

Presentation of Department and Study of Industrial Engineering at FESB, University of Split

The Future for Industrial Engineering

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Faculty of Electrical Engineering, Mechanical
Engineering and Naval Architecture - FESB

University of Split, Croatia

Braunschweig, September 25, 2009

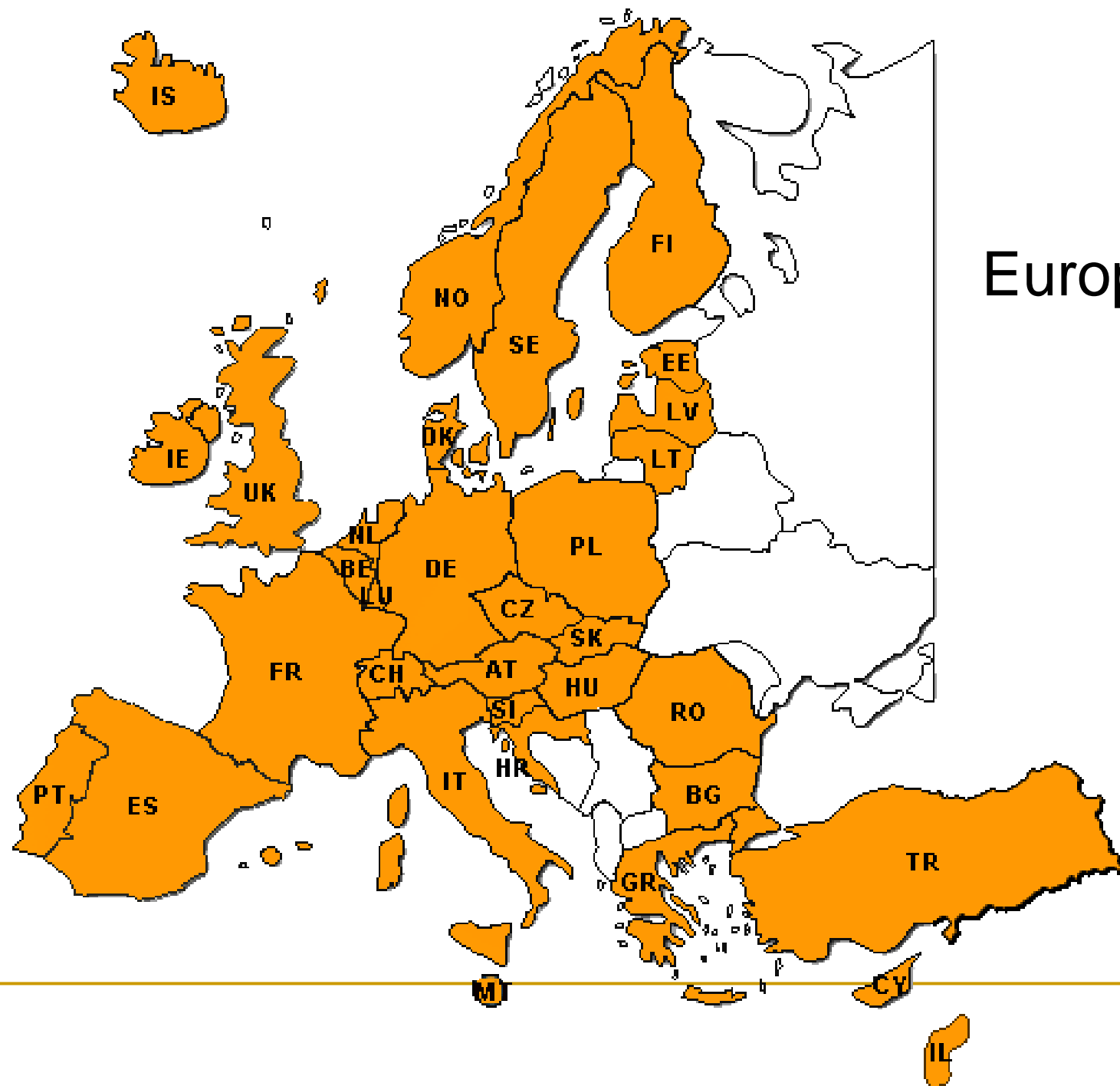


Agenda

1. Split-Dalmatian County
 2. City of Split
 3. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
 4. Department and Study of Industrial Engineering
 5. Research and Development Projects
 6. Future of Industrial Engineering
-

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Europa – Croatia?





OUR ROLE IN CROATIA



- Largest Croatian county with surface area of 14,045 km² (mainland 4,572 km²)
- Highest number of inhabitants among Croatian counties (464 thousand)
- Total 55 local self-government units, out of that 16 cities and 39 municipalities
- Natural diversity (hinterland, coastland, islands) and attractions (Natural Park Biokovo, Cetina River, Zlatni Rat beach, Blue Cave...)
- Rich cultural heritage: UNESCO (Old Town Split with Diocletian's Palace, Old Town Trogir), archaeological findings (Salona, Pharos, Issa), events (Split Summer Festival, Harmony-Singing Festival Sinjska Alka chivalrous tournament)...
- BDP in 2006 approximately EUR 6.000 per capita (approx. 80% Croatian average)
- Approx. 142 thousand of employees total

ECONOMY DEVELOPMENT - ACTIVITIES OF COUNTY ECONOMIC DEVELOPMENT DEPARTMENT



•The successfully society does not miss development chances; it undertakes steps in order to they would create it.



**ECONOMIC
RESTRUCTURING
PROGRAM**



CLUSTER DEVELOPMENT



**SMALL AND MEDIUM SIZE
ENTERPRISE
INCENTIVE PROGRAM**



DEVELOPMENT FUNDS



**ENTREPRENEURSHIP ZONE
ESTABLISHING PROGRAM**



MASTER PLAN OF TOURISM



**AGRICULTURE AND
AGROTOURISM
DEVELOPMENT PROGRAM**



**SCIENCE-
TECHNOLOGY PARK**



**ENERGY DEVELOPMENT
PROGRAM**



CLUSTER DEVELOPMENT (1)

1. *ITC, multimedium*

→ Siemens, Ericsson, enel, Swing, Gideon, Net Media, SME, FESB (Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture)

2. *Shipbuilding/Maritime*

→ *Shipyard Split, ShipyardTrogir, Shipyard&Repair Vranjic, small shipyard industry, FESB, ...*

3. *Car and their supply industry*

→ AD Plastik, Tvornica diesel motora, Adriawinch, SME, FESB, ...

4. *Renewable energy – solar energy, wind energy, fuel cells, biomass.*

→ Demonstration zone for new technology (OPNT) & Research and Education Centre (IOC) for energy efficiency and renewable energy resources (in development proces), FESB and SME's



CLUSTER DEVELOPMENT (2)

5. Industry of stone

- 29 location of the decorative (sawmill) stone and 21 location of technically (crushed) stone***
- in the process yet 36 investigative and 29 exploitative fields***

6. Service sector (tourizm, culture, trade, fair, congrese, ...)

- hotels, ports, logistic centres, Faculty of Economy, Faculty of Maritime, cultural institutions, theatre, ...***

7. Health food industry

- Prerada, Dalmeso, SMS, Dalmacijavino, wineries, producer of oliva oil, fishes, Faculty of chemistry, Institute of oceanography and fisheries, Study of Mediterranean agriculture, Institute of Adriatic Crops and Karst Reclamation***

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Split
Diocletian's palace 305-2005



Split is the cultural and economic hub of Central Dalmatia.

It grew out of the Palace of the Roman Emperor Diocletian, built around AD 300 and now a place where ancient times live on along side the urban rhythm of the twentieth century. Its 1700 years of living history is protected by the UNESCO and will always fire the interest of visitors and travellers.

CITY PROFILE

SPLIT – GENERAL PROFILE



- The second largest town in Croatia and the largest town on the Croatian coast of Adriatic (200 thousand inhabitants)
- Center of the most dynamic administrative, economic, and transportation activities in the region of Dalmatia, with growing entrepreneurship and traffic connections
- The cultural and historical center of Croatia with rich, diverse, and globally attractive cultural and historical heritage
- The sports center of Croatia with global reputation in the world of sports
- The city with the largest potentials for tourism development in Croatia

DEVELOPMENT PROJECTS



SPLIT – VISION OF DEVELOPMENT

ECONOMICALLY ACTIVE CITY

ATTRACTIVE TRAVEL DESTINATION WITH STRONG IDENTITY

CITY THAT INSPIRES CREATIVITY AND INNOVATION

SOCIALLY RESPONSIBLE CITY

**DEVELOPMENT OF
CITY
INFRASTRUCTURE**

**DEVELOPMENT OF
TOURISM AND
HIGH TECHNOLOGIES**

**DEVELOPMENT VIA
PUBLIC-PRIVATE
PARTNERSHIP**

CITY PROFILE

SPLIT – CITY OF KNOWLEDGE



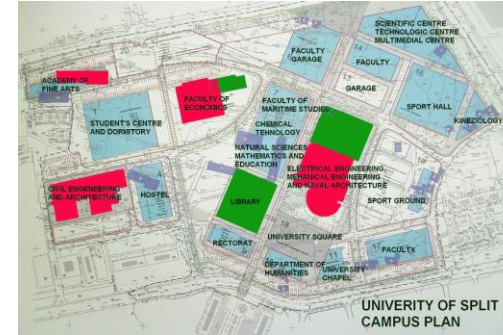
UNIVERSITY OF SPLIT

- The largest university in Dalmatia
- 11 faculties
- 3 university centers for studies
- University library
- Approximately one thousand professors and assistants
- Approximately 25 thousand students

OTHER INSTITUTIONS OF EDUCATION AND KNOWLEDGE


- 28 elementary schools
- 26 high schools
- Mediterranean Institute for Life Sciences





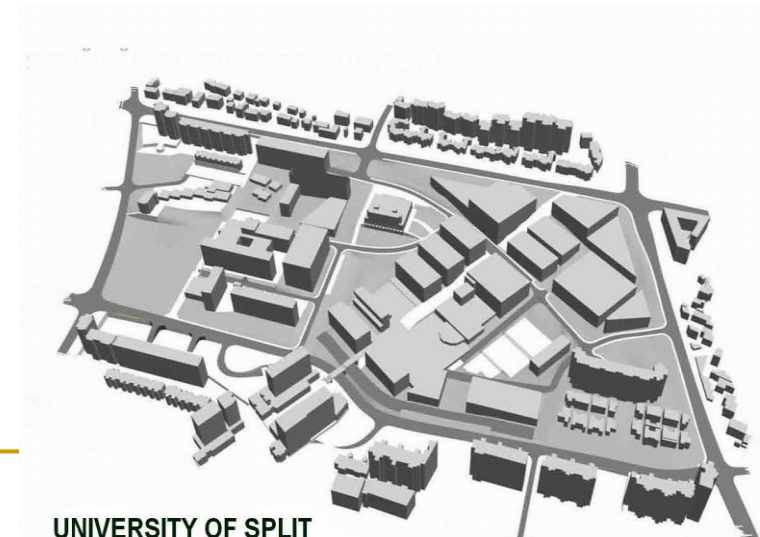
■ **20,16 hectares**

Development of university campus with the following facilities:

- **New buildings of several faculties**
 - **Scientific center, technology center, and multimedia center**
 - **University library**
 - **Sports hall and sports courts**
 - **Student center, student housing, and hostel**
 - **Administrative and supporting facilities**
- 
- An aerial photograph of a modern university campus. The image shows a large, open area with several large, modern buildings, including a prominent circular structure. There are extensive green spaces, trees, and parking areas. The campus is surrounded by a road and some smaller buildings in the background.

- **Approximately 180 million euros**

- **From 2006 to 2010**



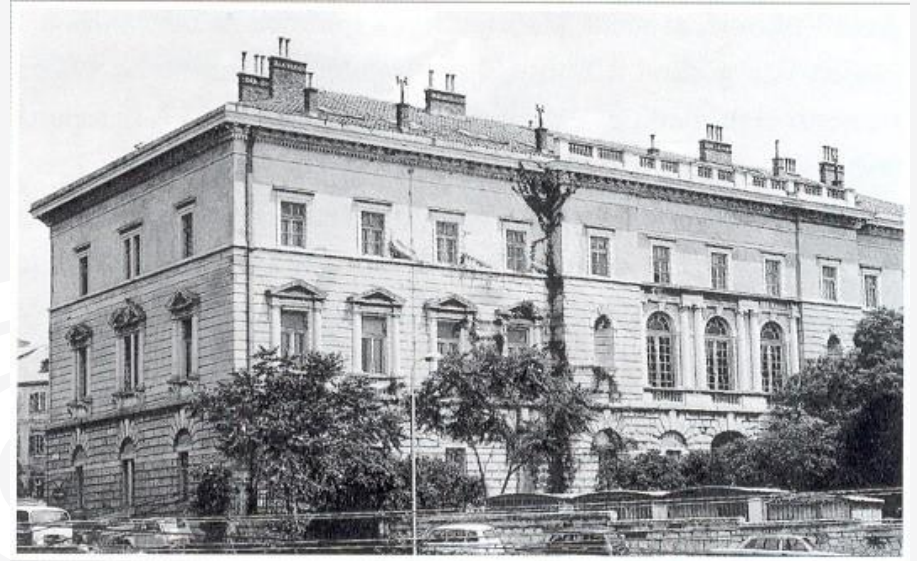
UNIVERSITY OF SPLIT CAMPUS PLAN - 3D SIMULATION

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FESB 1960 – 2009

- Founded 1960
- 1980 – New building



FESB - PRESENT



Organisation

- Department of
 - Power engineering
 - Electronics
 - Mechanical engineering and naval architecture
 - Mechanical technology
 - Mathematics and physics
 - Centre for common courses
- Computing centre
- Library
- Office of the Dean
- 190 employees
 - 130 lecturers and researchers



Some statistics

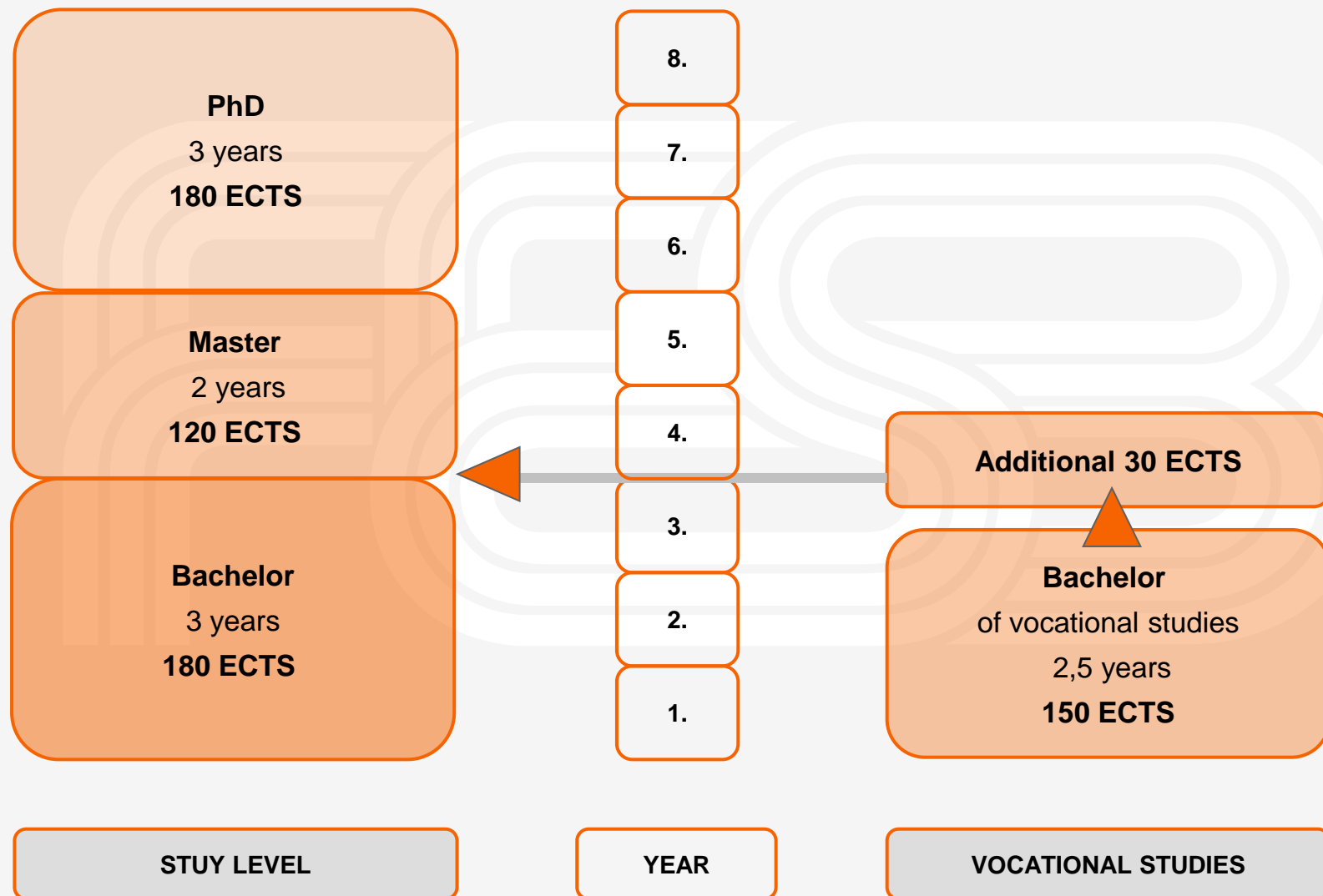
Students:

Bachelor/Master	Vocational studies
<i>Current number of students</i>	
1700	650
<i>Enrolled in 2009./2010.</i>	
450	200
<i>Graduated</i>	
3400	1350
Master of science	PhD
75	27

Teaching stuff:

Full professors	26
Associated professors	17
Assistant professors	16
Assistants and lecturers	54
Technical support	18

Bologna process @ FESB



Electrical Engineering and Information Technology

▪ Freshmen per year: 200 (40 paying fees)

- Bachelor of

- **ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY**



- Master of

- **AUTOMATICS AND SYSTEMS**
 - **ELECTRONICS AND COMPUTING ENGINEERING**
 - **ELECTRICAL ENGINEERING**
 - **COMMUNICATION AND INFORMATION TECHNOLOGY**

Computing

- Bachelor of

- Freshmen per year:

80

(50 paying fees)

- **COMPUTING**

- First year: general knowledge and basic programming
- Second year: databases, algorithms, OOP, discrete systems ...
- Third year: networks, software engineering, distributed systems, business systems ...



- Master of

- **COMPUTING**

- Advanced programming
- Advanced distributed systems
 - e.g. research in GRID
- Advanced architectures
- Multimedia systems ...
- Diploma thesis – whole semester



Mechanical Engineering

- Bachelor of

- **MECHANICAL ENGINEERING**

- Freshmen per year: 90



- Master of

- **MECHANICAL ENGINEERING**

- Specialisations in:

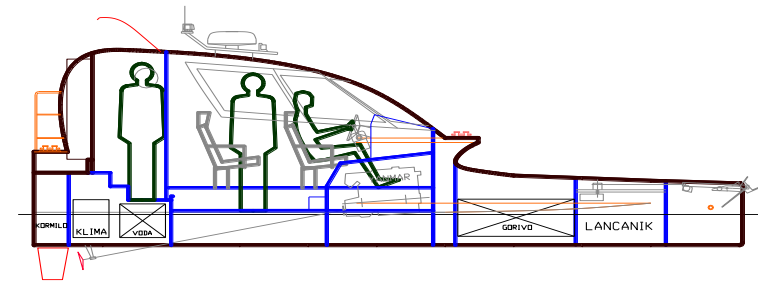
- **ENGINEERING DESIGN**
 - **PRODUCTION ENGINEERING**
 - **COMPUTER AIDED DESIGN AND ENGINEERING**

Naval Architecture

- Bachelor of
 - **NAVAL ARCHITECTURE**
 - Freshmen per year: 40

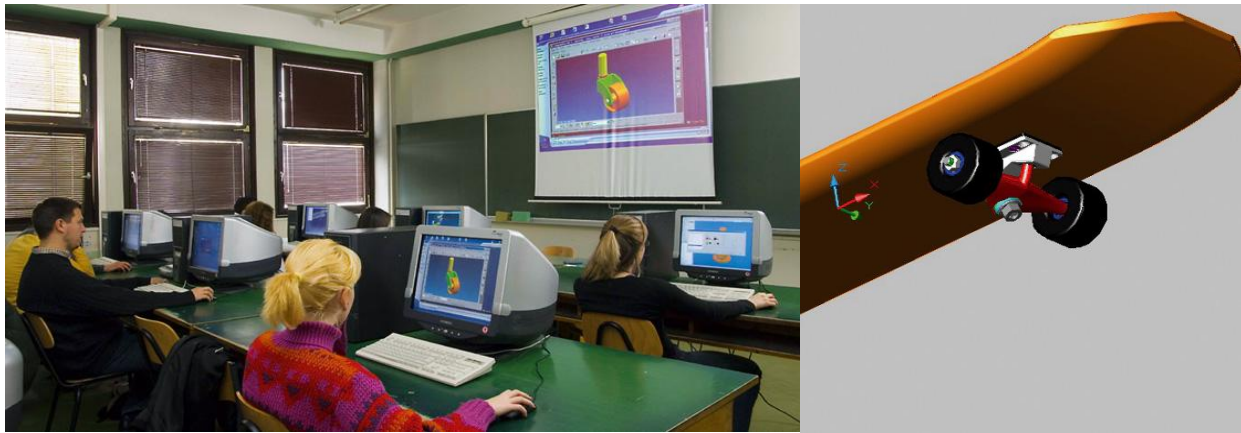


- Master studies in Zagreb or Rijeka



Industrial Engineering

- Bachelor of
 - **INDUSTRIAL ENGINEERING**
 - Freshmen per year: **80** (30 paying fees)



- Master of
 - **INDUSTRIAL ENGINEERING**

- Joint study with Faculty of Economics in Split

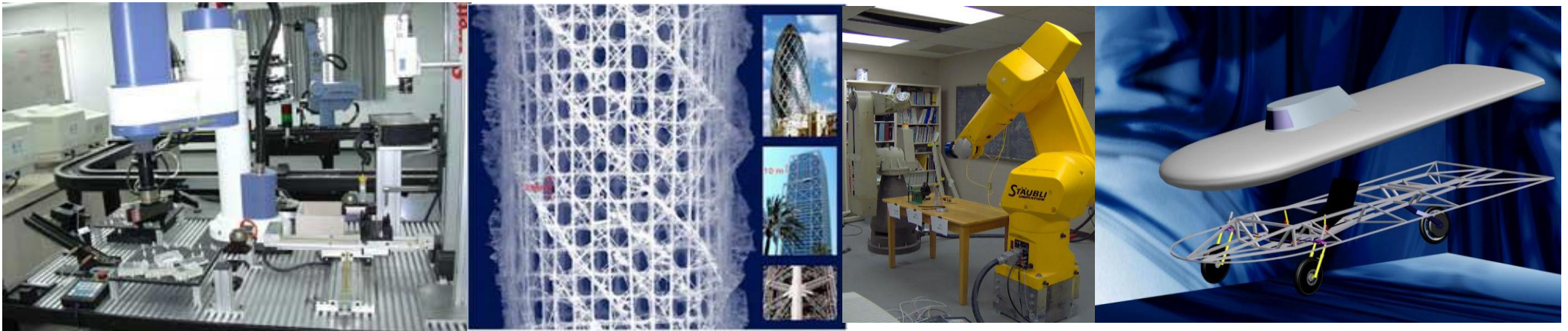


Doctoral studies

■ ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

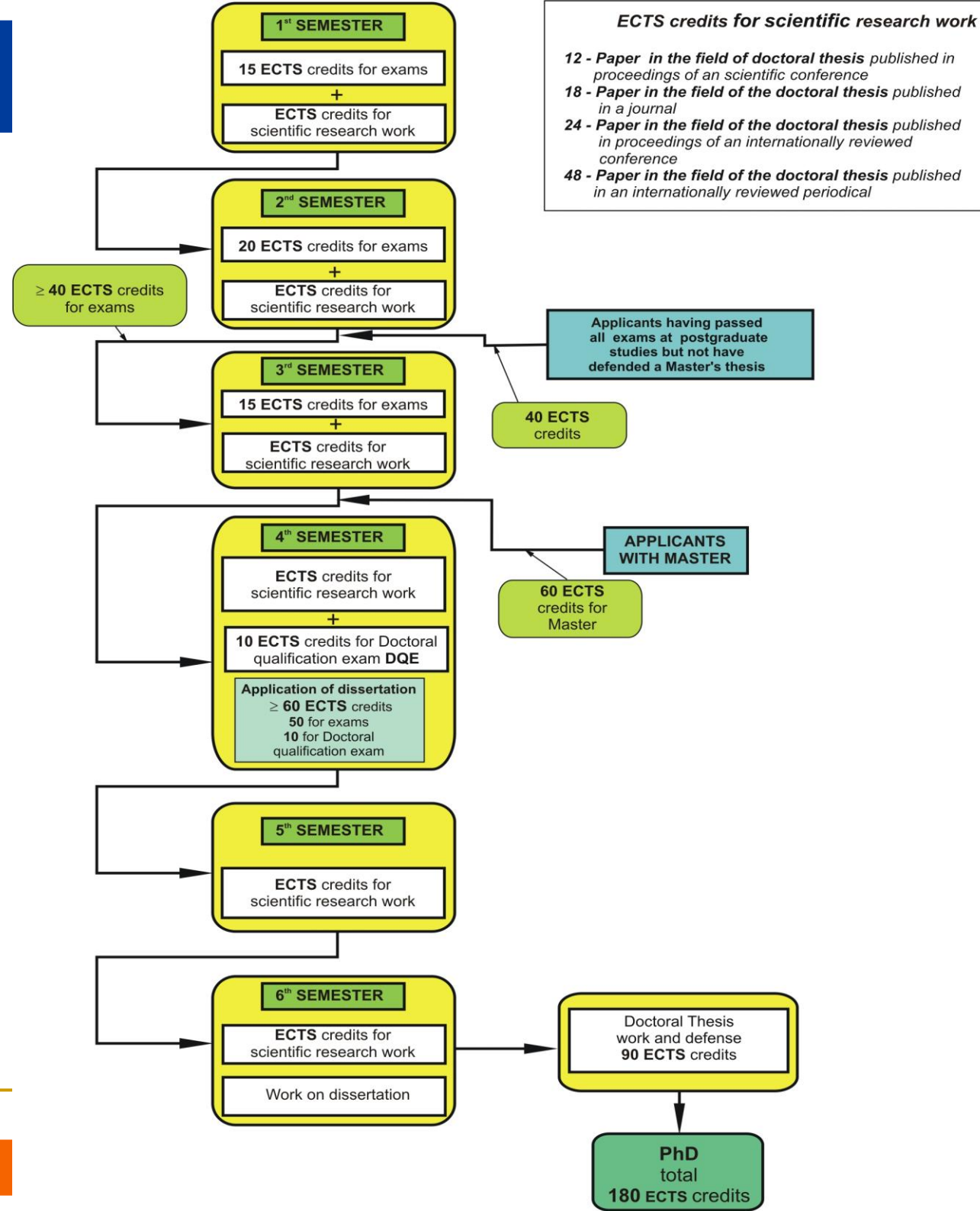


■ MECHANICAL ENGINEERING



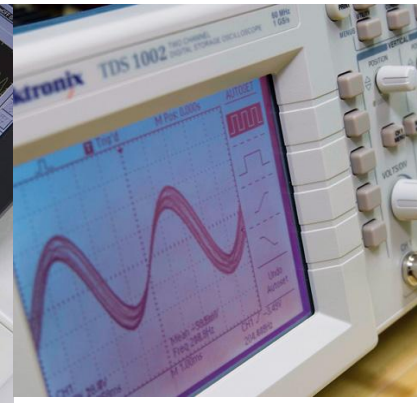
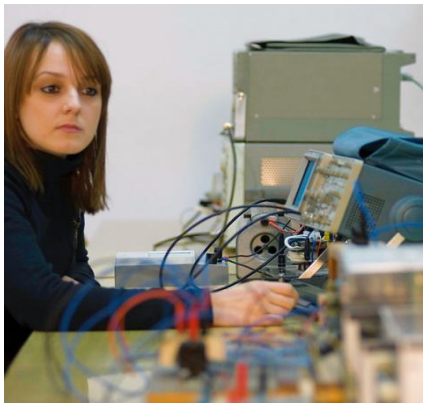
Doctoral studies

- **About 90 elective courses**
 - ~ 40 % in ICT
- **Flexibility:**
 - Students design course list with supervisor
 - One obligatory course
 - *Research methods*
 - Nine elective courses
- **Thesis subject public defence**
- **Strong emphasis on research**
- **Mobility:**
 - Scholarships, internships, visits etc. strongly encouraged and supported
 - Recognition of ECTS from abroad



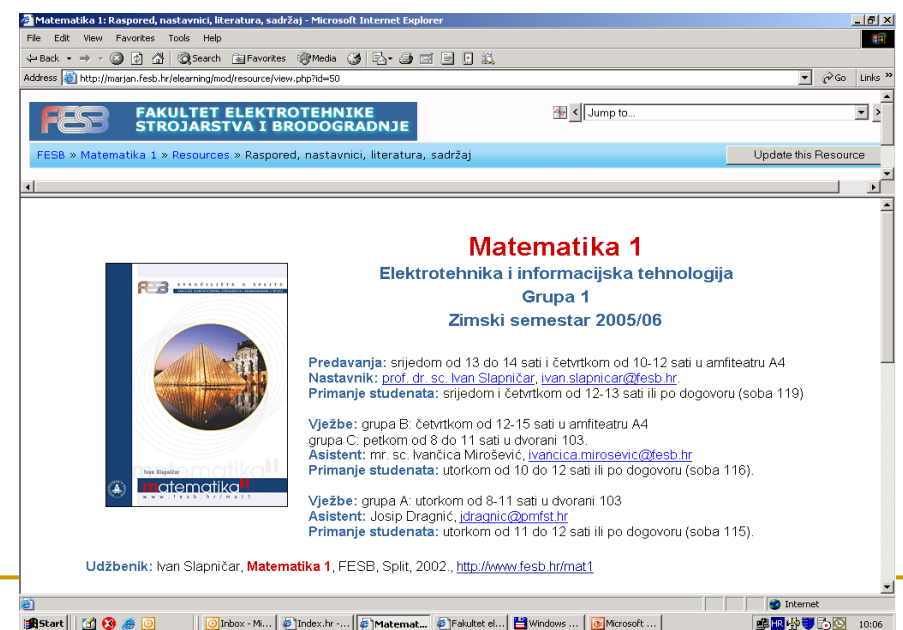
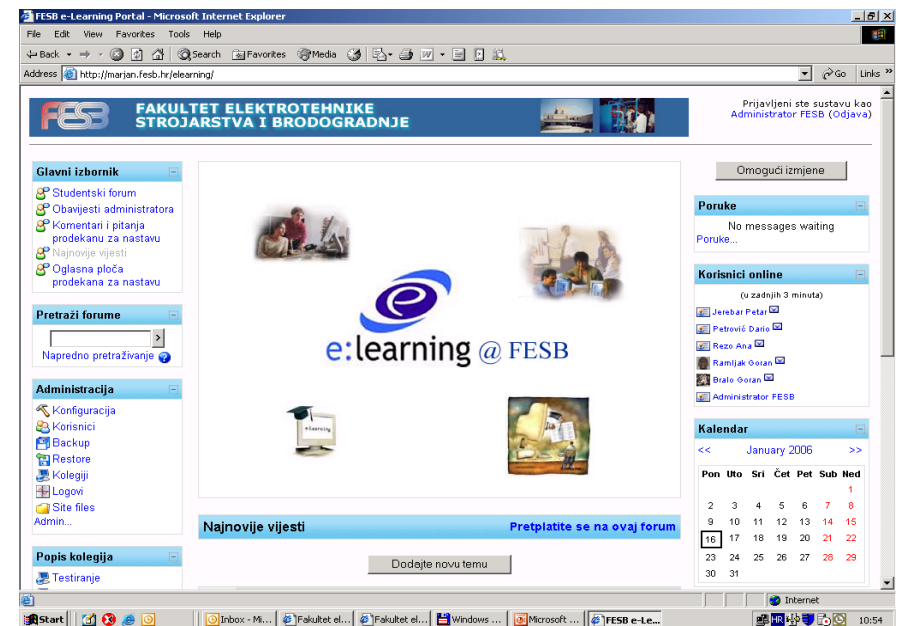
Vocational studies

- **ELECTRICAL ENGINEERING**
 - Students per year: **80** (50 paying fees)
- **COMPUTING**
 - Students per year: **60** (50 paying fees)
- **MECHANICAL ENGINEERING**
 - Students per year: **40** (20 paying fees)
- **NAVAL ARCHITECTURE**
 - Students per year: **40** (20 paying fees)



ICT in Education: E-learning @ FESB

- Basic information for each course
- Material distribution
- Attendance module
- Grades
- Calendar, News
- Exams, quizzes, journals, wiki
- Forums
 - Student forum
 - 'Ask vicedean' forum
- Widely accepted by students



Computing equipment

- One medium size computer classroom (30 PCs)
- Two small size computer classroom (20 PCs)
- Few more small computer labs (~ 10 PCs)
- Public terminals
- WiFi
- GRID cluster
- Teleconferencing room
- 100 MB/s internal network with a 1 GB/s backbone
- Missing space for computer classroom
 - Problem being solved with new building
- FESB E-campus



Number of students graduating per year

University studies (diploma engineers = master)

Electrical engineering	110
Mechanical engineering	30
Computing	30
Industrial engineering	15 (first engineers this year)

Vocational studies (engineers)

Electrical engineering	40
Mechanical engineering	10
Naval architecture	15
Computing	20

Our researchers are

- Leaders of more than 40 scientific/technological/information technology projects sponsored by Ministry of science, education and sports
- ***Participating in international projects:***
 - Croatian-Slovenian cooperation program
 - COST (Electromagnetic Compatibility in Distributed and Complex Systems)
 - ALIS CROATIA - The British Council
 - CEEPUS
 - CERN (ALICE - A Large Ion Collider Experiment, CMS - Compact Muon Solenoid)
 - CROATEA (CROatian Observatory At The Eastern Adriatic)
 - FP6 i FP 7 projects
- ***Guest professors and guest scientists*** at many universities and labs
 - University of Berkeley, Universität Stuttgart, Technische Universität Berlin, Fraunhofer Institut für Betriebsfestigkeit, Columbia University, Imperial College of Science, University of Texas, Stanford University, Max Planck Institute, Université Libre de Bruxelles, King's College London, University of Vienna, University of Wales, Emory University Atlanta, Paul Scherrer Institute, Ecole Polytechnique, UNIDU ...

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The History of the Disciplines

- Aerospace Eng.
- Agricultural Eng.
- Chemical Eng.
- Civil Eng.
- Computer Eng.
- Electrical Eng.
- **Industrial Eng.**
- Mechanical Eng.



Charles W. Babbage



Fredrick Winslow Taylor



Lillian M. Gilbreth

Engineering Majors

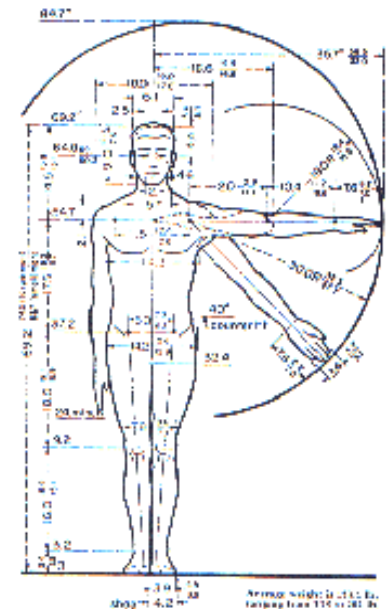
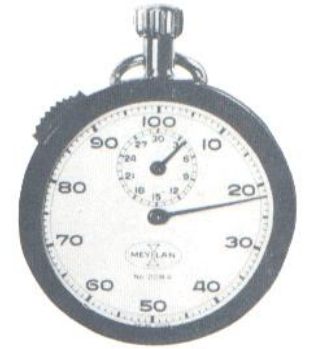
Industrial Engineering

- **“Industrial engineers design, install, and improve systems that integrate**
 - ❑ people,
 - ❑ material,
 - ❑ machines, and
 - ❑ energy**to improve efficiency”**
- Emphasis placed on: Production, Manufacturing, Human Factors Area, and Operations Research
- Production focuses on plant layout, scheduling, and quality control
- Human Factors focuses on the efficient placement of human resources within a plant/facility



The Industrial Engineering study at the FESB includes the following fields

- Design and analysis of systems for inventory control, production planning, transportation and distribution, quality control
- Analysis of location, capacity sizing and layout problems
- Studies in facilities and workplace design
- Design of information and telecommunications systems
- Applications of operations research methods, including optimization, scheduling, queuing theory and computer simulation
- Analysis and design of work methods
- Ergonomics analysis of industrial and service systems
- Quality control and quality assurance systems
- Communication, psychology and social science



Industrial Engineers find a better way... in many industries



Industrial Engineering

Functional work areas

Product Engineering



- Team Facilitation
- Product Development

Finance



- Make/Buy Analysis
- Comparison of Alternatives
- Cost Estimating

Facilities



- Layout Design
- Process Flow Analysis

IE Methods



- Workstation Design
- Ergonomics
- Methods Engineering

Production Control



- Job Scheduling
- Expedite procedures

Tooling

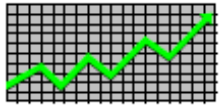


- Tool Fab process
- Tool Offload procedures
- Tool Repair process
- Tool Room procedures

Industrial Engineering

Functional work areas

Quality



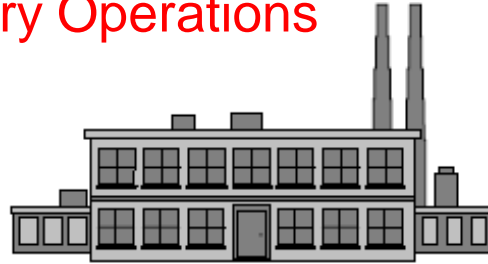
- SPC/SQC
- DOE
- Supplier Quality
- Queuing Theory
- Six Sigma

Transportation



- Logistics Planning
- Material Handling

Factory Operations



- Production Simulation
- Theory of Constraints
- Systems Integration
- Safety Management
- Linear Programming
- Lean Manufacturing

Training



Project Management



- Resource Planning
- Risk Analysis
- Project Scheduling

Inventory



- Inventory Management
- Supplier Selection
- Material Requirements Planning
- Supply Chain Management

IEs work in many types of industries

- Aluminum & Steel
- Banking
- Construction
- Consulting
- Electronics Assembly
- Energy
- Entertainment
- Forestry
- Insurance
- Materials Testing
- Medical Services
- Military
- Oil & Gas
- Plastics & Forming
- Retail
- Shipbuilding
- State & Federal Government
- Transportation



Some techniques utilized by IEs

- Benchmarking
- Design of Experiments
- Employee Involvement
- Equipment Utilization
- Flow Diagramming
- Information & Data Flow Diagramming
- Interviewing for Information
- Lean Manufacturing
- Modelling & Testing
- Operations Auditing
- Organizational Analysis
- Pilot Programs
- Plant & Equipment Layout
- Project Management
- Simulation
- Six Sigma projects
- Statistical Analysis
- Strategic Planning
- Theory of Constraints
- Time Studies
- Work Sampling

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Ivica Veza: Curriculum vitae

- Professor in fields of Production Management, Production Systems, Plant Layout and Logistic,
- Specialization at Fraunhofer Institutes - IPA Stuttgart, IPK Berlin, RTWH Aachen – three years
- Published 6 books, 20 papers in journal and over 100 articles on domestic and foreign symposiums,
- Worked 3 years in Shipyard Split and development director in Jugoplastika Footwear Split
- Secretary of Mechanical Engineering and Naval Architecture department of Croatian Academy of Engineering
- Counselor of the president of Split-Dalmatian County for economy
- Management member of the Technology center Split
- Head of the Technology Platform of Croatia www.manufuture.org
- Head of the Shipbuilding cluster of the Split-Dalmatian County...

Training

- 1983/84, 1988, 1994 Fraunhofer – Institut für Produktionstechnik und Automatisierung IPA (Prof. Hans-Jürgen Warnecke), Stuttgart
 - 1989 Werkzeugmaschinenlabor der RWTH Aachen (Prof. Walter Eversheim), Aachen
 - 1990/1991 Fraunhofer – Institut für Produktionsanlagen und Konstruktionstechnik IPK (Prof. Günter Spur), Berlin
-

Books

1. Veža, I.; Rabe, M.; Wang, Y.: *Rechnerunterstützte Montageablaufplanung. Computer Aided Assembly Planning*, Scientific Series of the International Bureau, Volumen 11, Forschungszentrum Jülich, 1992.
2. Dulčić, Ž.; Pavić, I.; Rovani, M.; Veža, I. *Production Management*. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Faculty of Economics Split, 2002.
3. Veža, I.; Bilić, B.; Bajić, D. *Plant Layout*. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 2004.
4. Veža, I. *Project Management*. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 2005
5. Balič, J.; Veža, I.; Čuš, F.: *Advanced Production Systems*. Faculty of Mechanical Engineering, Maribor; Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 2006.
6. Balič, J.; Veža, I.; Čuš, F.: *Advanced Production Technology*. Faculty of Mechanical Engineering, Maribor; Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 2007.

Lecturer at Universities

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split

Undergraduate/graduate study:

- ***Production Management***
- ***Plant Layout***
- ***Production Systems***
- ***Logistic***
- ***Production Planning and Control***
- ***Project Management***
- ***Organization***

Doctoral study:

- ***Modelling and Simulation***
 - ***Computer Integrated Manufacturing***
 - ***Production Planning and Control***
-

Lecturer at Universities

School of Economics University Nagoya Japan:

- ***Technology Management (2007)***

University of Dubrovnik:

- ***Computer Integrated Manufacturing,***
- ***Production Planning and Control***

University of Osijek, Faculty of Mechanical Engineering Slavonski Brod:

- ***Project Management***

Faculty of Economics University of Split:

- ***Production Management***
- ***Technology Management***

Guest professor:

- ***University of Maribor, Faculty of Mechanical Engineering***
- ***University of Tuzla, Faculty of Mechanical Engineering***
- ***University of Brno, Technical Faculty***

Technology Management at the University Nagoya Japan

1. Introduction: (1) Globalisation and factory of future
2. Introduction: (2) Manufacturing vision – European Technological Platform
3. Product and Process Development: (1) Rapid Product Development
4. Product and Process Development: (2) Innovation Management
5. Product and Process Development: (3) Simultaneous Engineering
6. Product and Process Development: (4) Mass Customization, Modularisation
7. Modern Organisational Concepts: (1) Lean Production
8. Modern Organisational Concepts: (2) Process Management – Business Process Reengineering
9. Modern Organisational Concepts: (3) Fractal factory
10. Modern Organisational Concepts: (4) Benchmarking
11. Modern Organisational Concepts: (5) Six Sigma (DMAIC – Define, Measure, Analyse, Improve, Control)
12. Modern Organisational Concepts: (6) Kaizen, Kaizen versus Business Process Reengineering
13. Modern Organisational Concepts: (7) Supply Chain Management
14. Modern Organisational Concepts: (8) Network Production
15. Modern Organisational Concepts: (9) Project Management



Croatian projects

- “System analysis and methodology design of flexible manufacturing systems”. Ministry of Science and Technology, Ministry of Science and Technology, 1986-1990.
- “Development of model for simulation of material flow”. Ministry of Science and Technology, 1987.
- "Integration of design and production process (Simultaneous Engineering)", Ministry of Science and Technology, 1991- 1996.
- “Development of innovative production systems", Ministry of Science and Technology, 1996-2002.
- “Modeling of network enterprises”, The Ministry of Science, Education and Sports; 2002-2006.
- “Technologically-organizational optimizing of competence cell”, The Ministry of Science, Education and Sports; 2006-

International projects

- ESPRIT-Project 2202 (CIM-PLATO) "Rechnerunterstützte Montageablaufplanung – [Computer Aided Assembly Planning](#)", FESB - Fraunhofer-IPK, Berlin, (leader Prof. Kai Mertins), 1991
- Fraunhofer-IPA, Stuttgart Project "[Production Planning and Control in Fractal Factories](#)" (leader of project: Ute Mussbach-Winter, B.Sc.), 1994
- Fraunhofer-IPA, Stuttgart "[Production Planning and Control in Shipbuilding](#)" (leader of project: Gerd Aupperle, B.Sc.), 1998
- Croatia-Slovenia Cooperation in Science and Technology, Project: "[Cooperation Network Modeling of SME at Regional Level](#)", FESB, Split - Faculty of Mechanical Engineering, Maribor, 2004-2005
- „[Inovations in Manufacturing](#)", Fraunhofer-Institut für Systemtechnik und Innovationsforschung, Karlsruhe, 2003-2005, 2006-
- CEEPUS network CZ-0103 "[The teaching, development and application of modern methods in Technical Cybernetics](#)". (Faculty of Mechanical Engineering Maribor, Technical University Brno, Polytechnic Bucharest, Technical University Kosice, Technical University Bratislava), 2004-2005
- "Croatia-Slovenia Cooperation in Science and Technology, Project – [Networking and Modeling of Evolutional Capabilities of SME](#)" FESB, Split - Faculty of Mechanical Engineering, Maribor, 2009-2010.
- TEMPUS ETF-JP-00453-2008, [Master Studies and Continuing Education Network in Product Lifecycle Management with Sustainable Production](#) (MAS-PLM), 2009-2011

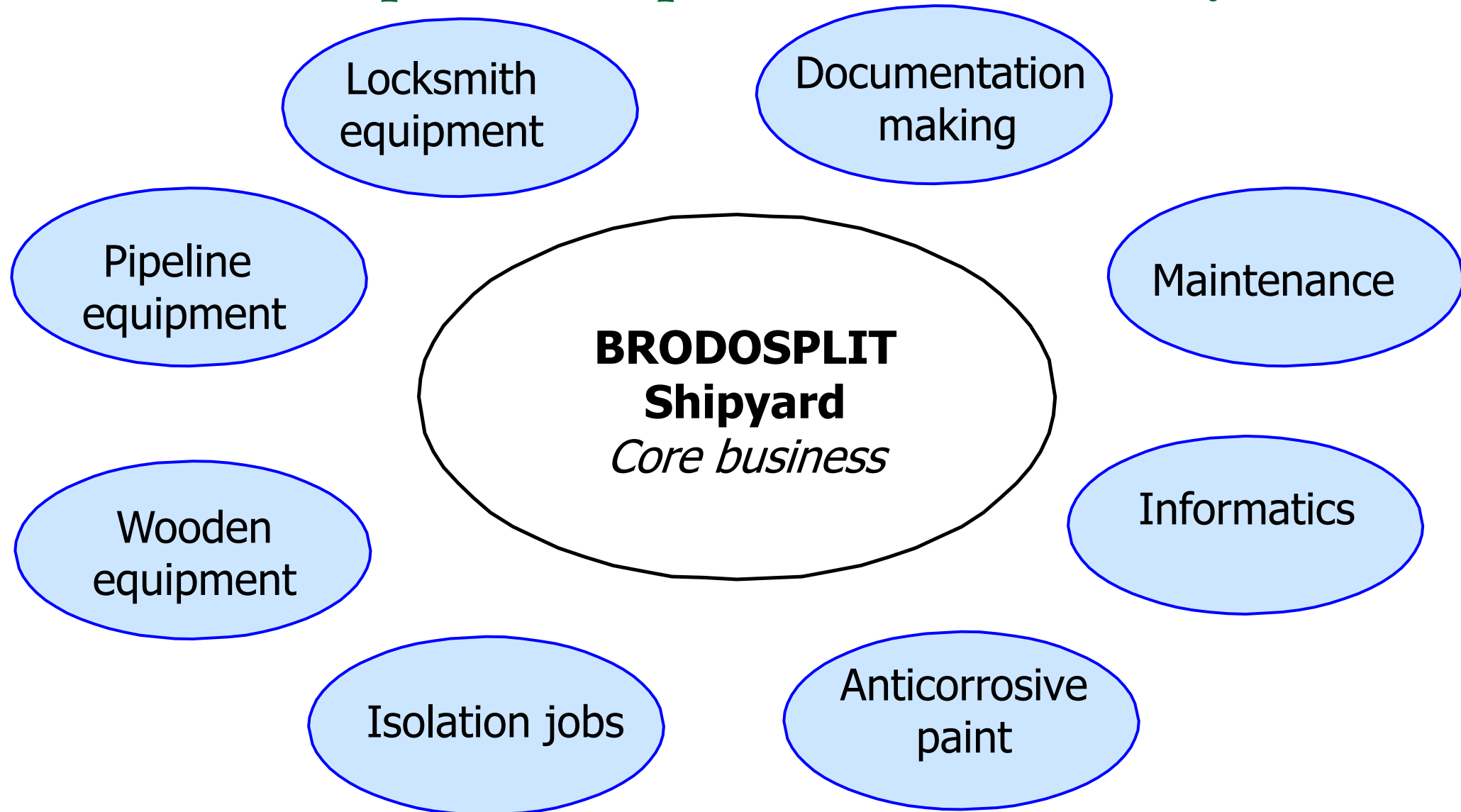
Main industry projects (last 5 years)

- Veža, I.; Dulčić, Ž.; Grčić, B.; Letilović, N.; Markovina, R.: “Concept of Compact Shipyard Brodosplit in Function of SME Development in Split-Dalmatian County”, Split, 2004
- Veža, I. “Dalmatian Technological Platform of Production Processes (manuFuture CRO-Dalmatian)”, 2006.
- Fraunhofer IPA (Wanner, Ch.; Sihn, W.), FESB (Veža, I.): “Organisational and Technology Restructuring of Shipyard Brodotrogir”, Rostock, Vienna, Split, 2007.
- Juraga, I.; Štefanić, N.; Šercer, M.; Udiljak, T.; Veža, I.: “With Cluster to Competitive Products”, Zagreb, 2008.



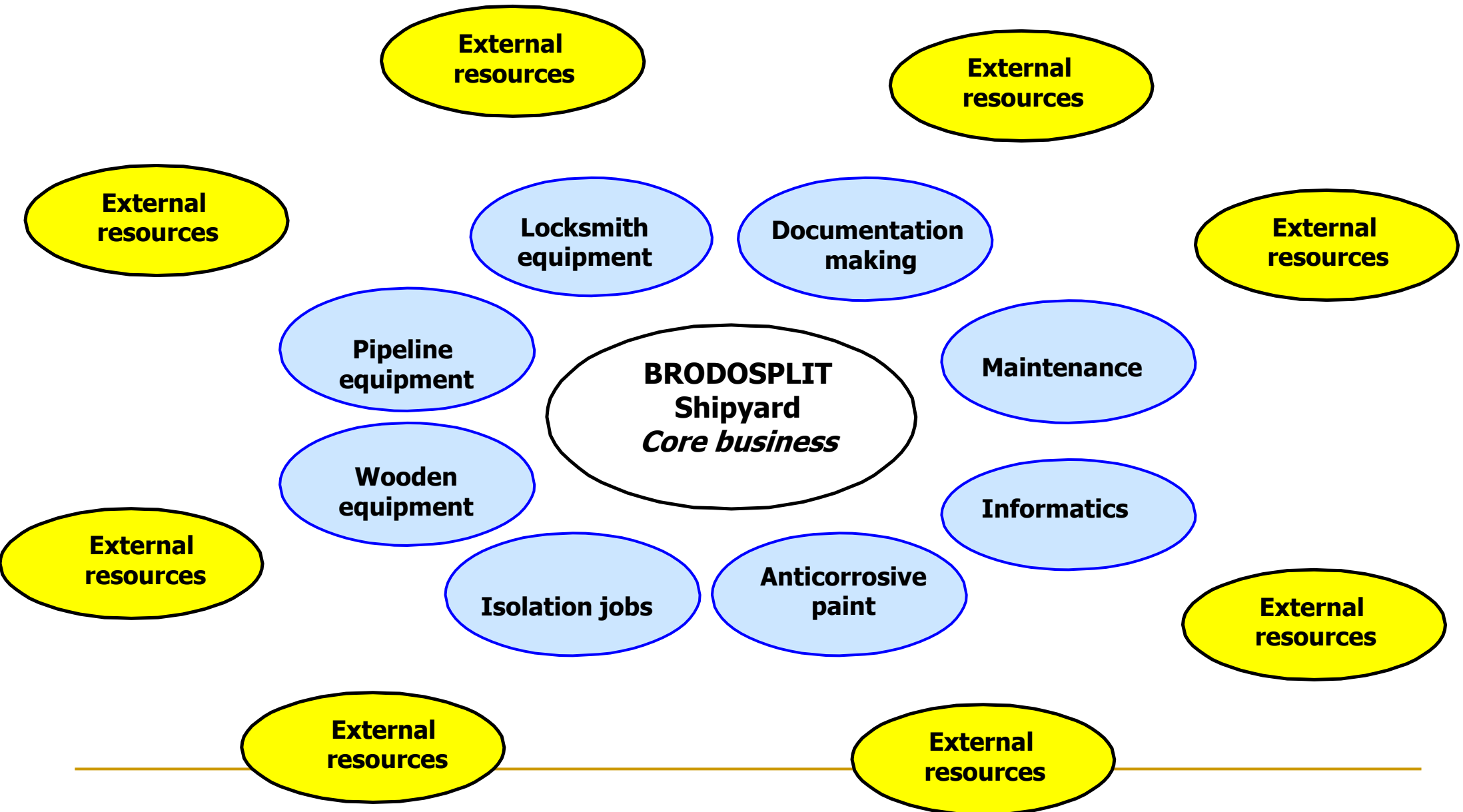
Founded 1922

Concept of Compact Shipyard Brodosplit in Function of SME Development in Split-Dalmatian County



Basic activities suggestion within the modular shipyard Brodosplit, and small and medium-sized companies

Brodosplit-Shipyard relation concept with external resources



Dalmatian Technological Platform of Production Processes (ManuFuture CRO-Dalmatian) www.manufuture.com

The objectives are as follows:

- development of the domestic strategy and core competencies,
- increased regional education,
- development of new products and services with higher VAT in the companies (introduce innovative production methods and technologies),
- technological and organisational reengineering and restructure of existing companies,
- regional networking and integration,
- improving cooperation within Supply Chain,
- development of networking procedures with other regions (in Croatia and around),
- development of networks of innovation (networking between research institutes),
- development of small and medium entrepreneurship,
- to prepare the Croatia organisations for 7 FP,
- to create modern R&D infrastructure: Regional Technological Parks and Centres, Competences Network Centres etc.



- 6 big companies including: Shipyard Split, Shipyard Trogir, AD Plastic, TLM Šibenik,
- 3 universities and 3 high schools,
- Automotive Parts Producers (4 companies),
- Association of Aluminium Production (8 companies),
- Machine Tools Producers (3 companies),
- Shipbuilding Cluster (2 big and about 50 SME)



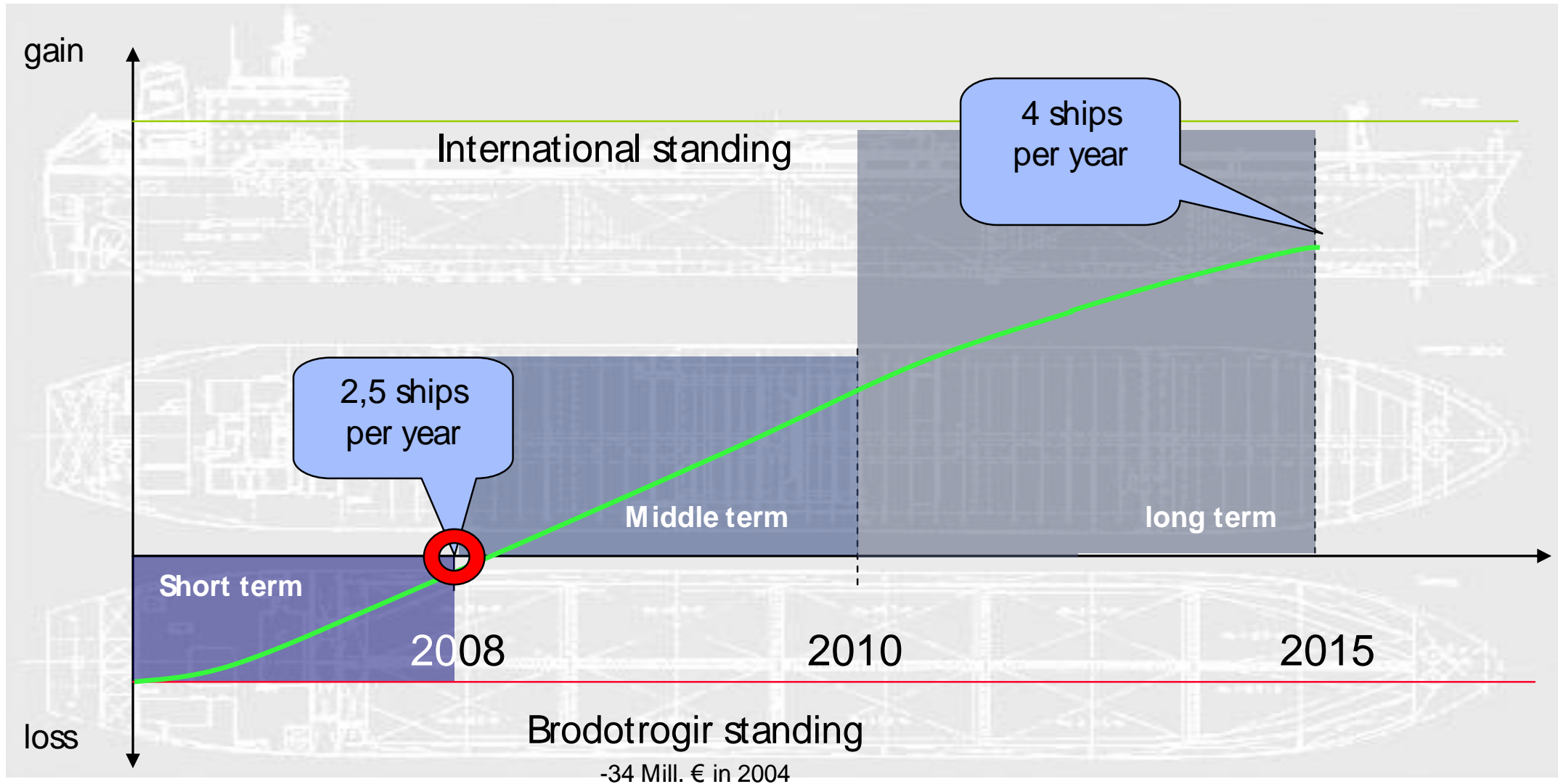
**Trogir
Shipyard**



Founded 1944

Project requirements for Brodotrogir

Definition of achievable project results



→ The minimum aim for Brodotrogir is to produce 4 ships per year in one shift

Project requirements

Applied methods

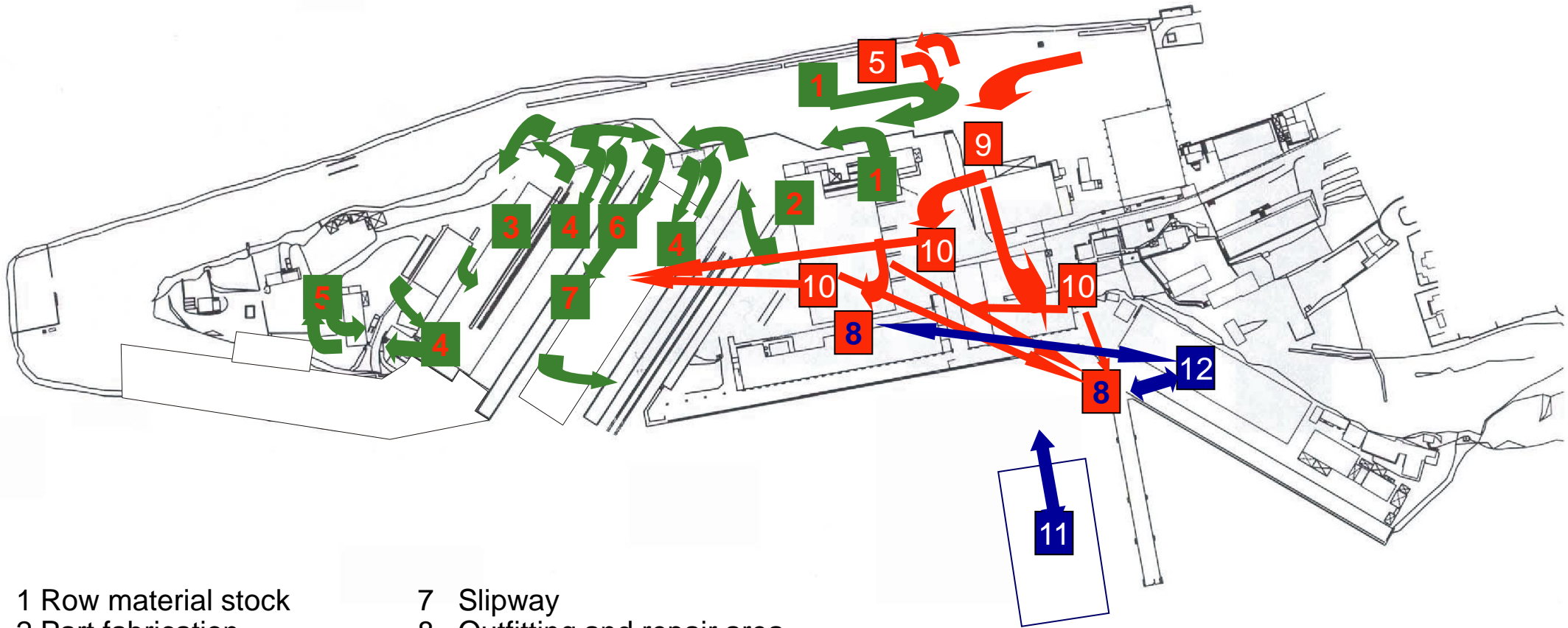
Analysis Fields	Description	Applied method for the analysing phase					
		Simulation	Input-Output relation	Benchmark	Planning table	Value Stream	Questionnaire
1	Analysis applying lean principles					x	
2	Analysis bottlenecks / improvable processes		x				(x)
3	Analysis crane capacity and technology	x	x				(x)
4	Analysis communication and information flow					x	
5	Analysis core competencies						x
6	Analysis Micro Panel Line		x	x			
7	Analysis organization of work		x				(x)
8	Analysis outfitting performance		x	x			
9	Analysis of payment methods			x			
10	Analysis process orientation					x	
11	Analysis second slipway	x	x				
12	Analysis spatial structures and flow				x		
13	Analysis welding speed and quality			x			
14	Analysis of new outfitting place					x	

14 analysis fields will be analysed with the methods:

- Shop floor simulation
- Input-output relation
- Benchmark
- Planning Table
- Value stream
- Questionnaire

Analysis of functional and spatial structures

Planning table: Analysis – *spatial structures and flow*

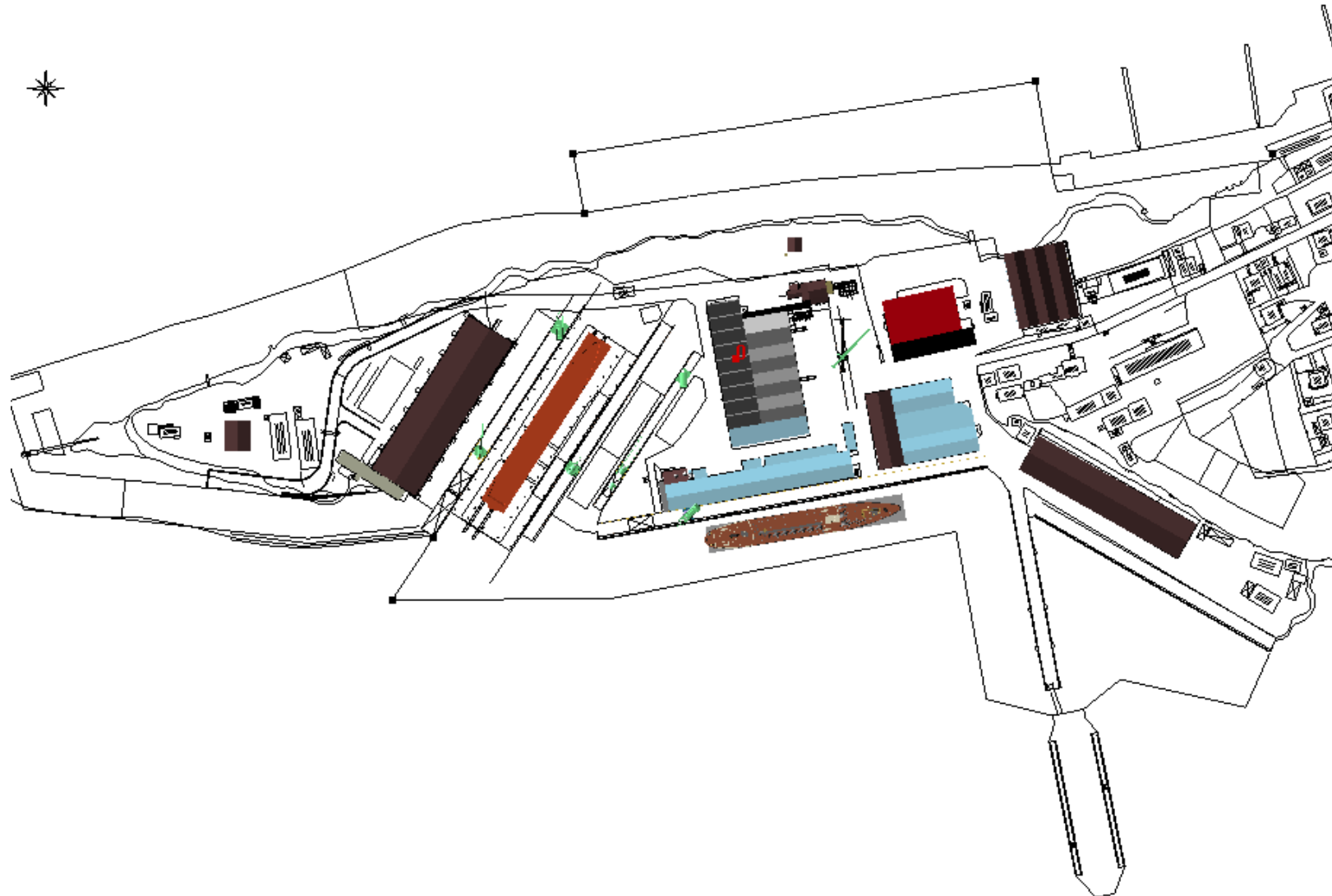


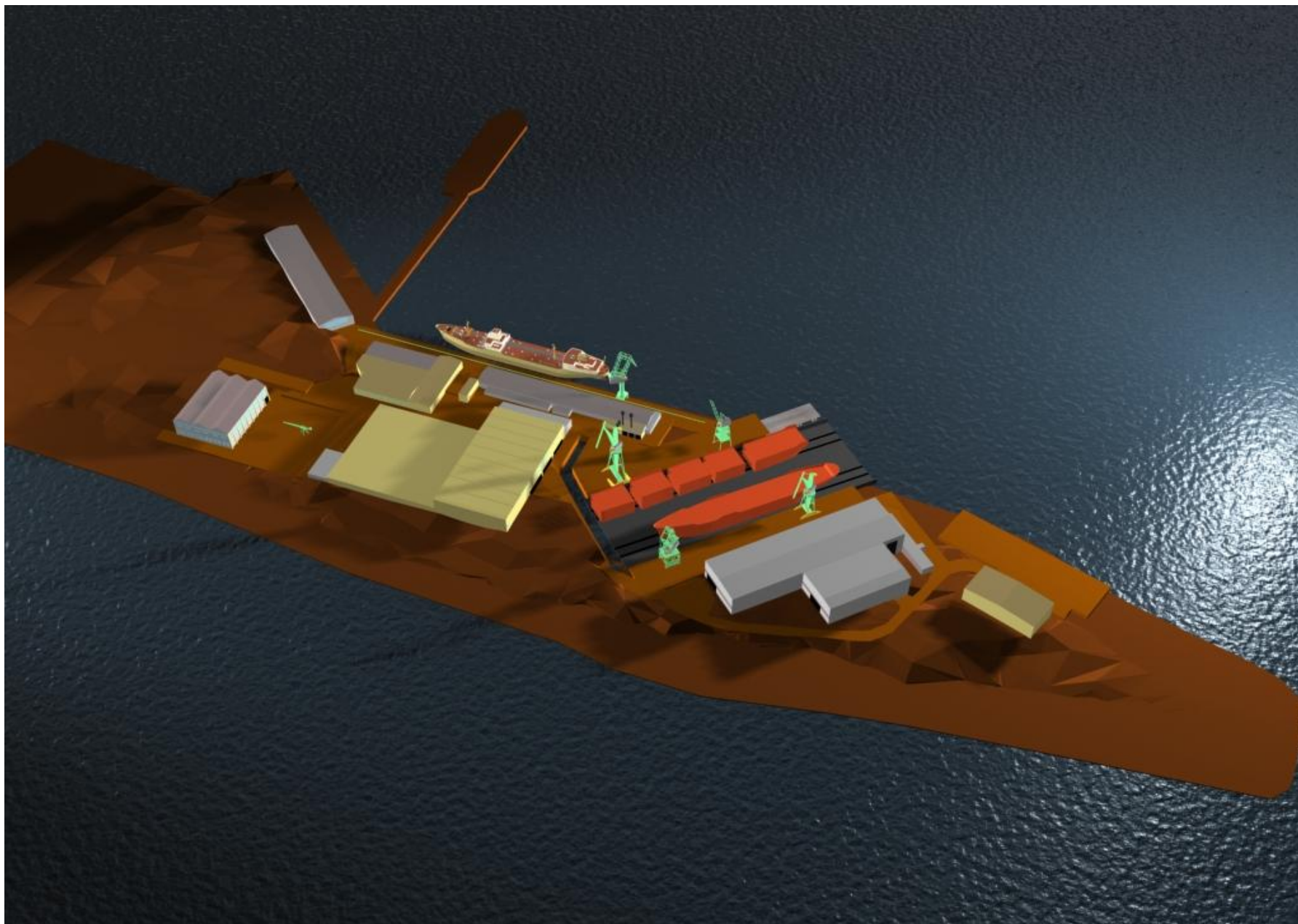
- 1 Raw material stock
- 2 Part fabrication
- 3 Panel fabrication
- 4 Section assembly
- 5 Painting
- 6 Final assembly

- 7 Slipway
- 8 Outfitting and repair area
- 9 Warehouse of equipment
- 10 Pipe fabrication, ventilation, electrical
- 11 Dock for ship repair
- 12 Ship repair division

Analysis of functional and spatial structures

Planning table: Actual state – *spatial structures and flow*

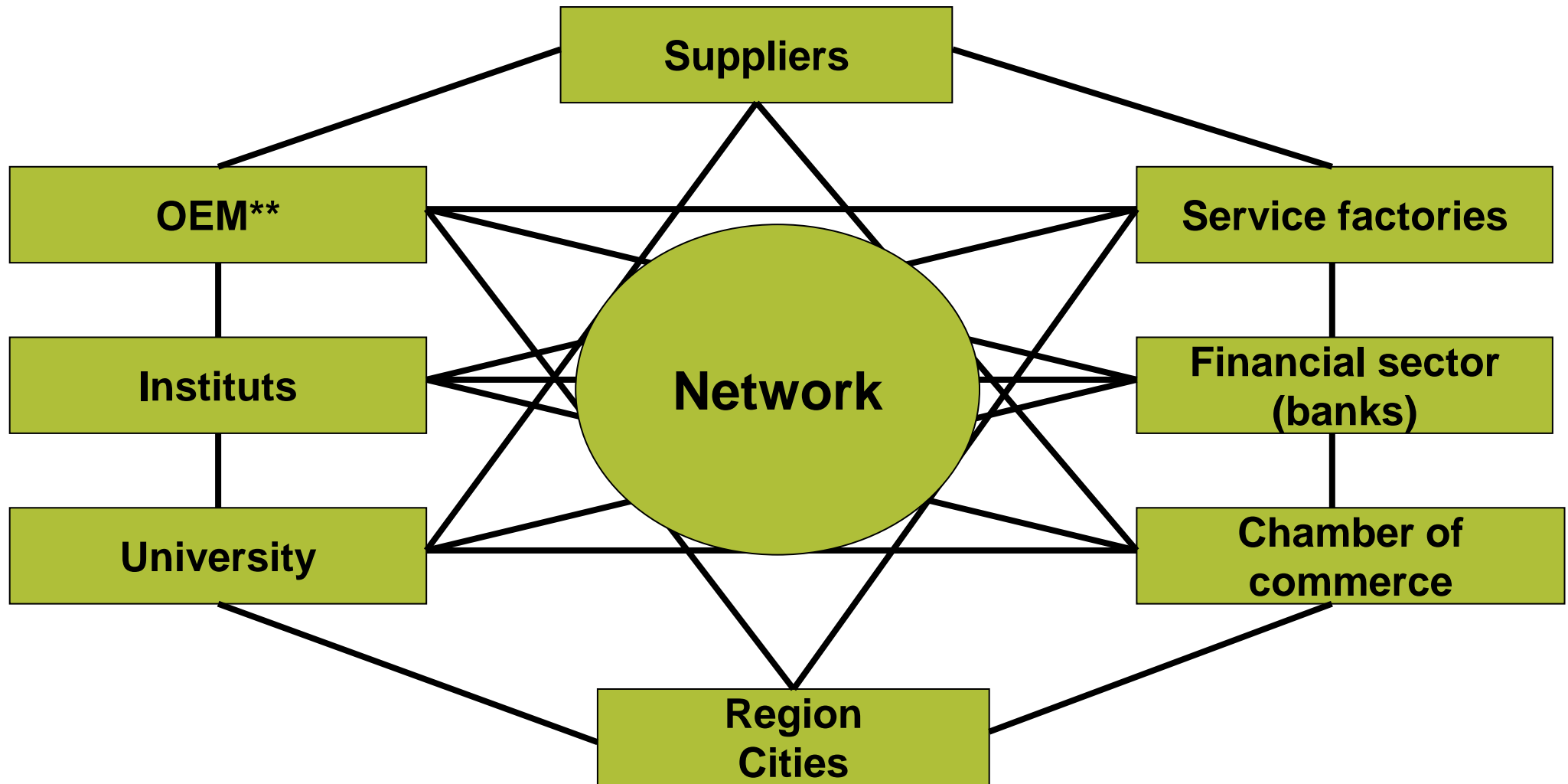






- **Movie**

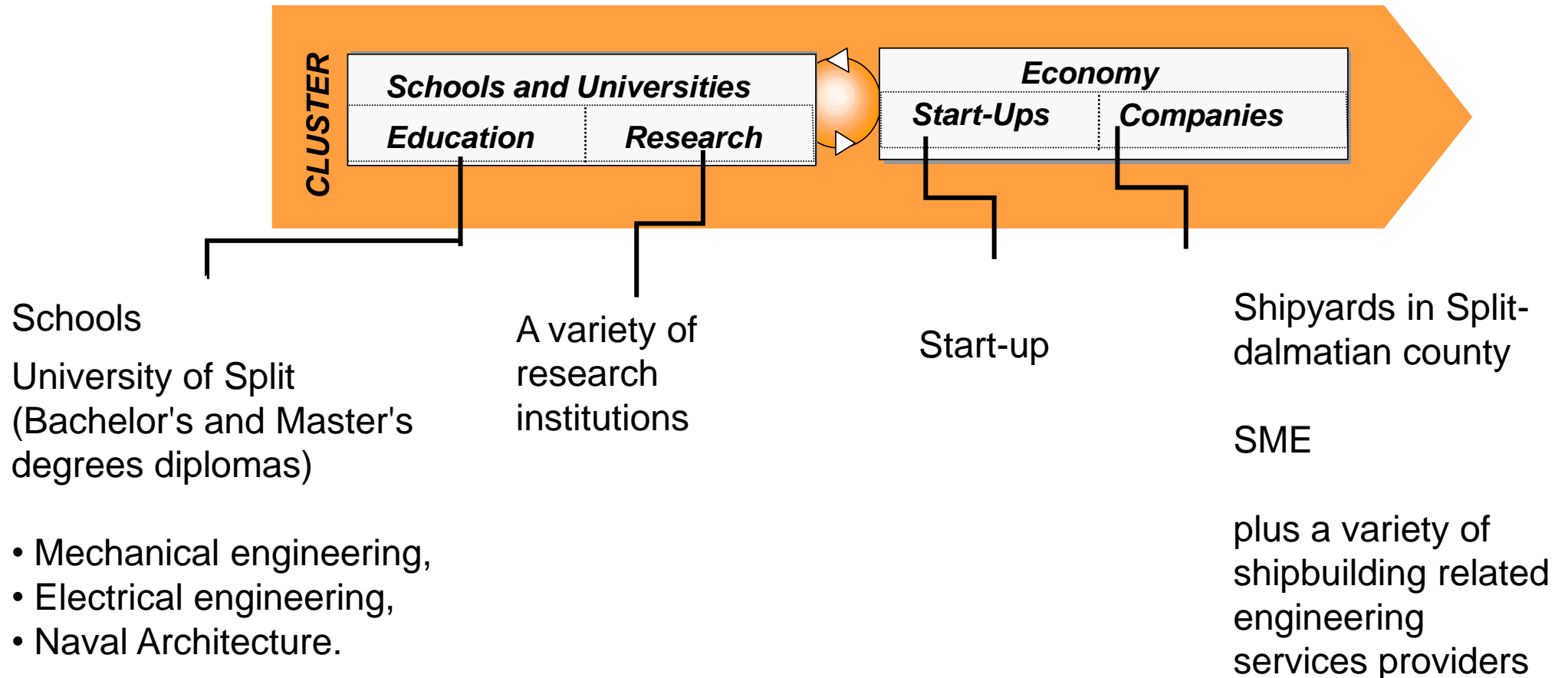
Cluster Model*



*Author: Veža

** OEM – Original Equipment Manufacturing

Cluster shipbuilding



Agenda

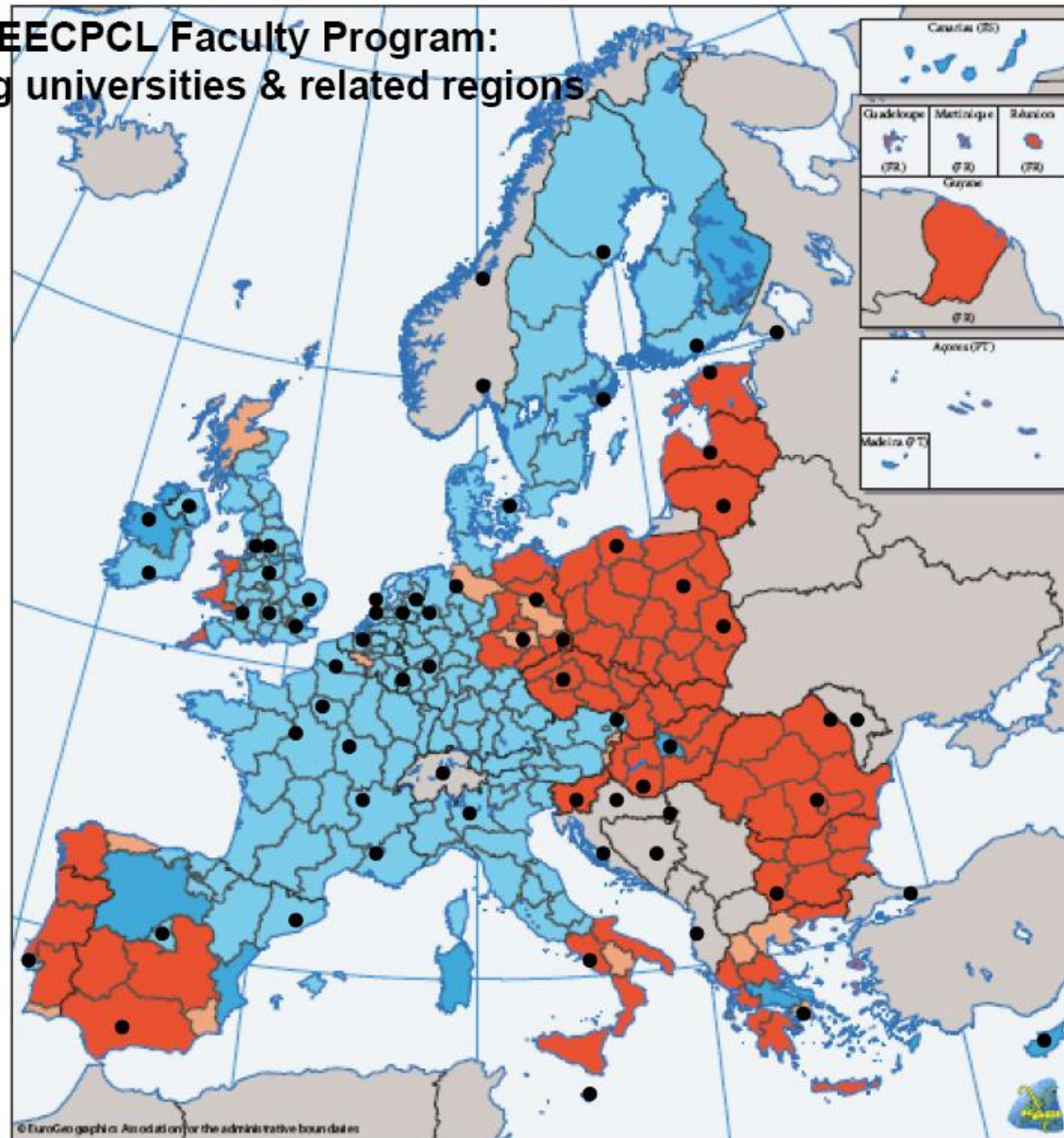
1. Split-Dalmatian County
 2. City of Split
 3. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
 4. Department and Study of Industrial Engineering
 5. Research and Development Projects
 6. Future of Industrial Engineering
-

Where is the future for Industrial Engineers? (1)

- Computers and the internet will continue to impact all engineering fields, including **Industrial Engineering Education**
- Industrial Engineering education could be spread between universities and institutes of different regions and countries

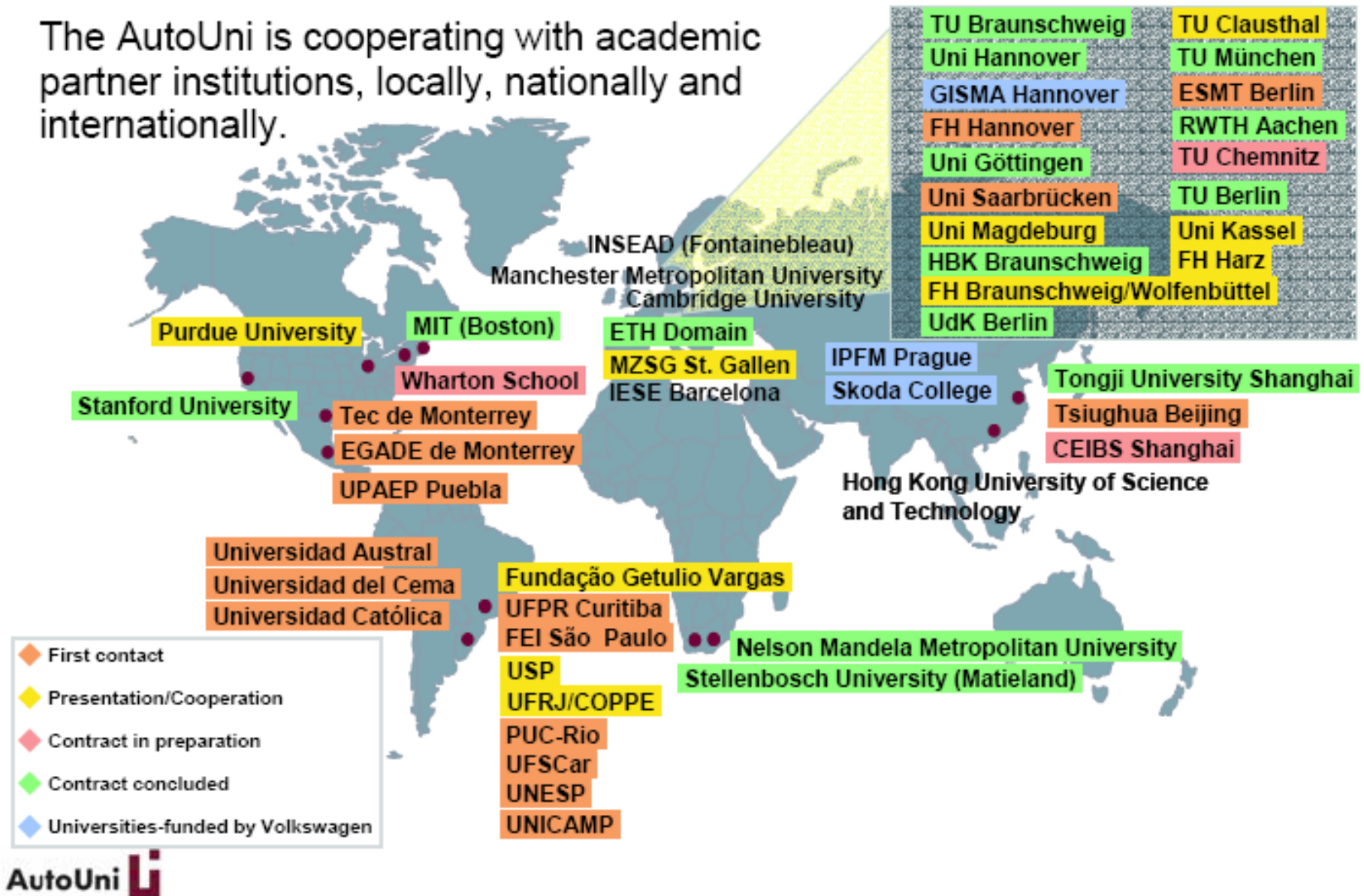
European Foundation for Entrepreneurship Research (EFER) and Entrepreneurship in Highe Education

EFER/ HBS EECPL Faculty Program:
Participating universities & related regions



AutoUni

The AutoUni is cooperating with academic partner institutions, locally, nationally and internationally.



Where is the future for Industrial Engineers? (2)

- Artificial Intelligence (AI) will combine with Robotics to create much smarter machines

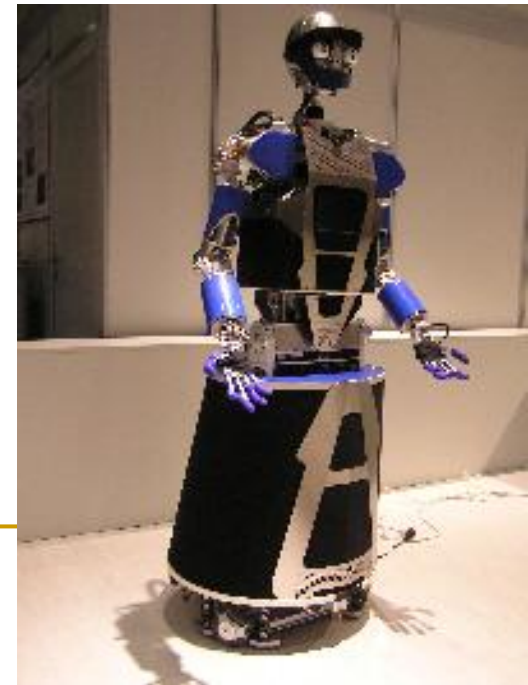
The Mars Rover



Robocup



March 13, 2004 - A DARPA Grand Challenge:
an unmanned off road race, 142 miles from Barstow to Las Vegas



Where is the future for Industrial Engineers? (3)

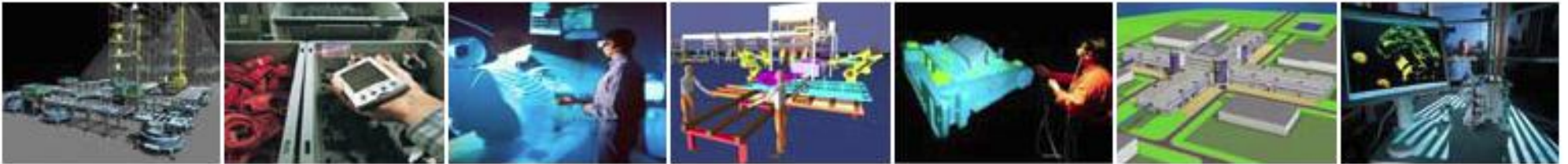
- Industrial Engineering will continue to shift towards the **service sector & consulting** and away from traditional manufacturing

The service must be obtained in the following sectors

1. Legal services
2. Accounting and bookkeeping
3. Taxation advisory services
4. Architectural services, urban planning
5. Engineering services, integrated engineering services
6. Computer and related services
7. Research and development services
8. Advertising
9. Management consulting services
10. Services related to management services
11. Technical testing and analysis services
12. Related and technical consulting services
13. Maintenance & repair of equipment in after sales of after-lease services contracts
14. Translation services
15. Construction services
16. Site investigation work
17. Higher education services
18. Environmental services
19. Travel agencies & tour operator services
20. Entertainment services
21. Services related to the sale of equipment or to the assignment of a patent

Where is the future for Industrial Engineers? (4)

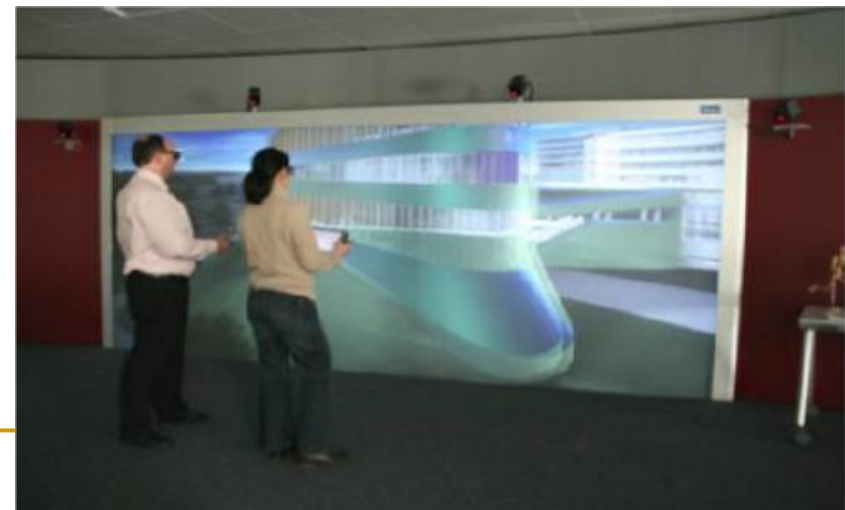
- **Virtual Reality** and **Digital Factory** will continue to integrate into design applications



Virtual Reality and Digital Factory

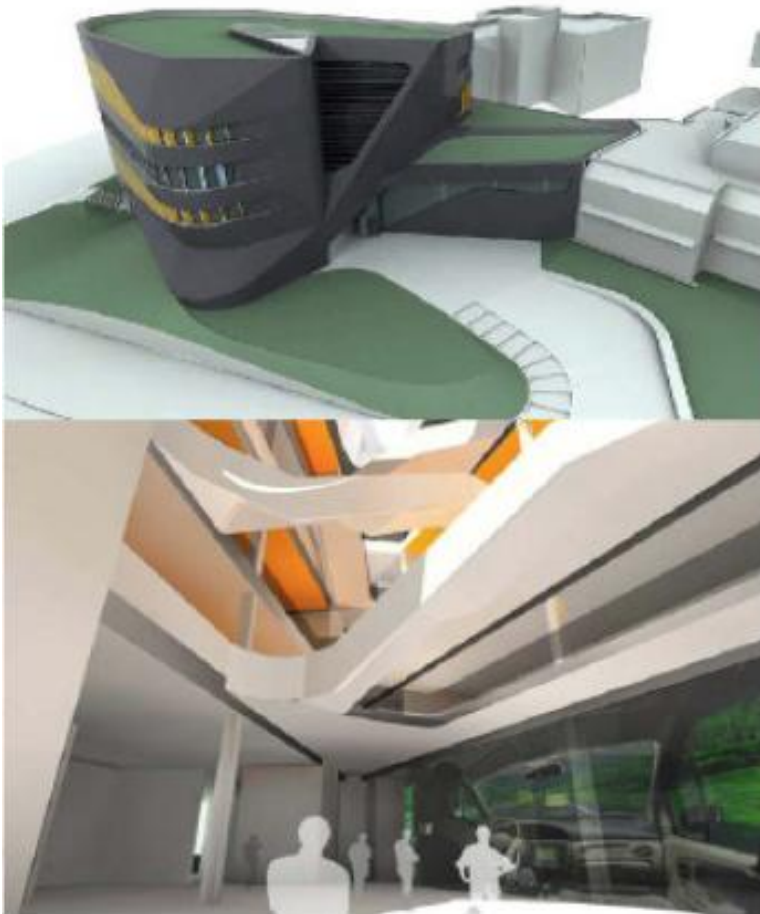
VR Facilities@Fraunhofer

Virtual Development and Training Centre

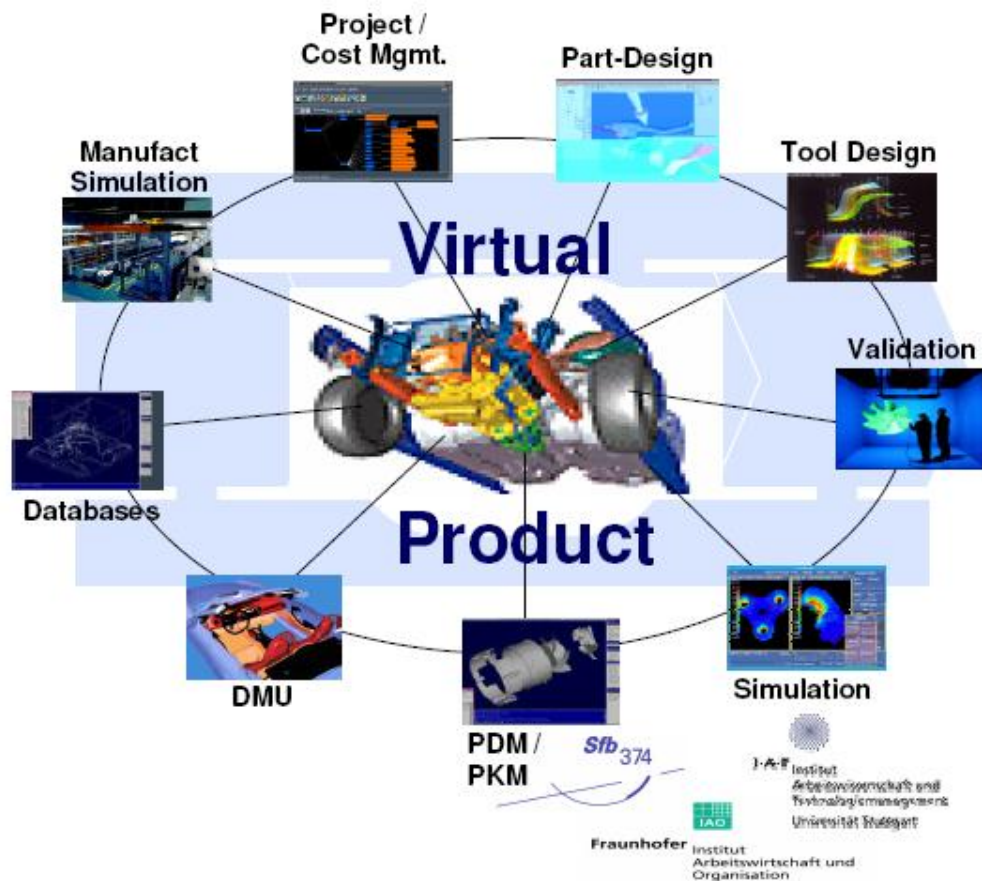


Fraunhofer IFF, Magdeburg

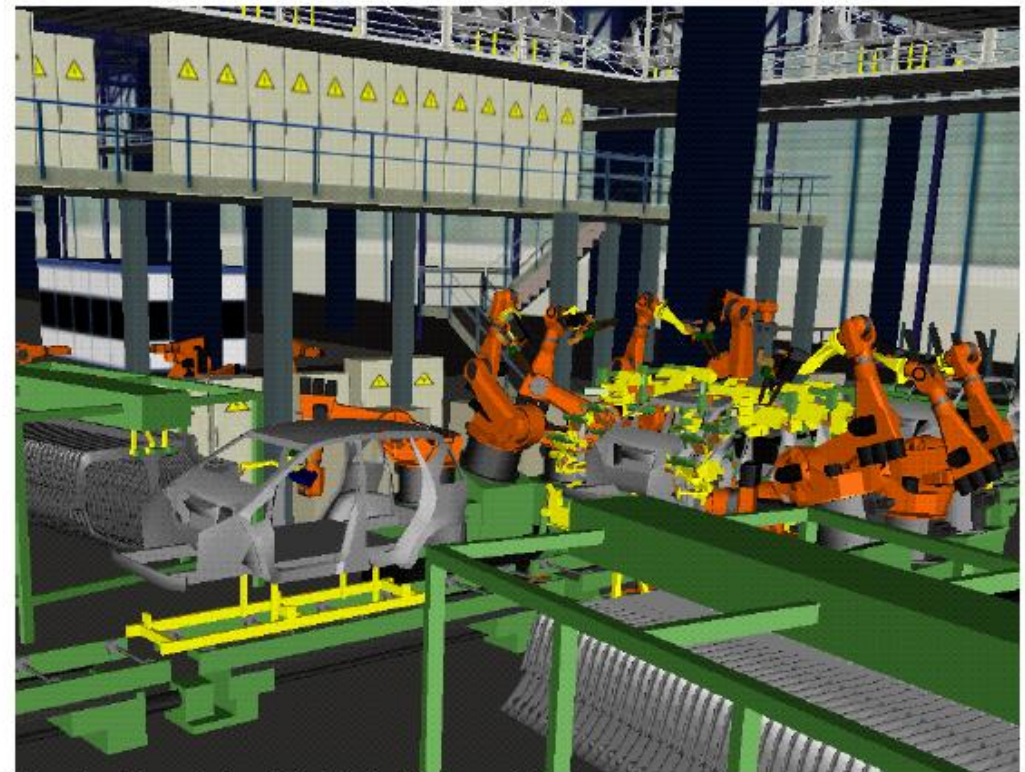
Virtual Reality and Digital Factory



Virtual Reality and Digital Factory



© Fraunhofer IAO Stuttgart



Quelle: Fraunhofer IPA, IAO, Siemens AG

Future of VR



Samsung 3D-TV



PlanarDisplay

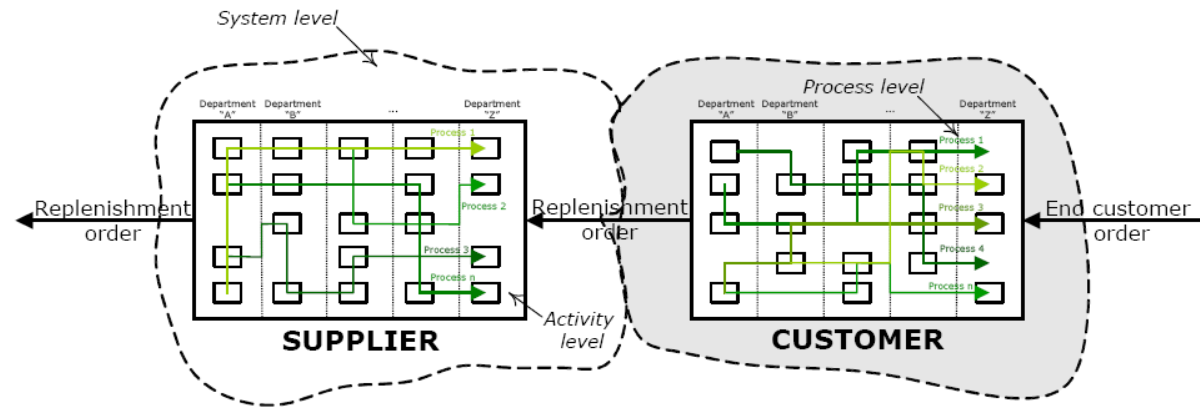


©Tridality

Low-cost VR systems

Where is the future for Industrial Engineers? (5)

- **Networking** is means for cooperation. Cooperation along whole **Supply Chain** and **virtual factories**



Logistic Management



RFID - Radio Frequency Identification



Networking and consolidation have led to a new industry structure



Characteristics

- High degree of added value
- Wide range of services and products
- Large number of individual tools
- Highly complex
- Minimal organization

Craftsmanship

Networking

Consolidation

Key:  Industrial tool-making
 Specialist

→ Consolidation
— Cooperation
X Bankruptcy

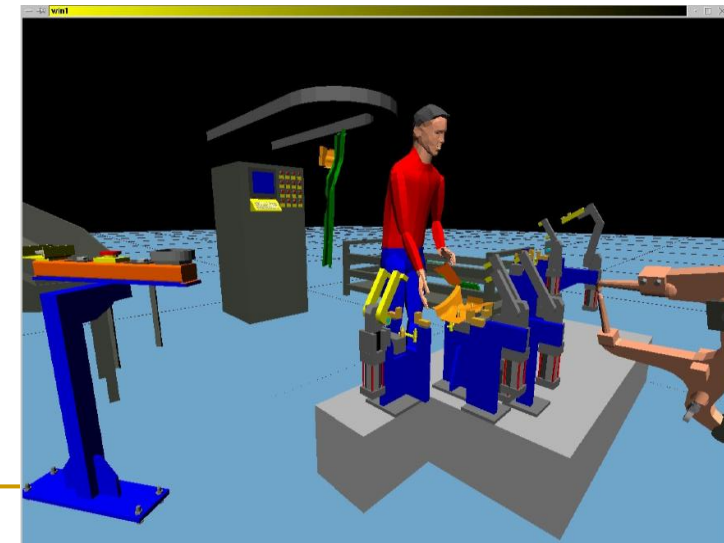
Characteristics

- Focusing
- Use of outsourcing
- Differentiation between standardization and individualization
- Concentration process
- Networking

Network consists of industrial tool-makers and flexible specialists

Where is the future for Industrial Engineers? (6)

- In the future the IE will be using more of the OR techniques coupled with advanced PC based modelling packages to analyze **production and service problems**.
- With the advent of E-Business the companies will need more advanced and accurate techniques of predicting outcomes. These techniques will come from **computer simulation**.
- The modern IE will need to be aware of and able to **use the tools available in IT** as well as the methods of the IE scientist to be successful in this new age.



Thank you for your attention!

