudolf Hamp
Welcome to the learning shopfloor of Opel Wien

Learning Factories – Learning Shopfloor

Content

1. Introduction of Opel Wien GmbH
2. Importance of People to be competitive
3. Living examples at Opel Wien
4. Summary
Introduction of Opel Wien GmbH

Opel Wien GmbH

Plant Aspern

Facts & Figures 2011

Currently ~ 2000 employees work at plant Aspern

Production

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines</td>
<td>603,188</td>
</tr>
<tr>
<td>5-gear transmissions</td>
<td>514,549</td>
</tr>
<tr>
<td>6-gear transmissions</td>
<td>432,421</td>
</tr>
<tr>
<td>Total</td>
<td>1,552,003</td>
</tr>
</tbody>
</table>

Production cumulative (1982 – 2011)

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines</td>
<td>11.8 Mill.</td>
</tr>
<tr>
<td>Transmissions</td>
<td>21.0 Mill.</td>
</tr>
<tr>
<td>Total</td>
<td>32.8 Mill. engines and transmissions</td>
</tr>
</tbody>
</table>

Products 2012

M20/32 transmission

6-gear manual + MTA

F17 transmission

5-gear manual + MTA

TWINPORT ECOTEC engine

1.0 / 1.2 / 1.4 / Ef lex / 1.4 Turbo

Variants

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20/32</td>
<td>74</td>
</tr>
<tr>
<td>F17</td>
<td>51</td>
</tr>
<tr>
<td>TWINPORT ECOTEC</td>
<td>47</td>
</tr>
</tbody>
</table>

Customers

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Count</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>GME</td>
<td>Opel/Vauxhall</td>
<td>Saab</td>
<td>Opel/Vauxhall</td>
</tr>
<tr>
<td>GMIO</td>
<td>Opel, Chevrolet, Buick, Holden</td>
<td>Opel, Chevrolet</td>
<td>Opel, Chevrolet</td>
</tr>
<tr>
<td>GMNA</td>
<td>Chevrolet</td>
<td>Chevrolet</td>
<td>Chevrolet</td>
</tr>
<tr>
<td>GMSA</td>
<td>Chevrolet</td>
<td>Chevrolet</td>
<td>Chevrolet</td>
</tr>
</tbody>
</table>
Global customers

Importance of People to be competitive

Volums distribution: 30% | GME: 70%

Opel Wien

Importance of people to be competitive

A production plant

- In a very competitive global business
- In a high cost country, without strong home market

- Manufacturing factors
  - Machine no competitive advantage, accessible to everybody, everywhere
  - Material competitive strength, must be developed in the plant

Our strength are our people

Learning Factories – Learning Shopfloor

Importance of people to be competitive

Applying the Power of people in all areas and levels
- There is no factory without people
- All new methods, technologies and systems are developed and applied by people
- Sustained execution and improvement of processes based on people

Skills, competences, continuous improvement, people involvement and development are key to be competitive

Importance of People to be competitive
Developing people and organization
A never ending Process

Our Evolution:
- Teamorganisation since 1981
- Strong suggestion system
- Systematic CIP since 1989
- Policy deployment (Hoshin Kanri) since 1993
- A strong set of improvement tools
- One integrated production system – GMS
- Consequently executed in daily live

Many setbacks and Lessons Learned

Living examples at Opel Wien

Global Manufacturing System

People Involve
ment
Build in Quality
Continous Improvement
Short Leadtime

Business Plan Deployment

Plant Level

Group Level

Team Level

Results

Targets

Visualisation and Management
BPD Boards

R. Hamp - Opel Wien GmbH
Continuous Improvement
Implementation and Tools

EVERY EMPLOYEE IS PART OF THE CONTINUOUS IMPROVEMENT PROCESS

Continuous Improvement Process (CIP)

- Select Area
- Identify further potential
- Project evaluation, Share ideas, Recognition/reward of performance
- Use ideas which are cost-free/cost less
- Standardize new current state
- Analyze current situation, use CIP tools
- See improvement possibilities, develop future state
- Inform involved employees
- CIP Team
- CIP Training

Value Stream Mapping Workshops

CIP – Creativity and Innovation
Standardized process and frame conditions

- Clear roles and responsibilities
- Well defined process (content and time wise)
- Clear definition of rewards (Bonuses etc.)
- Support and coaching by specialists from service areas

Manufacturing Systems/Analysis (Simulation)

Theory of Constraints
Value Stream Mapping

R. Hamp - Opel Wien GmbH 15

R. Hamp - Opel Wien GmbH 16

R. Hamp - Opel Wien GmbH 17

R. Hamp - Opel Wien GmbH 18
CIP Example

Before

300,000€ saving of planned investment

After

Continuous Improvement
Tools and Results 2011

EVERY EMPLOYEE IS PART OF THE CONTINUOUS IMPROVEMENT PROCESS

Summary
Continuous improvement requires continuous learning and development of people - this is a must to be competitive.
- It needs to be lived by everybody, everyday.
- It is a „FITNESS PROGRAM“ for the company, to be ready for future challenges.
- It is like the personal fitness – you can’t buy it – you have to work on it personally and in the team. So you have to develop it in the company.
- Partnerships with universities and other organizations can provide a strong support and access to new methods and processes.

The company can never be better than its people!

Thank you - for your attention

Wir leben Autos.
In June 2008 he joined the team of Volkswagen Slovakia a.s. as a head of “CIP and production system”. Since then he is in charge of leading and extending this organizational unit through the establishment and further development of the continuous improvement process in all areas. Thanks to Frank Werz and his dedicated and hard working team Volkswagen Slovakia have won the Automotive Lean Production Award for the year 2011 – for the best car-manufacturing plant in Europe. This is the first and only award for the Volkswagen brand ever in the history.

Excellent Qualified and Trained Employees - The Key for the successful Implementation of Lean Production

Volkswagen Slovakia was founded in 1991. In 1992 the production of the Volkswagen Passat Variant was established and the story of a successful and exemplary company began. In the plants in Bratislava and Martin, cars, gearboxes and components are made. Currently the production of the SUV class, such as the Volkswagen Touareg, Audi Q7 and the body of the Porsche Cayenne take place in Bratislava. Since 2011, this plant has also been used for the production of the New Small Family featuring the Volkswagen up!, Škoda Citigo and SEAT Mii. With a total production capacity to 400,000 vehicles a year and 8400 employees, Volkswagen Slovakia is one of the biggest employers in Slovakia as well as one of the biggest exporters. Last year Volkswagen Slovakia won the prestigious “Automotive Lean Production Award” in the category “OEM”.

DI (FH) Frank Werz, MBA

Head of CIP and Production System Volkswagen Slovakia a.s., Bratislava

After completing his studies as a graduate engineer for production technology at the University of Applied Science in Ulm / Germany he continued as a postgraduate with the Master of Business Administration. While being abroad he has gained a great knowledge and international experience in Mexico, USA and in Japan. Which he is applying at his current position. After graduating he worked as logistics planner at AUDI AG headquarter in Ingolstadt. His responsibilities included logistic-planning and calculation as well as establishing and developing logistic and optimization activities. In 2004 he invented the new improved method to realize a lean production in Audi, it was a great achievement and based on this success these methods are used in each and every plant of Volkswagen Group worldwide.
Excellent Qualified and Trained Employees - The Key for the successful Implementation of Lean Production

Frank Werz - Manager of „CIP & Production System“ at Volkswagen Slovakia

What is necessary to prepare a country or a team to win a football championship?
Agenda

1. Volkswagen Group and Volkswagen Slovakia
2. Internationally Standardised Group Production System (GPS)
3. The Way for Qualified and Trained Employees – Training Centers
4. The successful Result

Production plants

62 production plants worldwide

North America
2 plants

Europe
40 plants

South America
8 plants

South Africa
1 plant

Asia
11 plants

From Volkswagen Brand to Volkswagen Group
Volkswagen Company is with its 10 brands the biggest car producer in Europe.

Global market share: 12.3% (11.3%)
Profit after tax: 15.799 mil. € (7.226 mil. €)

Volkswagen Group
Year 2011

501,956 employees

Volkswagen Group
Year 2011

8,494,280 produced cars

Volkswagen Group
Year 2011

34,500 vehicles produced per day
Volkswagen Group
Year 2011

240+
models

Volkswagen Slovakia
Year 2011

8,400
employees*
210,441
vehicles
401,000
gear boxes
34,000,000
components

Products produced in Slovakia

Investment
Outlook until 2016

* Status of 31st December 2011
Challenges – Production volume

Increasing number of employees

What is necessary to prepare a country or a team to win a football championship?

Selection of the best players

Education

Training

Strategy

Discipline

Development of team-consciousness

2 Internationally Standardised Group Production System (GPS)

Group Production System (GPS)

Realisation of a lean, value-orientated production

A synchronised company oriented on added value

Crucial factors of implementation are excellent qualified and trained employees

Principles

Cycle

Flow

Pull

Perfection

Customer cycle as a parameter

Reduced lead time

Pull process

Zero defects

Efficiency

Fundamentals

Levelled and smoothed production

Consistent elimination of all types of waste

Standardisation

Work organisation

Environmental protection

...by the implementation of the concern production systems!
Selection Process

First contacts
15,000
Applications
10,000
Pre selection
6,000
Phone Interviews
3,500
Personal interviews and tests
2,500
Testing the basic skills
2,000
Contract Offer
1,700
Introductory Program, Training Center

Training Centers VW Slovakia - Location

Modules of Training & Objective Target Systematic Procedure for New Employees

"The focus on a target is measurable through positive results at the shopfloor"
**Enhancing Qualification of Consisting Employees**

...through several additional qualifications

- Raise consciousness for quality – passion for detail
- Training of difficult and challenging operations
- Issue-specific training (surface, quality-approval, EC-screwdriver)
- Problem-solving-strategies
The Key Points for the Successful Implementation of Lean Production

- Selection and testing
- Training of each employee
- Specific Training Centers of each Area
- Intensive Education
- Standardised Education for everybody

Lean Award 2011
Category OEM

Volkswagen Slovakia as winner in the category OEM

4 The successful Result

A SMALL CAR FULL OF GREAT IDEAS!

Thank you for your attention!
Klaus Zimmermann has held the position of Head of Training and Consulting with Festo Didactic GmbH & Co. KG since 1998. In this position he is responsible for all of Festo Germany's training and consulting activities. With more than 50 trainers and consultants, both employed and freelance, Festo has been an important player in the field of consulting, expert monitoring and competency development for almost 50 years. Klaus Zimmermann favours a holistic approach, attributing equal importance to the factors people, technology and organisation in order to develop successful and sustainable solutions for the customer. Following technical vocational training, Klaus Zimmermann studied Company and Management pedagogics. He is co-author of the book "Change Management in Production" (MI publishing).

Sometimes cold or wide, sometimes fast or dark - boosting changeability by learning factories.
Sometimes cold or wide, sometimes fast or dark — boosting changeability by learning factories

"I don't know if it will be better if it's different. But it must be different if it is to be better."

Georg Christoph Lichtenberg

Represented results based on the research project of WaProTek.

Promoting Versatility of Process Architecture.

Project was supported by the ministry of Education and Research.
Flexibility > Mutability

- **Univocality**: Ability to match various requirements in terms of products and technologies.
- **Mobility**: Locally unrestricted movement of objects.
- **Stability**: Technical, capital and personal sustainability, and reliability.
- **Modularity**: Ability to exchange standardized units of elements easily.
- **Compatibility**: Interconnectivity of material, information and energy.

**Festo model to build up Mutability**

- **Holistic Value Added Systems**: Increase value added in all business processes.
- **Lean Maintenance Systems**: Combine maintain efficiency and maintainance efficiency.
- **Shop Floor Management**: Develop an efficient communication and management culture that stems at problems.
- **Change Management**: Address cultural change to change and generate new awareness for improvements – open from attitude inclined improvement philosophies.
- **Learning organisation and development of competence**: Facilitate organisation to identify the next step after "Lean" and discover new potential within both the organisation and management level, as well as among employees.

**Capabilities to develop Mutability**

- **Univocality**: Ability to match various requirements in terms of products and technologies.
- **Mobility**: Locally unrestricted movement of objects.
- **Stability**: Technical, capital and personal sustainability, and reliability.
- **Modularity**: Ability to exchange standardized units of elements easily.
- **Compatibility**: Interconnectivity of material, information and energy.

**Produkte, Kostenstruktur, Zeit, Qualität, Flexibilität**

- **Fist**: Ist-Flexibilitätskorridor
- **Fpot**: Potenzieller Flexibilitätskorridor
- **tN**: Beginn der geplanten Wirkung einer Maßnahme
- **tE**: Entscheidung über Wandlungsmaßnahme
- **tN1, Fpot1, Fpot2**

 blockers are flexible but, ... learning methods are not sufficient, management methods and problem solving...

WF = f(W,A)

resources and energy efficiency demand, new technologies...

demographic change, change in social strcuture, ...

globalisation, higher and increasing variations in...

during change, change in social structure, changing customer behavior...

Flexible and dynamic...
Learning factories are didactic approach to develop competences

Festo Value Production System (FVP)

Learning factories are multifaceted like the structures and the processes in a company

With the continuous and sustainable improvement of our capabilities we support the target processes of all subsidiaries.
Thank you for your attention!
Dr. Markus Alexander Tomaschitz, born 1970 in Graz, Austria, studied Business Administration at California University of Hayward, U.S.A and Karl-Franzens-Universität/GRAZ/Austria. Several publications and articles on management, leadership, entrepreneurship, education and human resource management. As of 10/2006 Magna Int. Europe AG as Executive Director Magna Education & Research GmbH. & CO. KG, before Executive Director and CEO of FH JOANNEUM GmbH. - University of Applied Sciences, Graz, Austria; Senior Partner and CEO of EUROPE – MPO; Industrial experiences at Continentale AG and Oracle Inc. as project manager in the USA, Germany and Steirische Volkswirtschaftliche Gesellschaft; Graz/Austria.

Magna International Inc., is a global automotive supplier headquartered in Aurora, Ontario, Canada. It is North America’s largest automobile parts manufacturer and one of Canada’s largest companies. Its operating groups include Magna Steyr, Magna Powertrain, Magna Exteriors and Interiors, Magna Seating, Magna Chassis, Magna Mirrors, Magna Electronics and Cosma International. Magna manufactures auto parts that are primarily supplied to General Motors, Ford Motor Company, and Chrysler LLC. In addition to the Big 3 U.S. automakers, Magna’s major customers include Volkswagen, BMW, and Toyota. In Europe, Magna Steyr holds contracts for the assembly of the Peugeot RCZ, Aston Martin Rapide and Mini Countryman. Magna has approximately 138,000 employees in 286 manufacturing operations and 88 product development, engineering and sales centres in 26 countries. Revenue $29.7 billion USD (year end 2011), Operating income: $291 million USD (4th quarter 2011), Net income: $312 million USD (4th quarter 2011).

Education for the 21st century - impacts for teaching and learning
Education for the 21st century - impacts for teaching and learning

Dr. Markus Tomaschitz, Executive Director Magna Education & Research

TOPICS

• Skills needed for students to excel in the twenty-first century
• Three main categories of 21st Century Skills: learning and innovations skills; digital literacy skills; and life and career skills
• Timely issues such as the rapid advance of technology and increased economic competition
• Economic disruptions to come due to offshoring and automation
• Need for Skills not just Knowledge, and Creativity in particular
• Science/Technology/Engineering/Math for innovation agendas
Global Presence

~ 107,000 People | 26 Countries | Global Facilities 347 | $28.7 Billion (2011 Sales)

(Area of April 2012)

The importance of Education

There is a lot of knowledge and information about the huge role and importance of Education.

It didn’t find it’s way to boardrooms of companies.

But there is no alternative to education and research for European companies trying to stay competitive.

“The clearest form of lunacy is to keep on doing what you always did and hoping that something will change.”

Albert Einstein 1897 - 1955

Asking why?

• Many countries have seen rapidly rising numbers of people with higher qualifications. But in a fast-changing world, producing more of the same education will not suffice to address the challenges of the future.
• Students need to be capable not only of constantly adapting but also of constantly learning and growing, of positioning themselves and repositioning themselves in a fast changing world.
• These changes have profound implications for teachers, teaching and learning as well as for the leadership of schools and universities.
Benefits of learning

- Economic competitiveness
- Learning
- Lifelong personal prosperity
- Social & environmental wellbeing

Source: Charles Fadel, Speech in Vienna, Oct. 2011

TOP 10 breakthroughs

1. Alternative energy
2. Desalination of water
3. Precision farming
4. Biometrics
5. Quantum computers
6. Entertainment on demand
7. Global access
8. Virtual education
9. Nanotechnology
10. Smart Robots

Source: World Future Society

Displacement due to technology

- Ox → Harvester
- Horse → Automobile
- Lab Mice → Assays (not soon enough…)

Humans:
- Scribes → printing press
- Washers → washing machine
- Cashiers/Attendants → bar code scanner
- Healthcare/Finance/Services/Jeopardy champions → Watson

etc
So what do we teach for

- Possibly:
  - Better Engineering
  - Asking the right questions
  - Synthesizing/integrating
  - Creating
  - Ways of thinking. Creativity, critical thinking, problem-solving, decision-making and learning
  - Ways of working. Communication and collaboration
  - Tools for working. Information and communications technology (ICT) and information literacy
  - Skills for living in the world. Citizenship, life and career, and personal and social responsibility

Accelerating change demands different skills

Economy-Wide Measures of Routine and Nonroutine Task Input, 1960–2002


Qualification Shift

Distribution of talents or possibilities for qualification

Downward mobility

Reaction??

High tech qualification possibilities??

Labor market demands

More competition and immigration?

Unqualified segment

High tech segment

Qualification Shift

Unqualified segment

High tech segment
"The only lasting, inimitating competitive advantage an organization has is the quality of people."

Michael Porter, in a speech given at Columbus University 2010.
IN MORE DEVELOPED COUNTRIES

Source: "Tough Choices or Tough Issues: OECD's National Center on Education and the Economy

IN LESS DEVELOPED COUNTRIES

Race up the Value Chain

Creative Work

Routine Work

Done by People

Routine Work

Done by Machines

Schooling vs. the real world

Preparing Teachers and Developing School Leaders for the 21st Century Lessons from Around the World Edited by Robert F. M. Maran

“...school learning is abstract, theoretical and organized by disciplines while work is concrete, specific to the task, and organized by problems and projects...”

Source: OECD, “Learning for Jobs” 2009

Skills of Effective Managers – One Study

1. Verbal communication (including listening)
2. Managing time and stress
3. Managing individual decisions
4. Recognizing, defining, and solving problems
5. Motivating and influencing others
6. Delegating
7. Setting goals and articulating a vision
8. Self-awareness
9. Team building
10. Managing conflict

Rethinking – what is taught?

“Character” (incl. Values [morals, wisdom], Attitudes [motivation] etc)

Complete Individual

Knowledge (Relevance)

Skills (incl. Behaviors [performance])

Skills of Effective Managers – One Study

1. Verbal communication (including listening)
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Rethinking – what is taught?

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Complete Individual

Knowledge (Relevance)

Skills (incl. Behaviors [performance])
21st Century Skills Framework

- **Learning & Innovation Skills**
  - Critical Thinking & Problem Solving
  - Creativity & Innovation
  - Communication & Collaboration
- **Information, Media & Technology Skills**
  - Information Literacy
  - Media Literacy
  - ICT (Information, Communications & Technology) Literacy
- **Life & Career Skills**
  - Flexibility & Adaptability
  - Initiative & Self-Direction
  - Social & Cross-Cultural Skills
  - Productivity & Accountability
  - Leadership & Responsibility

The Challenge

... place the right people in the right spot on the team ...
Example: Literacy

- In the 21st century literacy is about reading for learning, the capacity and motivation to identify, understand, interpret, create and communicate knowledge, using written materials associated with varying situations in continuously changing contexts.
- In the past it was sufficient to direct students to an encyclopedia to find the answer to a question, and they could generally rely on what they found to be true.
- Today literacy is about curiosity and self-direction, managing non-linear information structures, building one’s own mental representation and synthesis of information as one finds one’s own way through hypertext on the Internet, about dealing with ambiguity, developing healthy skepticism, an inquiring mindset, and interpreting and resolving conflicting pieces of information.

- Source: OECD, Preparing teachers and developing school leaders for the 21st century – LESSONS FROM AROUND THE WORLD
Knowledge

- Knowledge – relevance required: students’ lack of motivation, and often disengagement, reflects the inability of education systems to connect the content to real-world relevance. Need to rethink the significance and applicability of what is taught, and in concert to strike a better balance between the conceptual and the practical.

STEM Professors have a positive impact

“Our evidence shows that countries with a higher concentration of engineering college majors grow faster, whereas countries with a higher proportion of law concentrators grow slower.”

“If an extra 10% of enrollment was engineering, the growth rate would rise 0.5% per year; if an extra 10% enrollment were in law, growth would fall by 0.3% per year”.

Source: “Allocation of Talent, Implications for growth” 1990 National Bureau of Economic Research, Murphy et al

STEM Education – OECD average

Why so little technology? Why is engineering only a college discipline?

Expanding the mindset

Source: Richard Miller, President Franklin Olin College
MIT – New understanding of education

M-shaped individual, not just t-shaped

We need both!!

“The future is already here – it’s just not very evenly distributed”

“STEM for Employability… …Humanities for Excellence”


Block I
Universities

Block II
Industry

Block III
Learning and Innovation Factory of the Vienna University of Technology
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 specialized in structuring and optimization 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.

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

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

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.

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.
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.-Wirts.-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. Dring Detlef Gerhard

Introduction

Learning and Innovation Factory of the Vienna University of Technology

Learning Factory

- Higher education
  - "Integrative product manufacturing"
  - Lecture, practical course (Bachelor Mechanical Engineering - Management)

- Advanced training
  - Methods focus: Lean Assembly, Lean Production & Logistics
  - Technology focus: RFID and pick-by-voice assembly support

Innovation

- e.g. process evaluation and optimization of Lean Assembly, development of innovative factory planning methods, etc.

Industry

- Service
  - e.g. use of innovative research and development facilities as high application and demo center

Students
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“

- Lecture name: Integrative Product Creation
- Parts: Engineering Design – Manufacturing – Assembly
- Students: Bachelor Program (Mechanical Engineering - Management)
- Lecture: Theoretical preparation
  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 Faculty of Mechanical and Industrial Engineering

Faculty-wide learning factory through cooperation of:

- **Industrial Engineering**
  Industrial and Systems Engineering in cooperation with Fraunhofer Austria

- **Product Development**
  Institute for Engineering Design and Logistics Engineering

- **Production Technology**
  Institute for Production Engineering and Laser Technology

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 Agriculture/machinery producers
  - Engineering and Plant Construction
  - Electronics Industry
  - Metal industry
  - Energy Suppliers

Method Competencies

Theme Competencies

Higher education Research Development Realization Application
Higher Education
"Integrative Product Creation" – Focus 2

- Production Engineering
  - Design for manufacturability
  - Technology and process planning
    - Selection of processes, equipment and tools
    - Definition of machining parameters, setup instructions and quality assurance checklists
  - Sequencing of operations
  - Creation of manufacturing BOMs and routings
  - NC-programming

- Production Planning
  - Material requirements planning
  - Scheduling
  - Machining
  - Quality inspection

Focus 2: Content of teaching

---

Higher Education
"Integrative Product Creation" – Focus 3

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

- Time Management
  - Time observations vs. MTM

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

Focus 3: Content of teaching

---

Higher Education
"Integrative Product Creation" – Tasks

Task 1: Development and Planning

From protoype to series

- Failure frequency
- Quality
- Time
- Costs
- Production time
- Production costs

Task 2: Product and Process optimization

- Students’ tasks
  - Analysis of slotcar prototype and characteristics
  - Baring of waste in manufacturing and assembly processes
  - Determination of assembly friendly product structure
  - Reorganisation of manufacturing and assembly processes
  - Redesigned and planning of slotcars series
  - NC-manufacturing
  - Assembly and quality checks
Higher Education
„Integrative Product Creation“

Advanced Education for Industry
Training with following project monitoring

Training Model: Industry
5 + 1 steps

LEARNING FACTORY AS ADVANCED EDUCATION TOOL FOR INDUSTRY
Advanced Education

Focus

Learning and Innovation Factory

- Product Development
- Production Technology
- Industrial Engineering

Focus

Lean Assembly
- Lean Basics
- RFID
- Assembly by voice

Lean Logistics
- Full material supply
- Operations planning
- Pick by voice

Innovation / Services
- *Vision 15 years*
- *Research Infrastructure*
- *Interactive demonstration center*
- *Company based development*

Customdesigned 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
  - SS, SMED, Poka-Joke
  - Lean factory layout planning
- Current development:
  - RFID time tracking
- Preview:
  - Assembly / pick by voice

Contact Persons

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CUSTOMER LANDSCAPE
- 27,000 total active customers
- 1.5 million active commercial customer seats
- Industries Served:
  - Automotive
  - Industrial
  - Medical device
  - Aerospace & defense
  - Electronics & high tech
  - Retail & consumer
- Market Segments:
  - Mechanical CAD (MCAD)
  - Product Lifecycle Management (PLM)
  - Application Lifecycle Management (ALM)
  - Supply Chain Management (SCM)
  - Services Lifecycle Management (SLM)

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Corporate philosophy

World is changing. Globalization and international cooperation determine our working environment. In the past, fixed, rigid solutions designed "forever" are increasingly replaced by intelligent, flexible approaches that better satisfy the requirements of speedy production and reaction, as well as the need for price squeezing in many areas.

- Processes connected with flexibility - we are committed to support you on your way to process optimization.

Flexible system for all sectors of industry

As a medium-sized company BeeVatec relies consequently on a continuous high standard of quality - this applies for the production of our products as well as for the application of these systems at the customers' plants. Technical equipment is no longer a company's most important capital - satisfied and committed staff members are a company's driving force.

For this reason, topics such as the simplification and facilitation of daily working processes, ergonomics and health protection play an important role.

Well-known companies figure among the customer base of our corporate companies and its partners. Our product portfolio enables you to create anything you want and in any industry sector you are working in - automotive industry, supplying industry, electrical industry or any general industry.

Therefore, we provide support along your way of process optimization: individual advice, engineering, supply of kits and/or complete developments (e.g. work stations, material supply systems from warehouse to work station by using tugger trains etc.), trainings and workshops, up to a highly-skilled international sales and service network.

Product portfolio

- The BeeVatec pipe racking system by G.S. ACE opens up new ways of designing your ideas - from work stations to tugger trains - a versatile, flexible and above all high-quality kit system that allows you to implement your ideas quickly and simply.

- With our own low cost AGV system as well as our trailer systems, we offer tried and tested intralogistic solutions.

- You will find a broad range of working aids for assembly work stations, the workshop and for workflow management, all of which make use of the pipe racking system. Also we draw your attention to our Business Equipment catalogue, featuring an extensive programme of tables, work benches, cupboards, trolleys, chairs and so on.

Services

- Technical support and expert advice from our experienced staff, nationally and internationally
- Planning support: construction of your projects and the drawing up of building plans
- User training: workshops in your own plant or in our company - for a successful start with your system
- Continuous improvement: our kits are being continuously improved. We should also be pleased to design products, components or complete solutions especially for you!

References

TRUMPF • SIEMENS • OlrineSafety • Zima • Mofle Schmidl • Kärcher • ABB • Festo • Bosch Automotive Lighting • Volkswagen • Daimler Electronics • etc.
Siemens is one of the world’s leading suppliers of innovative, environmentally friendly products and solutions for industry customers. Solid market expertise, technology-based services and software for industrial processes are the levers we use to increase our customers’ productivity, efficiency and flexibility.

Industry Automation
The Industry Automation Division is a worldwide leader in the fields of automation systems, industrial controls and industrial software. Its portfolio ranges from standard products for the manufacturing and process industries to solutions for whole industrial sectors that encompass the automation of entire automobile production facilities and chemical plants. As a leading software supplier, Industry Automation optimizes the entire value-added chain of manufacturers – from product design and development to production, sales and a wide range of maintenance services.

Drive Technologies
Higher productivity, faster time to market, more efficient use of resources and energy, high availability and quality standards – our customers have to meet these needs in production in ever shorter cycles today, and their machinery and systems have to be ready to make that possible. Our innovative automation and drive solutions are the basis for flexible, future-ready and highly productive systems and equipment. They enable the Drive Technologies Division to increase availability and support efficient operations.

Metals Technologies
Siemens VAI Metals Technologies is one of the world’s leading engineering and plant building companies for the iron and steel industry, and for the rolling sector of the aluminum and non-ferrous industries. Headquartered in Linz, Austria, Siemens VAI supplies the latest technologies, solutions and services for metallurgical plants along the entire value-added process chain – from the raw materials to the finished rolled product.

Customer Services
With our service offerings we help industrial customers increase their productivity. Our portfolio includes product-related services and innovative service offerings to enable the operation of industrial plants with reliability and at the highest levels of profitability, efficiency and environmental compatibility. We support our customers over the entire product lifecycle – with retrofit and repair services, technical as well as online support, spare part management and commissioning services. We also offer services designed to increase energy efficiency.

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www.siemens.at/industry
Operating in over 50 countries, Schoeller Arca Systems provides reliable, high-quality plastic packaging systems and services. As an innovative and experienced development partner, we are committed to helping our customers reduce their overall logistics costs and enhancing product branding. Our systems are used in a broad variety of industry segments including, beverage, automotive, agriculture, retail distribution, postal services and pool providers. Through our own production facilities and selected licensee partners, we are able to combine a global presence with fruitful local partnerships.

At the core of our business is a relentless dedication to our customers’ needs. We help customers earn higher rates of return through the use of more efficient secondary packaging, and generate higher revenues through more effective product branding. We design and manufacture innovative, high-quality plastic solutions for industrial and commercial use, and we provide customers with services that enhance the value of our physical products. By the same token, we consult our suppliers on a regular basis and develop long-term relationships that foster innovation, stable production and deliveries.

Industries:
1. Agriculture
2. Automotive Industry
3. Beverage Industry
4. Chemical and Pharmaceutical Industry
5. Postal Services
6. Fluid Handling
7. Food Processing
8. Pooling Services
9. Retailing
10. Recycling & Waste Management

Product range
- Rigid pallet containers “BIG BOX” (1,200 x 800, 1,200 x 1,000)
- Foldable large containers “MAGNUM” (800 x 600, 1,200 x 800, 1,200 x 1,000)
- Intermedia/bulk container “COMBO” for fluid handling
- Euro containers, stackable containers “VDA R-/RL-KLT”
- Stacknest containers “INTEGRA/TELLUS” with/without attached lid
- Nestable containers “SMALL BOXES”
- Foldable small containers “PRELOG”
- Plastic pallets “EOS” and “BIPP”
- Storage trays, modular & storage bins “SYSTEM 9000”
- Customised solutions (workpiece carrier, intakps, dividers, inserts, blister packaging, …)
- Services: 360° IN RETURNABLE PLASTIC PACKAGING SOLUTIONS

Schoeller Arca Systems GmbH
Rudolf Diesel-Gasse 24
2700 Wiener Neustadt - Austria
Contact: ppa. Ing. Mag (FH) Martin Gansterer
P: +43 2622 20656 0
F: +43 2622 20656 21
E: info.neustadt@schoellerarca.com
W: www.schoellerarca.com
Head office: Zwolle (The Netherlands)
Global group turnover 2010: € 1,235 mio
Employees (worldwide): approx. 1,000

Global group turnover 2010: € 433 mio
Employees (worldwide): approx. 1,000

SAS Company Profile A4.indd   1
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Bus transfer to the Learning and Innovation Factory of the Vienna University of Technology

Learning and Innovation Factory of the Vienna University of Technology
Laboratory for Production Engineering and Laser Technology
Engerthstrasse 119
1200 Vienna
Evening event at the City Hall of Vienna
From “Karlsplatz” with the subway U2 (direction Aspernstrasse) to “Rathaus”

Entrance of the Vienna City Hall
**Wireless Internet Access (user name and password)
(One account can be used by several users)**

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