Education for European Production Engineers

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December 5, 2005 CeTUSS, Uppsala
AGENDA

Background

- Production Engineering
  - Production engineer is a specialist of production, production control, design, facilities planning, plant layout, methods engineering, quality control, work standards, systems engineering, statistical process control, processing, and manufacturing engineering management—hence the whole spectrum of manufacturing concerns.

- The future of Production Engineering will involve processes, materials, products, industries, and applications of technology that will open new markets and provide new challenges for manufacturing.

Education in Production Engineering (PE)

- Key Factors
  - Demographic structure
  - Employment structure
  - University graduates
  - Labour costs

- The Threats
  - China is a formidable competitor
  - Low-cost manufacturing
  - Chinese domestic market lures European and US businesses
  - Domino Effect: Suppliers follow customers

- The Weakness
  - There is great concern that Europe no longer has the reservoir of expertise in manufacturing to take full advantage of these exciting opportunities and to meet the challenge posed by foreign competitors.

- Production Engineer Skills
  - Production engineering is a specialty of professional engineering, able to understand, apply, and control engineering procedures in manufacturing processes.
  - A production engineer needs the ability to plan manufacturing practices, to research and develop tools, processes, machines, and equipment, and integrates the facilities and systems for producing quality products with optimal expenditure.

- Need for a Rewarding System
  - After working in manufacturing, highly qualified engineers often transfer into non-engineering or non-manufacturing classifications that offer salary increases or other rewards.
  - Manufacturers must recognize the loss they suffer when an experienced manufacturing engineer leaves; the production function because there is no salary or promotion incentive to stay in that classification.

- The Curricula Disagreement
  - There appears to be no general agreement on what the course content should be, or how it can be applied to a given industry.
  - Examples stressing manufacturing applications should be introduced into the curriculum.
  - There is also considerable uncertainty about what a manufacturing engineer is in terms of education and training, as well as the nature of manufacturing and engineering and the skills and ideas involved.
AGENDA

- EPRODE - European Education in PE

**The EPRODE Goals**
- Define and understand the needs of the manufacturing industry for training and education in manufacturing strategy on a global basis.
- To enhance the interaction among educators in PE form many European countries.
- To establish a unified, transparent European education and accreditation system in Production Engineering.
- Enhance the prestige of manufacturing as a profession and as an intellectual challenge.

**EPRODE Key Targets**
- Increase the commitment of European engineering schools to production engineering.
- Increase the interaction between industry and universities in production engineering education and research.
- Increase mobility among students, teachers, production engineers.

**The EPRODE Educational System**
(1) A European Network - the EPRODE Organisational Structure.
(2) Procedures and practices for assurance and maintenance of academic standard - the Quality Assurance Manual.
(3) An educational plan - EPRODE Curriculum.
(4) A complete course package, the EPRODE Course Programme including examination tests and

**EPRODE Curricula**

**Excerpt from Curricula**

**Quality Assurance and Monitoring**
- Body of knowledge
- Homogenous PE knowledge among practitioners.
- A highly qualified faculty staff.
Production engineering is that specialty of professional engineering able to understand, apply, and control engineering procedures in manufacturing processes.
The skills needed by production engineers should be defined based on the factory of the future, not on the traditional academic degrees.
The future of Production Engineering will involve processes, materials, products, industries, and applications of technology that will open new markets and provide new challenges for manufacturing.
Key Factors

- Demographic structure
- Employment structure
- University graduates
- Labour costs

Sweden's demographic structure, 1970–2020

Changes in production in different sectors of industry, 1970–2000

University graduates in selected countries, 1999

Labour costs in selected countries, 1990 and 2000
2002 average labour cost in Sweden was SEK 198
- Germany SEK 250
- US SEK 215
- England SEK 165
- Ireland SEK 135

40 hours/week working time
The Threats

“… Let me tell you this story: I just went to [a trade show] in Anaheim… 7 out of 10 people who stopped at the booth asked “Do you produce your molds overseas?”

When I said, “No” they just walked away, automatically assuming I couldn’t compete. They wouldn’t hear any of the spiel, nothing….I’m a third generation molder. That’s humiliating! Just because I make my molds here (potential) customers won’t buy from me.” Company Interview
China is a Formidable Competitor
- Low-cost of manufacturing
- Chinese domestic market lures European and U.S. businesses
- Domino Effect: Suppliers follow customers
A recent survey conducted by the European Commission has estimated that over 400,000 European born researchers are now working in the US. Of the thousands who depart for the US each year, more than 70% are destined never to bring the education they receive there back home.
European universities are at the crossroad of a dual deficit: the EU spends only 1.1 % of GDP (US: 2.3%) on higher education and only 1.9 % of GDP (US: 2.7 %) on research.
The Weakness and.. the Problem

There is great concern that Europe no longer has the reservoir of expertise in manufacturing to take full advantage of these exciting opportunities and to meet the challenge posed by foreign competitors.

Today's growing rate at which new technologies are being introduced into manufacturing has created a large demand for production engineers competent in the new technologies.
How can education contribute to the revitalization of European manufacturing industry?

• Gearing the educational system more to the industrial need and facilitate closer cooperation between academic institutions and industry.

Increased importance of managerial and teamwork skills – industry is in need of people who are able to work in teams, have a broad knowledge of modern and advanced manufacturing practices and are capable of managing projects and other people.
The Production engineer must understand production, production control, design, facilities planning, plant layout, methods engineering, quality control, work standards, systems engineering, statistical process control, processing, and manufacturing engineering management— in other words, the whole spectrum of manufacturing concerns.
Production Engineer Skills

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# EPRODE CURRICULA

<table>
<thead>
<tr>
<th>Module I, 15 ECTS</th>
<th>Module II, 15 ECTS</th>
<th>Module III, 15 ECTS</th>
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<td><strong>Integrated Product and Process Design</strong></td>
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<td><strong>Manufacturing Systems</strong></td>
<td><strong>Forming Technology Sheet Metal Forming</strong></td>
<td><strong>Joining Technology Welding</strong></td>
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<th>Module X, 15 ECTS</th>
<th>Module XI, 15 ECTS</th>
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<td><strong>Production Management</strong></td>
<td><strong>Joining Technology Chemical &amp; Mechanical</strong></td>
<td><strong>Manufacturing Technology</strong></td>
<td><strong>Forming Technology Bulk Forming</strong></td>
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## Excerpt from Curricula

### MODULE 3  15ECTS

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<th>Subject</th>
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<td>EPR301</td>
<td>Engineering Statistics</td>
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<td>EPR302</td>
<td>Experiment Design</td>
<td>3</td>
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<td>EPR303</td>
<td>Quality assurance and Control</td>
<td>3</td>
</tr>
<tr>
<td>EPR304</td>
<td>Process and Capability Analysis</td>
<td>2</td>
</tr>
<tr>
<td>EPR305</td>
<td>Technical English</td>
<td>2</td>
</tr>
<tr>
<td>EPR306</td>
<td>Project work/Industrial case</td>
<td>3</td>
</tr>
</tbody>
</table>

- **Basics Subjects**
- **Competence Subjects**
- **Language**
- **Practical activity**
Quality Assurance and Monitoring

- Body of knowledge
- Homogenous PE knowledge among practitioners
- A highly qualified faculty staff.
EPRODE Module Structure

- Basics
- Competence Courses
- Industrial Cases
- Language and Culture
## Conclusions

### Production Engineering
- In the focus is the competitiveness of European PE companies.
- The nature of work is changing as are the workforce skills in manufacturing industry.
- Gearing the educational system more to the industrial need and facilitate closer cooperation between academic institutions and industry.
- There appears to be no general agreement on what the course content should be, or how it can be applied to a given industry.

### EPRODE
- To establish a unitary, transparent European training and validation system in Production Engineering.
- Enhance the prestige of PE as a profession and as an intellectual challenge.
- European Dimension
- Modular Curricula

[www.eprode.iip.kth.se](http://www.eprode.iip.kth.se)