Project Orientated Teaching for Industry University Cooperation

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Birzeit University – Ramallah, Palestine
Date: 24th of March 2014
Agenda

- Challenges of value creation
- Qualification as enabler
- International project orientated teaching
- National project orientated teaching
Agenda

- Challenges of value creation
- Qualification as enabler
- International project orientated teaching
- National project orientated teaching
Resource challenge

Source: [Seliger, 2010]
Quality of life and consumption of resources

Source: [Seliger, 2010]

- Irresponsible development path: Wealth for all people relying on present technologies
- Responsible consumption of resources
- Improving quality of life with a responsible consumption of resources
- Acceptable standard living with responsible consumption of resources
- Early industrialised countries
- Acceptable living standard
- Maintaining the quality of life while reducing the resource consumption

Emerging countries
Agenda

- Challenges of value creation
- Qualification as enabler
- International project orientated teaching
  - Global Engineering Teams
  - Housing-Manufacturing-Water
- National project orientated teaching
Global Engineering Teams (GET): Partners

- **Africa**
  - Universiteit Stellenbosch (SA), South Africa;
  - University of Botswana (UOB), Botswana

- **Europe**
  - Technische Universität Berlin (TUB), Germany;
  - Hasso-Plattner-Institute (HPI)

- **North America**
  - Pennsylvania State University (PennState), USA;
  - Massachusetts Institute of Technology (MIT), USA,
  - Renssealaer Polytechnic Institute (RPI), USA

- **South America**
  - Universidade de São Paulo (USP), Brazil;
  - Pontificia Universidad Católica de Chile (PUC), Chile
Main Stakeholders and Communication Scheme

symbol legend

- university professor
- partner company
- team supervisor
- student team
- information flow
GET Program milestones description

**Kick-Off Meeting**
Define project work packages and team organisation, team building.

1. **1. Milestone**
**Conceptual design**
State of the art analyse, first theoretical concepts.

2. **2. Milestone**
**Detailed design**
Evaluation and selection of design elements, final theoretical concept.

3. **3. Milestone**
**Prototype**
Realization of final prototype including all requested functions. Partner companies and professors decide upon project continuation.

**Final Meeting**
The team presents the developed solution and the next steps.

**02-08.03.2014 South Africa**

**Online teamwork**

**July 2014**
Phases of Global Engineering Teams

- **Student application phase**
- **Acquisition of projects**
- **Supervised project work**
- **Student project work**

Legend:
- Project kick-off meeting
- 3 milestone presentations and reports
- Final Presentation
- Delivery of final report

- **January**
- **February**
- **March**
- **April**
- **May**
- **June**
- **July**
- **August**
- **September**
- **October**
- **November**
- **December**

- Project kick-off meeting: March 2-8th, 2014 Stellenbosch, South Africa

**Phases of Global Engineering Teams**

- **January**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **February**
  - 3 milestone presentations and reports
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- **March**
  - Project kick-off meeting
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  - Delivery of final report

- **April**
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  - Final Presentation
  - Delivery of final report

- **May**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **June**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **July**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **August**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **September**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **October**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **November**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report

- **December**
  - 3 milestone presentations and reports
  - Final Presentation
  - Delivery of final report
Costs of a GET project

- Cost of a GET project is € 30,000 for 4 students
- This cost includes:
  - Travel costs for the students and the supervisor to attend kick off and final presentation,
  - Organizational costs for meetings, material and knowledge management,
  - Overhead costs for GET UG and the partner universities.
- This cost does not include:
  - Prototype costs
  - Optional travel costs to and from your company and for your company staff.

Benefits
- Potential for innovative solution finding
- Contact to outstanding engineers
- International knowledge network
- Public awareness effects

Agenda

- Challenges of value creation
- Qualification as enabler
  - International project orientated teaching
    - Global Engineering Teams
      - Housing-Manufacturing-Water
- National project orientated teaching
Existing Competence

- Improving the living conditions of the urban poor
- Sustainable access to safe drinking water and basic sanitation.
- Reduce by two thirds the under-five mortality rate.
- Improve the lives of slum dwellers.
- Achieve full and productive employment and decent work for all.
Bundling Competence

- Provide platform to integrate competences in “Think Tank”

- Central management unit, supported by the President of TU Berlin.

- Competence fields are both mutually interdependent and supportive
“Housing-Manufacturing-Water”-Projekt (HMW)

Motivation

- Achievement of Millennium goals,
- create an interdisciplinary international network,
- responsible for building up an educational structure regarding the housing, manufacturing and water competence fields through:
  - Individual projects,
  - yearly joint seminar / short course,
  - building of local capacity,
  - development of interdisciplinary global communities

HMW Partners

- Technische Universität Berlin, Germany
- Universidade de São Paulo, Brazil
- Universidade Federal de Espírito Santo, Brazil
- Stellenbosch University, South Africa
- Pontificia Universidad Católica de Chile, Chile
- University of Botswana, Botswana

Kamla Raheja Vidyanidhi, Institute for Architecture and Environmental Studies, India

HMW = Housing, Manufacturing, Water
Housing – Water – Income for the Urban Poor

- Enabling actors and capacity building for appropriate technologies
Housing Manufacturing Water: Example (1/5)
Kick-off meeting – Vitoria- Brazil March 2013
Housing Manufacturing Water: Example (2/5)
Kick-off – Stakeholder meeting

- Participants:
  - German professors and students,
  - Brazilian professors and students and a
  - local NGO.

- Goal definition: **Factory** that produces **bricks** out of **recycled aggregates** for the brazilian favellas.

- Criteria:
  - Total cost: R $ 180.000,00
  - Noise restriction: max. 78 dB
  - Eco-friendly, no waste production
  - Size limitations
  - No man work inside the container
  - ...
Housing Manufacturing Water: Example (3/5)

Project structure – Team division

- Division into groups:
  - Business, Marketing and Law,
  - Process, Energy & Layout,
  - Design & Development,
  - Project Management.

- Project charter as a guideline

- Regular overall meetings in groups

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Team Structure

<table>
<thead>
<tr>
<th>Rev No.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25-Mar-13</td>
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</table>

### M - Team Project: Design of "Decentralized mini value creation unit"

<table>
<thead>
<tr>
<th>Management</th>
<th>Marketing, Business and Law</th>
<th>Energy Procurement, Process and Layout</th>
<th>Design and Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monica</td>
<td>Nicholas</td>
<td>Carlos</td>
<td>Roberto</td>
</tr>
<tr>
<td>Bernhard</td>
<td>David</td>
<td>Elisa</td>
<td>Sarah</td>
</tr>
</tbody>
</table>

Total Members:
- Project Management: 5
- Marketing, Business and Law: 5
- Energy Procurement, Process and Layout: 12
- Design and Development: 9
Housing Manufacturing Water: Example (4/5)
The outcomes (Manufacturing perspective)

Mobile mini factory I for the creation of recycled aggregate

Mobile mini factory II for the creation of bricks
Housing Manufacturing Water: Example (5/5)

H & W Integration

- Exchange of information, e.g. construction material market
- Planning steps including each other’s needs
  - Housing: Construction material data base
  - Water & Housing: input for product development
- Input to each other
  - Follow up in presentations and meetings
- Design enables markets
  - Construction plans based on the factories output

Example for information exchange between the housing and manufacturing team
Agenda

- Challenges of value creation
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  - National project orientated teaching
Project orientated teaching at the department of machine tools and factory management – TU Berlin

- The department of Machine Tools and Factory Management offers project oriented courses (PMF).

- These projects are supervised by research assistants, often in collaboration with local industry partners.

PMF:

- Ideal for mini research topics,
- Teams with 4-6 students,
- Effective research time: 500 – 1,000 hours*,
- Costs for customer: 5,000 €.

Benefits:

- Potential for innovative solution finding
- Contact to outstanding engineers
- International knowledge network
- Public awareness effects

* Depending on the group size and the number of credit points.
PMF Phases

- Project acquisition
- Task definition
- Assignment of students to project

Legende:
- Overall introduction for students
- Project Kick-off meeting
- Intermediate presentation
- Final presentation
- Submission final report

PMF = Project Assembly Technology and Factory Management
PMF Roles (I/IV)

- **Who**
  - Department of Machine Tools and Factory Management.

- **What**
  - Provides rough direction of project goals (according to current research projects).

Roles

- Project owner
- Project sponsor
- Team coordinator
- Project team

PMF = Project Assembly Technology and Factory Management
PMF Roles (II/IV)

- **Who**
  - Research assistant
  - Industry partner

- **What**
  - Provides the project goal,
  - supports team coordinator in organizational and technical issues,
  - provides necessary infrastructure (e.g. special literature and rooms),
  - evaluates the project results,
  - is **NOT** involved in the project work.

PMF = Project Assembly Technology and Factory Management
PMF Roles (III/IV)

- **Who**
  - One student

- **What**
  - Single point of contact to the project sponsor,
  - coordinates work proceedings,
  - circulates information,
  - supports conflict resolution in the project team.

Roles

- Project owner
- Project sponsor
- Team coordinator
- Project team

PMF = Project Assembly Technology and Factory Management
PMF Roles (IV/IV)

Who
- All students

What
- Generation of results by working on tasks,
  - taking decisions,
  - planning and definition of approaches to solve the task.
PMF Example (1/4)
Greenfield factory planning for a SME in Berlin

A SME is currently located in an industrial park, divided in a lot of separated rooms. The growing SME plans to move in their own building.

Goal
- Development and evaluation of three layout alternatives and proposing a recommendation based on the procedure model proposed in the VDI 5200 (guideline for German engineers).

Work content
- Goal definition in close cooperation with the customer,
- data acquisition (e.g. products, estate data, ...),
- concept planning of three layout alternatives and
- concept evaluation and development of a recommendation for the customer.
PMF Example (2/4)
Project team of a PMF Group in the winter semester 2013/2014

Team mit jeweiligem Planungsbereich und Studiengang

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>Layout planning</td>
<td>Production technology (M.Sc.)</td>
</tr>
<tr>
<td>Martin</td>
<td>Layout planning</td>
<td>Mechanical engineering (M.Sc.)</td>
</tr>
<tr>
<td>Lukas</td>
<td></td>
<td>Technical building systems</td>
</tr>
<tr>
<td>Vincenz</td>
<td>Layout planning</td>
<td>Industrial engineering (B.Sc.)</td>
</tr>
<tr>
<td>Moritz</td>
<td>Team Coordinator</td>
<td>Production technology (M.Sc.)</td>
</tr>
<tr>
<td>Angelina</td>
<td></td>
<td>Production technology (M.Sc.)</td>
</tr>
</tbody>
</table>
PMF Example (3/4)
Factory planning according to VDI 5200

- Seven phases according to VDI 5200.
- Project scope: phases 1-3.

1. Setting of objectives
2. Establishment of the project basis
3. Concept planning
4. Detailed planning
5. Preparation for realization
6. Monitoring realization
7. Ramp-up support

Additional focus on technical building systems.

Source: [VDI-5200]
PMF Example (4/4)
Gantt-Chart created by the students

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Setting of objectives</th>
<th>Start</th>
<th>End</th>
<th>Duration (days)</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analysis of corporate objectives and general constraints</td>
<td>28.10.2013</td>
<td>31.10.2013</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>1.2.1</td>
<td>Setting the factory end project objectives</td>
<td>31.10.2013</td>
<td>14.11.2013</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>1.2.2</td>
<td></td>
<td>31.10.2013</td>
<td>07.11.2013</td>
<td>11</td>
<td>100%</td>
</tr>
</tbody>
</table>

| 1.3 | Itemization of evaluative criteria | 31.10.2013 | 07.11.2013 | 8 | 100% |
| 1.4 | Definition of work packages | 28.10.2013 | 07.11.2013 | 11 | 100% |

| M1 | Final goal definition | 14.11.2013 | 14.11.2013 | 1 | 100% |

| 2 | Establishment of the product basis | 01.11.2013 | 06.12.2013 | 36 | 100% |

| 2.1 | Procurement of information | 01.11.2013 | 06.12.2013 | 36 | 100% |
| 2.2 | Evaluation of information | 12.11.2013 | 06.12.2013 | 25 | 100% |

| 3 | Concept planning | 22.11.2013 | 07.03.2014 | 106 | 100% |

| 3.1 | Structure planning | 22.11.2013 | 01.12.2013 | 10 | 100% |
| 3.1.1 |              | 22.11.2013 | 24.11.2013 | 3 | 100% |
| 3.1.2 |              | 24.11.2013 | 26.11.2013 | 3 | 100% |
| 3.1.3 |              | 26.11.2013 | 29.11.2013 | 4 | 100% |
| 3.1.4 |              | 29.11.2013 | 01.12.2013 | 3 | 100% |

| 3.2 | Dimensioning | 01.12.2013 | 12.12.2013 | 12 | 100% |
| 3.2.1 |              | 01.12.2013 | 03.12.2013 | 3 | 100% |
| 3.2.2 |              | 03.12.2013 | 05.12.2013 | 3 | 100% |
| 3.2.3 |              | 05.12.2013 | 10.12.2013 | 5 | 100% |
| 3.2.4 |              | 07.12.2013 | 12.12.2013 | 5 | 100% |

| 3.3 | Ideal planning | 12.12.2013 | 21.12.2013 | 10 | 100% |

| M2 | Intermediate presentation | 13.01.2014 | 17.01.2014 | 5 | 100% |

| M3 | Final presentation | 05.05.2014 | 07.05.2014 | 5 | 100% |

| M4 | Documentation | 31.10.2013 | 21.03.2014 | 142 | 60% |

| M5 | Submit documentation | 21.03.2014 | 21.03.2014 | 1 | 0% |

Gantt-Chart created by the students in order to structure their group work.
## References

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Source</th>
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