



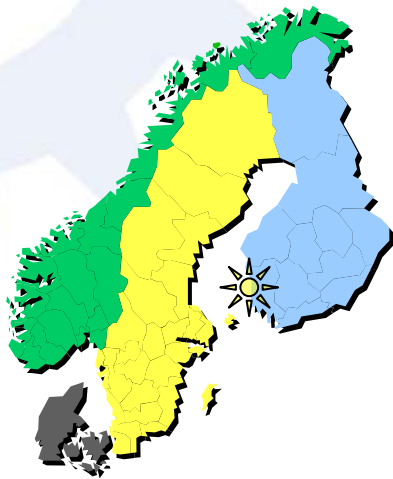
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*Pori*



# Discussion topics in Software Process Improvement (SPI) - Research, Training and University Education

*Professor Hannu Jaakkola,  
Tampere University of Technology,  
Pori*



# Abstract

The aim of the presentation is to **introduce** shortly the activities going on **CoSE** (Center of Software Expertise) Institute, which is a part of the Tampere University of Technology (Pori).

The **university** itself is the second biggest technical university in Finland. It has a satellite faculty in the City of Pori as a part of **University Consortium of Pori**. CoSE Institute covers academic education, industry oriented training and research in the area of software systems. In research the focus of CoSE is in the problems of software development organisations - taking into account the quality and productivity. A special attention is given in the operations of **small software organisations**, which suffer from very much different improvement needs than the bigger ones. In addition, the well managed **growth path** of small software organisations (less than 10 employees) towards the category small / medium size (up to 50 employees) is not well known. There is also reasonable little amount of studies focusing in the problems of offshoring and well managed software processes in a **distributed multi-cultural development organisation**. The presentation introduces the work done by CoSE in the research area described above. The other academic activities of the organisation are introduced shortly, too. After the presentation **discussion** on co-operation activities between Charles University and Tampere University of Technology is possible.

# The Campus



Opposite side  
of the river



(c)

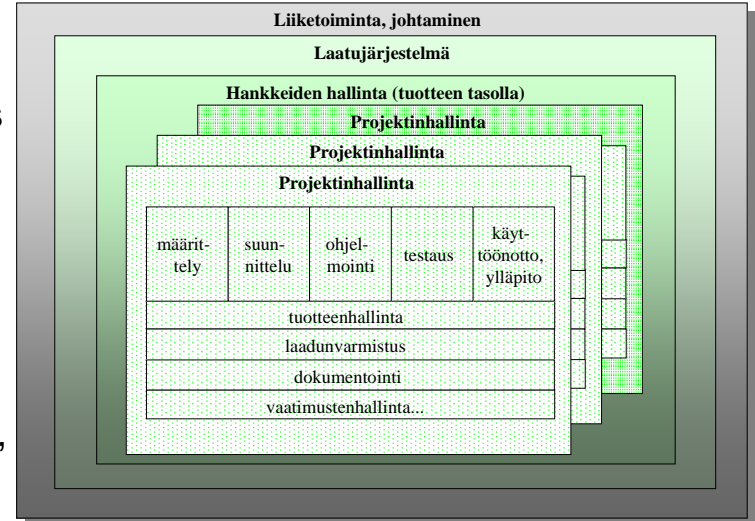
# Professor Hannu Jaakkola

- Education
  - PhD – Tampere University of Technology (electrical engineering)
  - MSc and LicPhil – University of Tampere (computer Science)
  - BSc (Business Economics) – University of Tampere
- Professional experience
  - Lecturer (computer science), University of Tampere
  - Associate professor (computer science), University of Tampere
  - Professor (software systems), Tampere university of technology (TUT)
  - Director, Research institute for information technology , TUT
  - Professor, Software engineering, TUT Pori
  - Director of TUT Pori since 1992-10/2006
  - In addition: some (short) periods industry work, advisor work in industrial development projects
- Professional activities: several, some to mention are
  - Regional development programmes in Pirkanmaa and Satakunta area
  - Industry Management Training, IT Professional Training
  - International networks (conferences, research and development organisations)
  - Over 190 publications (SE, SE education, SPI related topics, Data mining and security, Technology Diffusion, Databases, Regional Technology Policies, ...)



# Professor Hannu Jaakkola

- Professor in SE
- Teaching
  - Requirements Specification and Analysis
  - Software design
  - Software Project
  - PhD level courses (topic varying)
- Research
  - Software Architectures
  - Modelling (Software, Processes)
  - Software Business Analysis – processes,
  - SE Teaching
  - Data Mining
  - (Modelling of Diffusion)
- Hobbies (professional)
  - Management Training (JOKO,MBA)
  - Industry oriented training
- Hobbies (Private)
  - Music
  - Sports for body shape – NON professional





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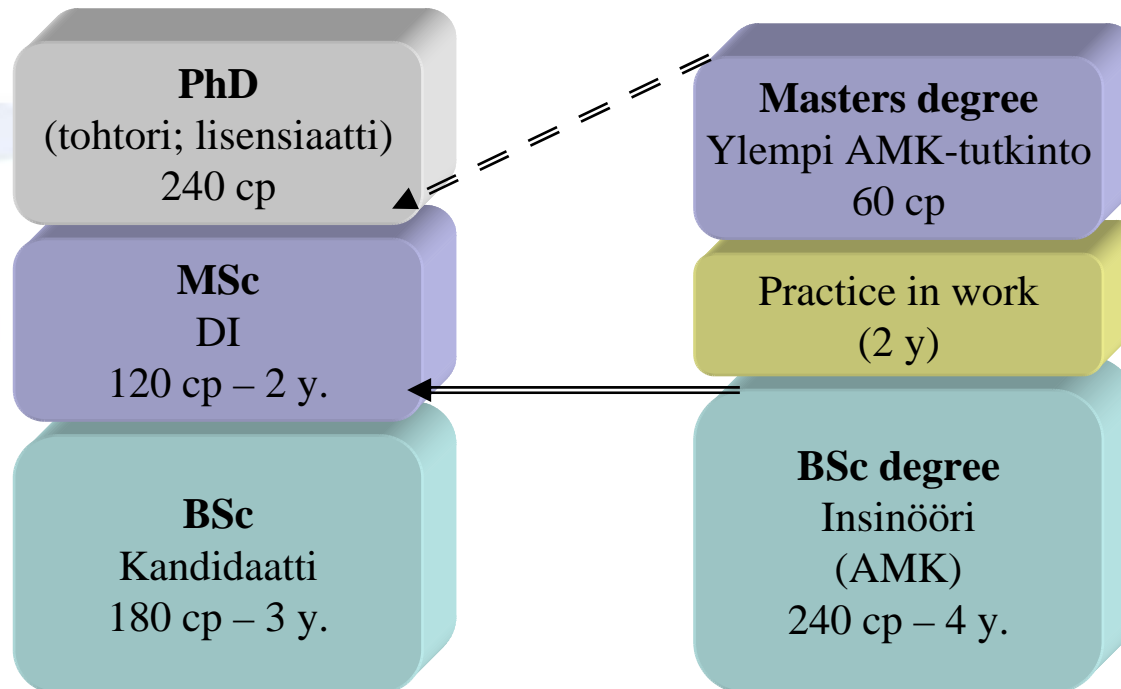
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# Higher education in Finland

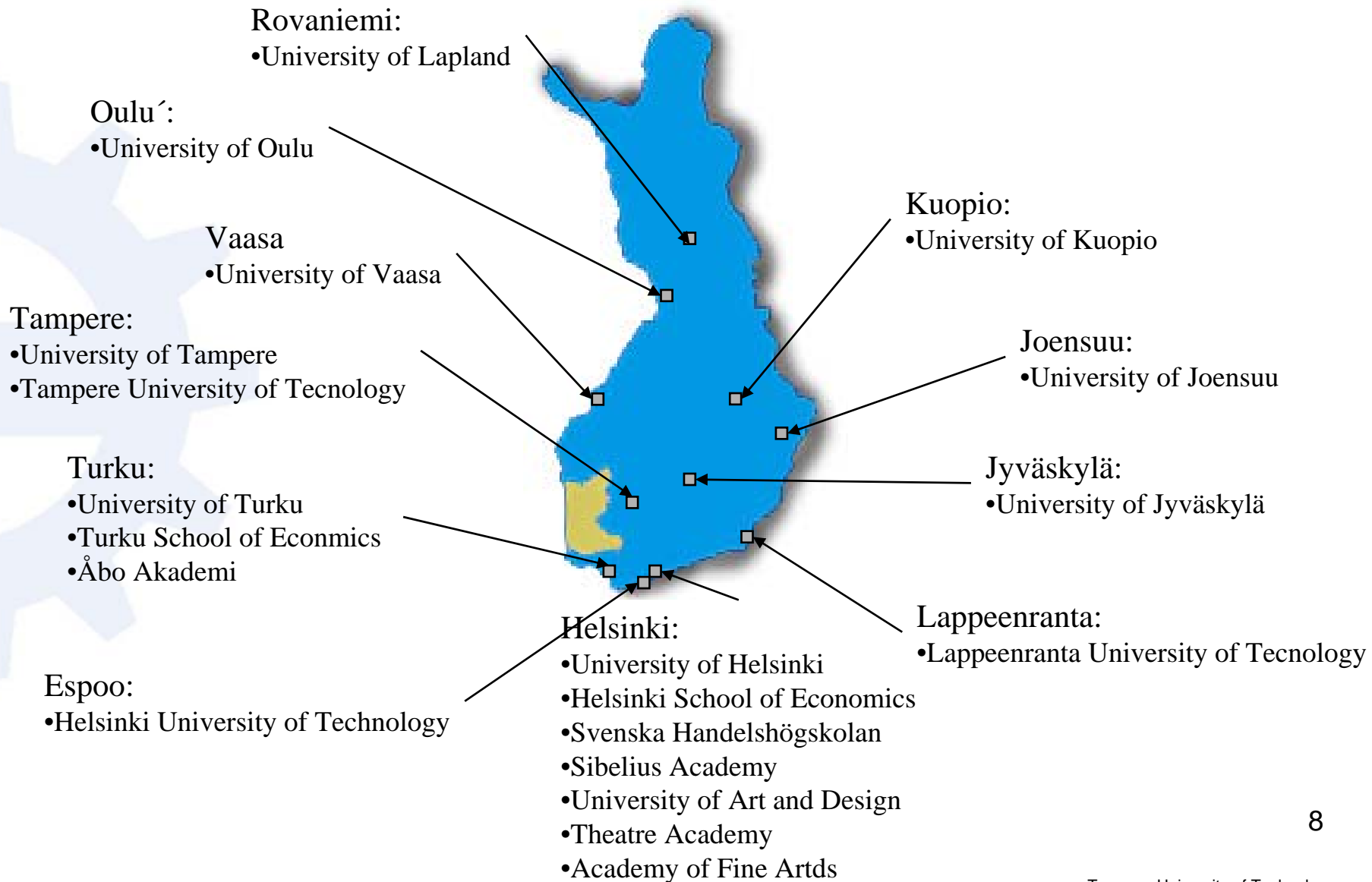
# Higher education in Finland

- Harmonized according to the Bologna model
- Dual model – two separate paths (academic, professional)
- Moving between paths possible (but not primarily recommended)
  - This causes some problems in theory, not much in practice

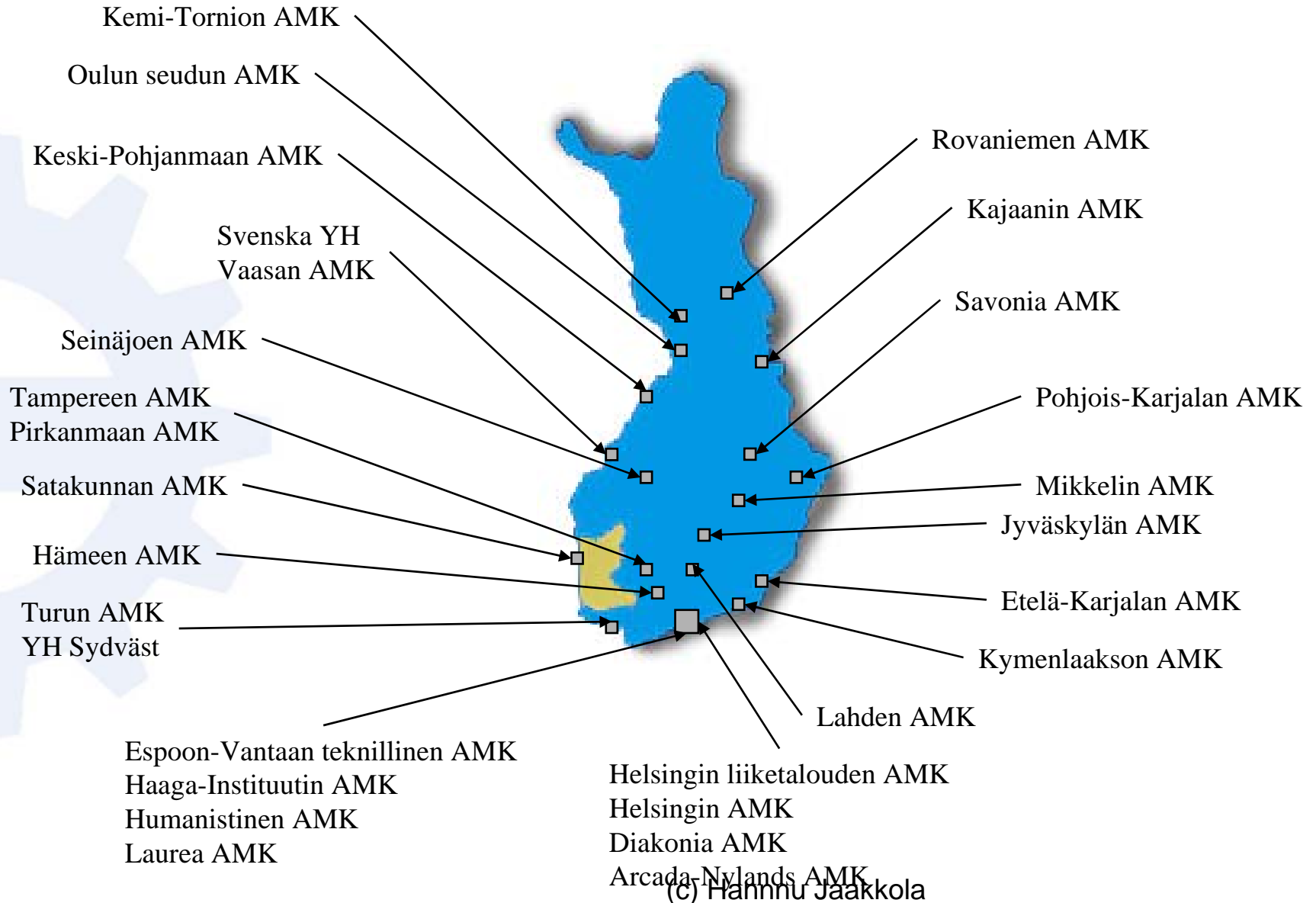


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# Universities in Finland (22)

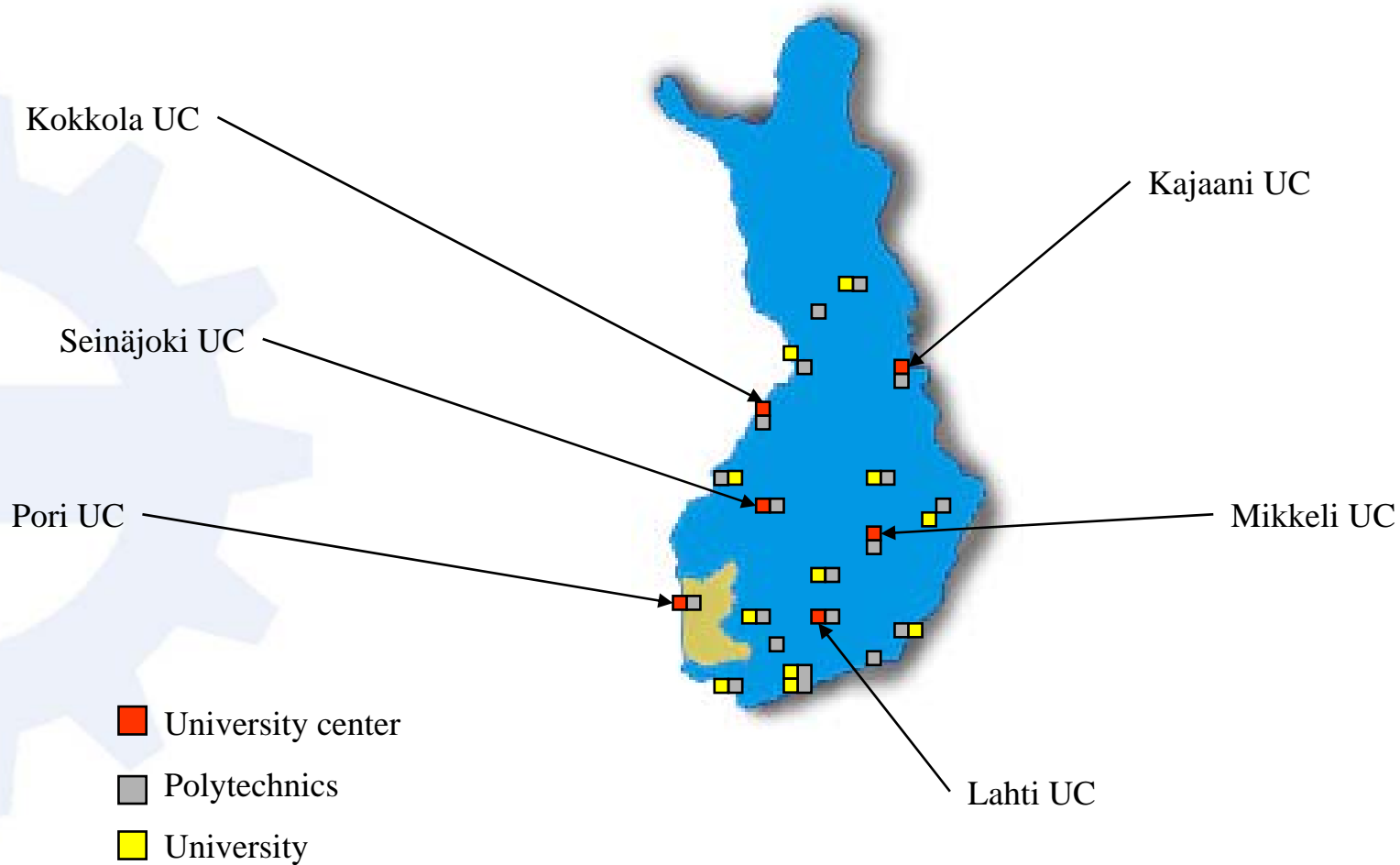


# Polytechnics in Finland (29)



(c) Hannu Jaakkola

# University Consortia in Finland (6)



(c) Hannu Jaakkola

# What is a University Consortium (UC)

- term consolidated in 2001: Ministry of Education, Regional Higher Education Policy Report
  - six UC in Finland (in addition to Pori: Kajaani, Kokkola, Lahti, Mikkeli, Seinäjoki)
- specialized – own profile of parts and the whole
- network concept – independent universities in the region
- synergy and co-operation with a strong Polytechnics in the region
- regional role
  - does not conflict the goal to reach an internationally competitive expertise!!!
  - connecting to the surrounding society (industry, public sector)
- regional demand – positive attitude to improve UC in the region
- flexibility - reactivity

# Re-engineering -> 2020

## Towards bigger units

- Universities from 22 to 12-15
  - Annual intake 17 500
  - Research strategies
  - Towards top level research
  - International
  - Aalto University = HUT+HBS+UoAD
- Polytechnics from 29 to 15-18
  - intake 22 500
  - degree studies in 50 units
  - Polytechnics – industry collaboration
- In addition Strategic Alliances (4-5)
  - Regional view (in its broad interpretation)
  - Response to the industry expectations



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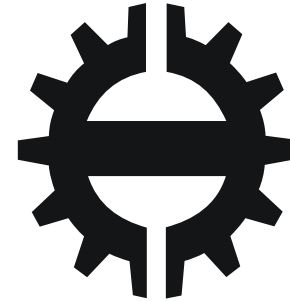
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# Tampere University of Technology

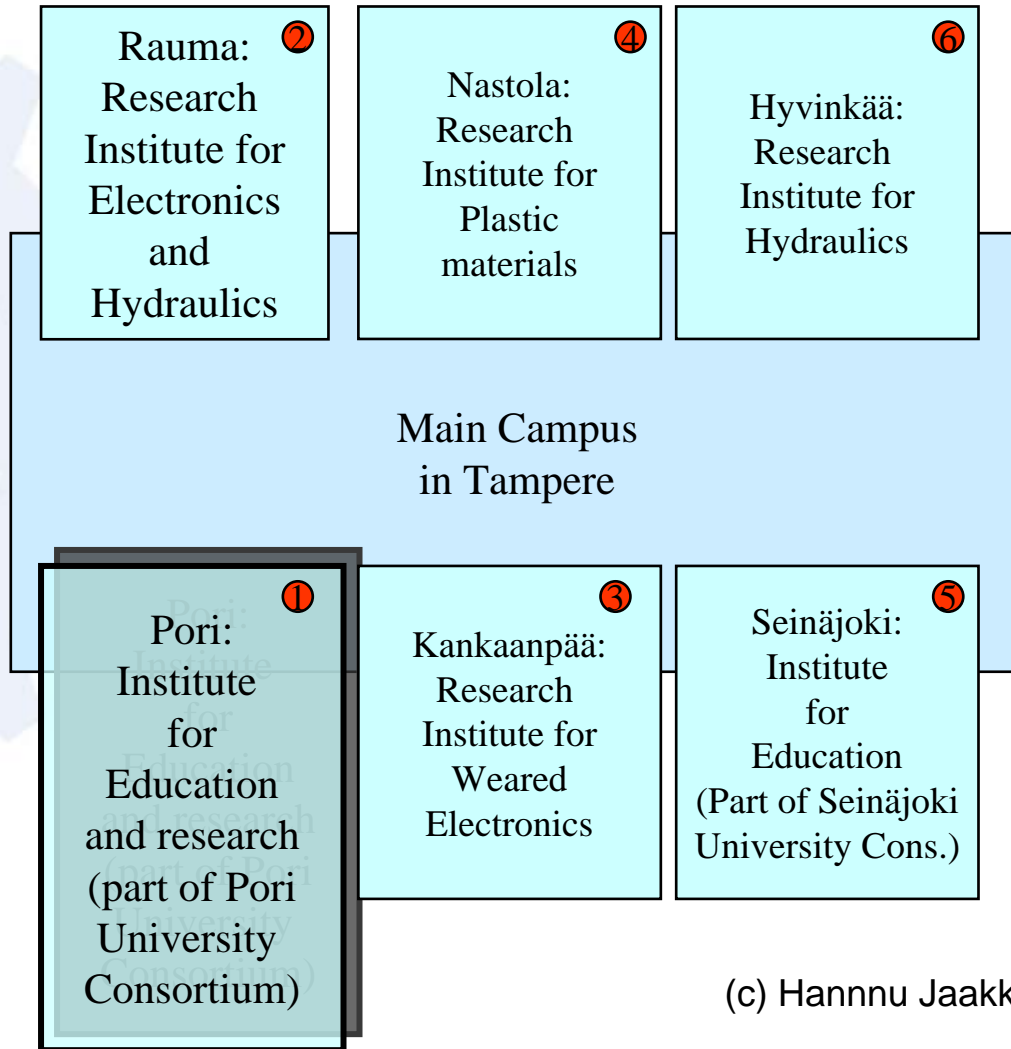
# Tampere University of Technology

- second biggest technical university in Finland (13.000 students)
- profile: international, applied research
- activities in several cities in Finland
- employees appr. 2.000



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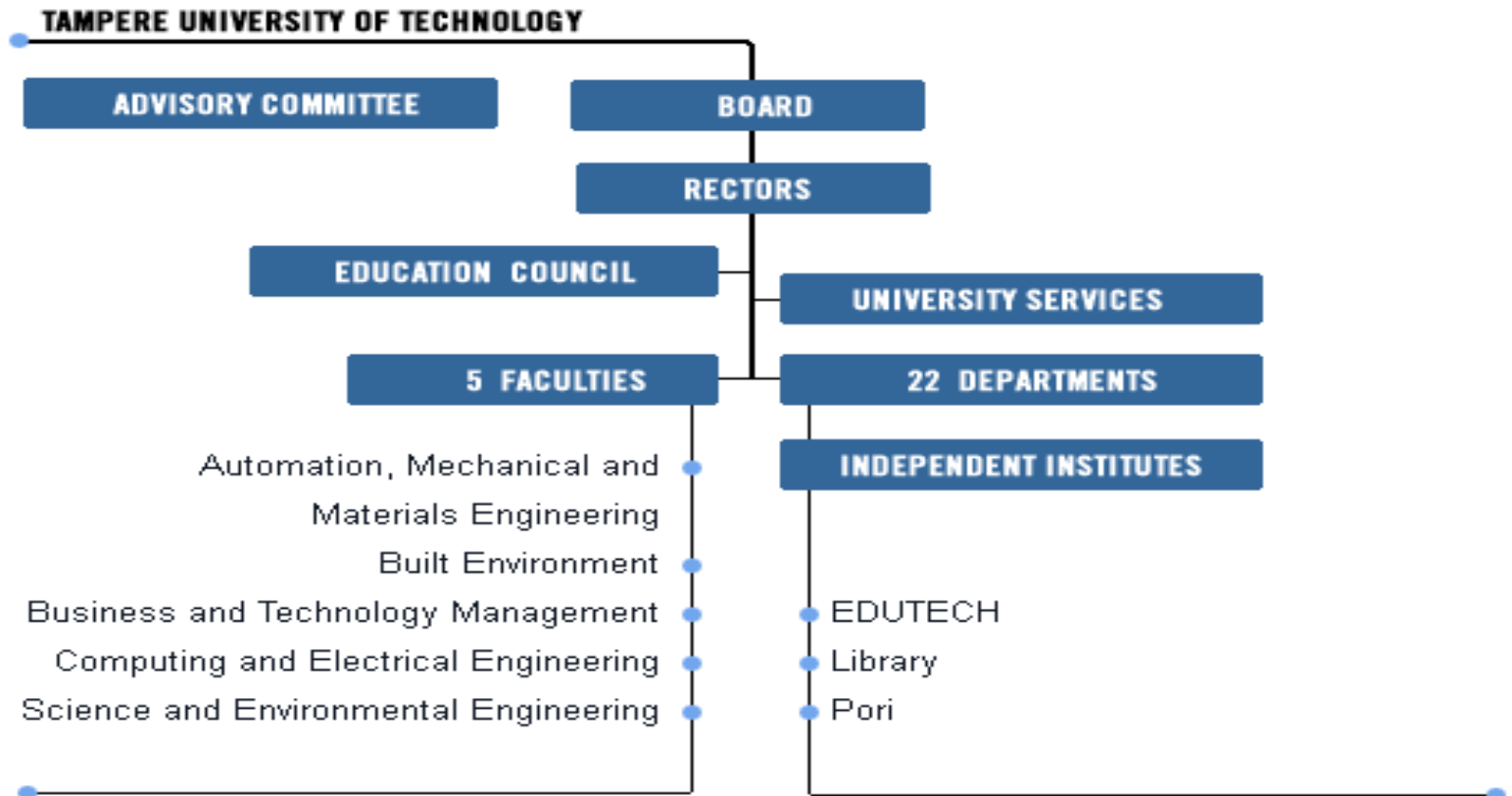
# TUT – Geographical Scope



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# TUT Organization





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# Pori University Consortium

*And TUT Pori*

# Pori University Consortium – topics in focus



- **Tampere University of Technology (technology)**
  - Information technology (software systems, telecommunication, signal processing), Electronics, Industrial Engineering and Management
- **Turku Business School (business)**
  - accounting, marketing, information systems sciences, management and organisation
- **University of Turku (humanistic)**
  - Cultural heritage studies, landscape studies, digital culture
- **University of Tampere (social)**
  - Social policy, sociology, social work
- **University of Art and Design (arts)**
  - Visual culture

## In addition:

- Short sea studies (UTu)
- Medicine (UTu)
- Welfare studies (UTa) (c) Hannu Jaakkola

# TUT Pori

Students appr. 700  
Staff over 80  
Budget appr. 6 MEUR

- **Software systems (prof. Hannu Jaakkola; prof. Jari Multisilta)**
  - Software process improvement – productivity in business,
  - Software engineering methodology,
  - Algorithmic solutions
  - Wireless services and service platforms,
  - Modern learning environments and adaptable user interfaces,
  - Structured documents and semantic web
- **Telecommunication (prof. Pekka Loula)**
  - wide band transmission,
  - IP based open architectures,
  - Security and service quality in telecom,
  - Wireless transmission methods,
  - Telematics in medical applications



<http://www.tut.fi/cose/>

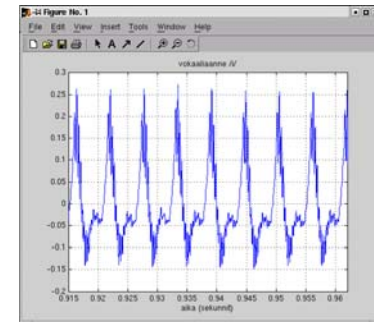


<http://www.tut.fi/amc/>



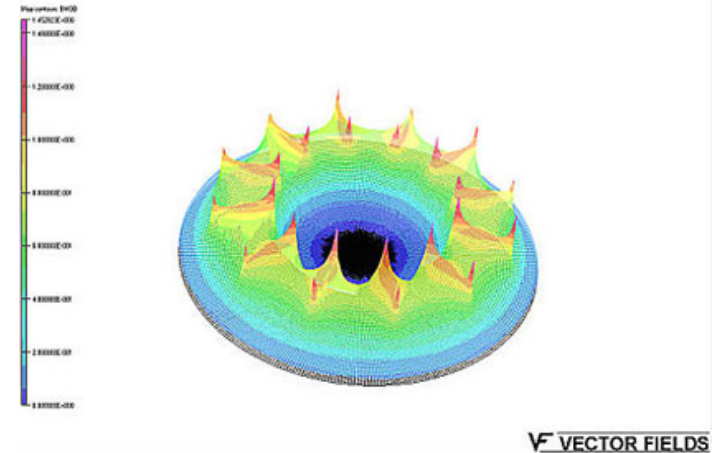
# TUT Pori

- **Elektronics (EMTC; prof. Pekka Ruuskanen)**
  - Materials,
  - Packing technologies,
  - Bonding technologies,
  - Electronics assembly and production.
- **Signal Processing (prof. Tarmo Lipping; prof. Juha Tantt)**
  - Medical signal processing,
  - Image bases,
  - Computer vision,
  - Image processing in environmental analysis,
  - Speech recognition and processing



# TUT Pori

- **Magnet Technology Research Center (Director Martti Paju)**
  - Durable Magnets
  - Supra Conductive materials and magnets
  - Modelling of magnetic phenomena
  - Measuring of Magnetism
- **IEM (prof. Hannu Vanharanta)**
  - Strategic design,
  - Peopleware management,
  - Information systems management,
  - Management information support systems.



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# Ongoing Research Projects at TUT Pori (CoSE excluded)

- AMC
  - Work satisfaction in SE work
  - Mobile Social Media: video applications for entertainment and learning
  - Social media tools in work and learning
- TRC
  - Flexible Network Monitoring for security (FNMS)
  - Wireless monitoring in surgery laboratory
- Signal Processing
  - Geographical ground analysis (InnoGEO)
  - Modelling the environmental changes in a nuclear power plant environment (permanent nuclear waste custody)
  - EEG Pattern Analysis and Brain Monitoring of Sedated Trauma Patients

# Ongoing Research Projects at TUT Pori (CoSE excluded)

- Mathematics
  - Mathematical modelling of Cu-electrolysis process
  - Industrial applications of optimization: Safe handling of the nuclear waste
  - Bioacoustics – automatic recognition of birds' sing
- Electronics
  - Flexible electronic materials
  - ECO-circuit boards
  - RF-electronics printing
  - Magnetic and electrical materials
- IEM
  - Huoli: Safety and security in industry – improving productivity
  - E!3674 ITEA2 FLEXI – Added Value Ontology (Innovativity studies in Industry)
  - Intelligent Data Mining



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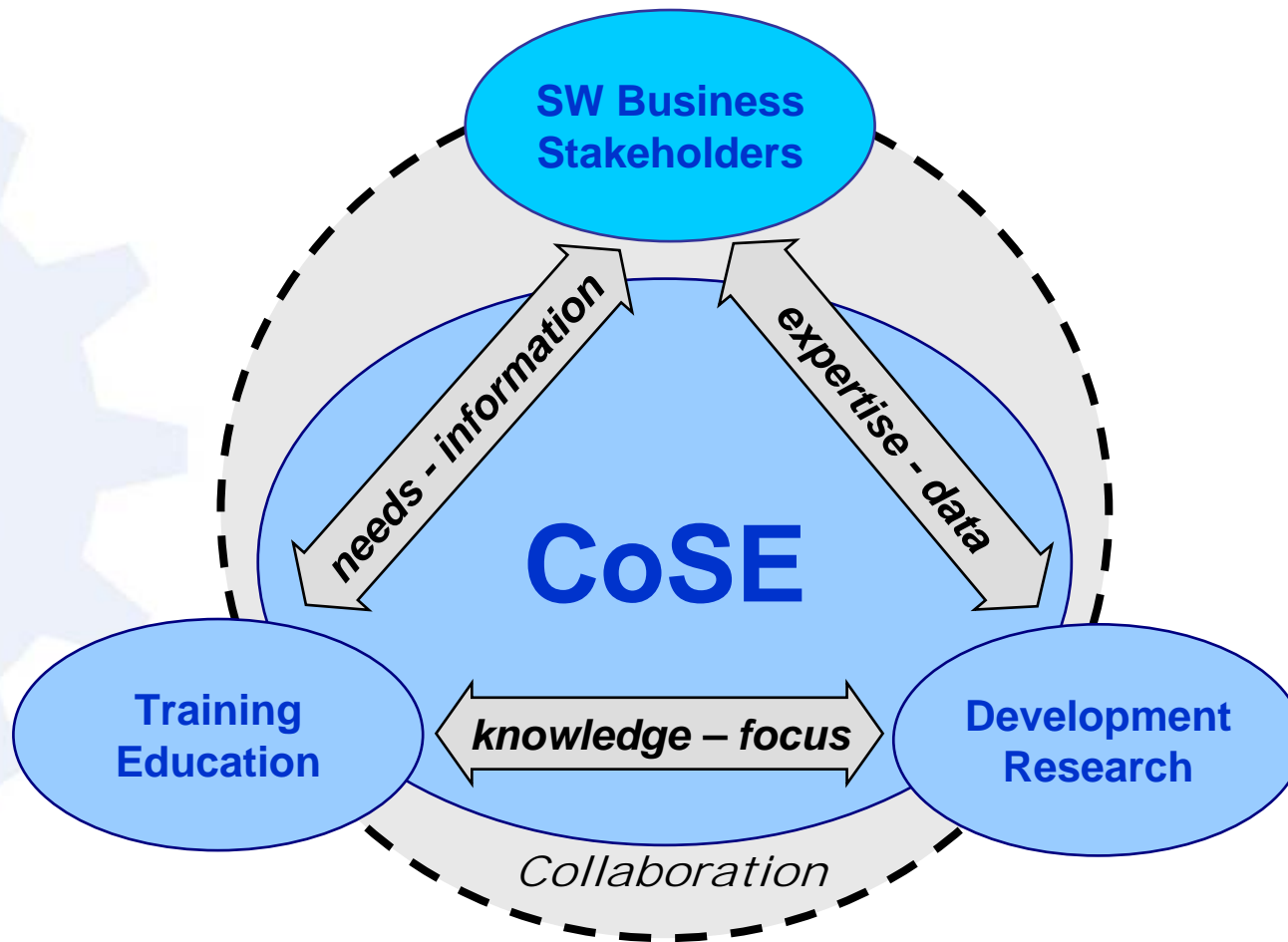
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CoSE

$$SE = CoSE + AMC$$

# CoSE strategic interactions



Prosessimallit

SC7 WG10 Software Process Assessment – ISO 15504

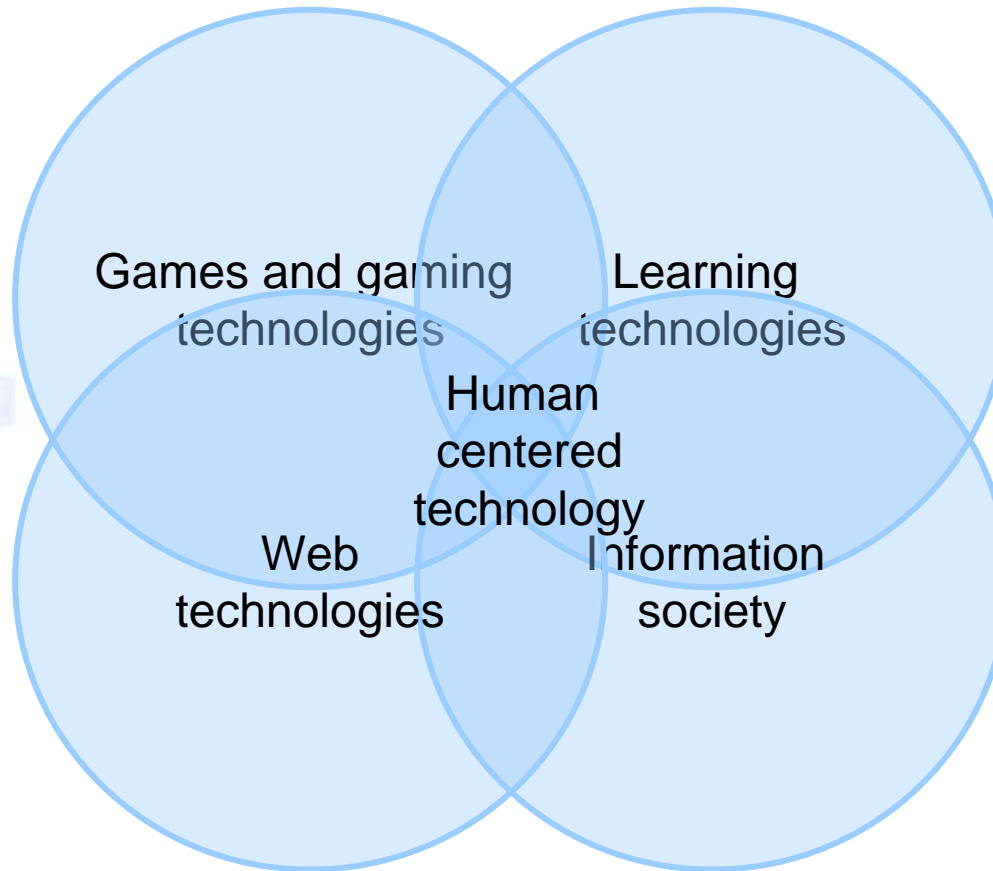
SC7 WG24 Software Life Cycles for Very Small Enterprises

ITIL

# CoSE Goals

- CoSE continually **develops** software engineering education, research and service functions at TUT Pori.
- CoSE studies, produces and applies means to improve ***software engineering productivity and to establish a supportive environment for software industry.***
- CoSE acts as a valuable **partner** of global research and expertise exchange on behalf of its stakeholders
  - Students, researchers
  - Software professionals and companies in its network
  - Supporting and funding organizations

# Advanced Multimedia Center(AMC)



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ADVANCED MULTIMEDIA CENTER  
- exploring human web



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CoSE

*Center of Software Expertise*

# CoSE Staff (16)

- Professor Hannu Jaakkola (Software Architectures; Reusability; SPI)
- Lecturer Harri Keto (Process Ontology in SE)
- Lecturer Markku Nevanranta (Genetic Algorithms)
- Lecturer Mika Saari (Software Development for Mobile Devices)
- Senior Researcher Timo Varkoi (SPI in S&M Software Organizations)
- Senior Researcher Timo Mäkinen (Software Process Knowledge Management)
- Senior researcher Jari Soini (Software Measurement; SSMC)
- Senior researcher Jari Leppäniemi (SSMC)
- Training Coordinator Paula Wahlberg-Eklund (problems in Software Industry)
- Senior Researcher Jari Palomäki (Conceptual Modelling)
- Project Researchers – Varying amount, project based topics ( at the moment 6)

# SW-companies in Finland (1)

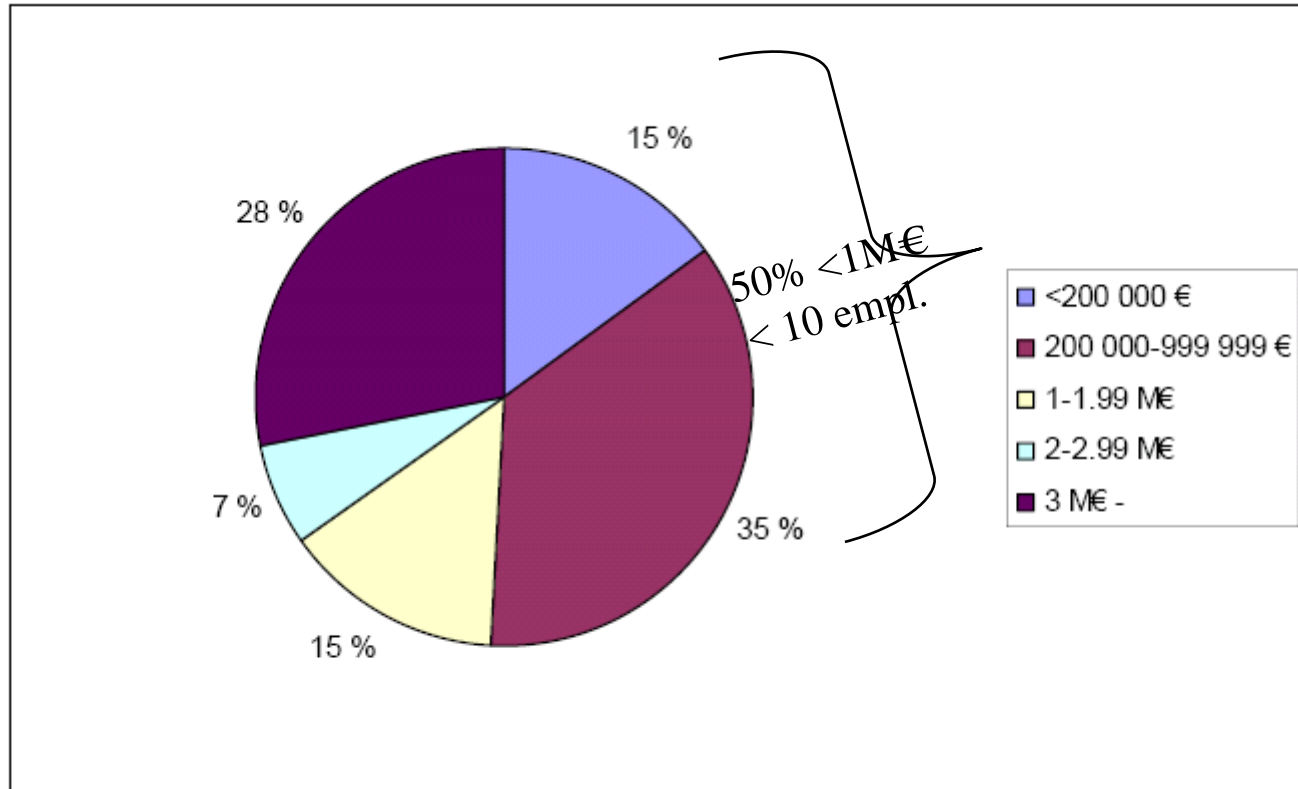


Figure 7. Responding Companies' Distribution of Total Revenue in 2004 (n=199)

(c) Hannu Jaakkola

# SW-companies in Finland (2)

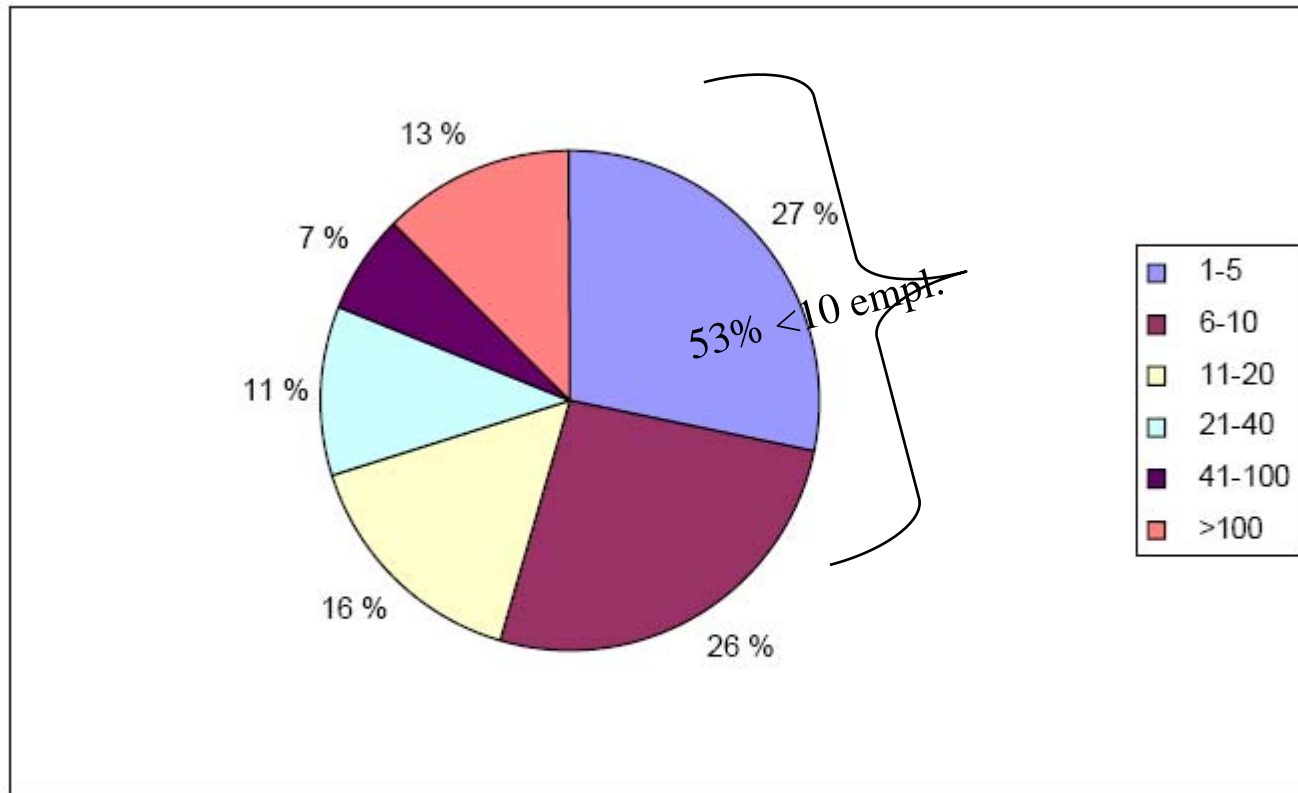
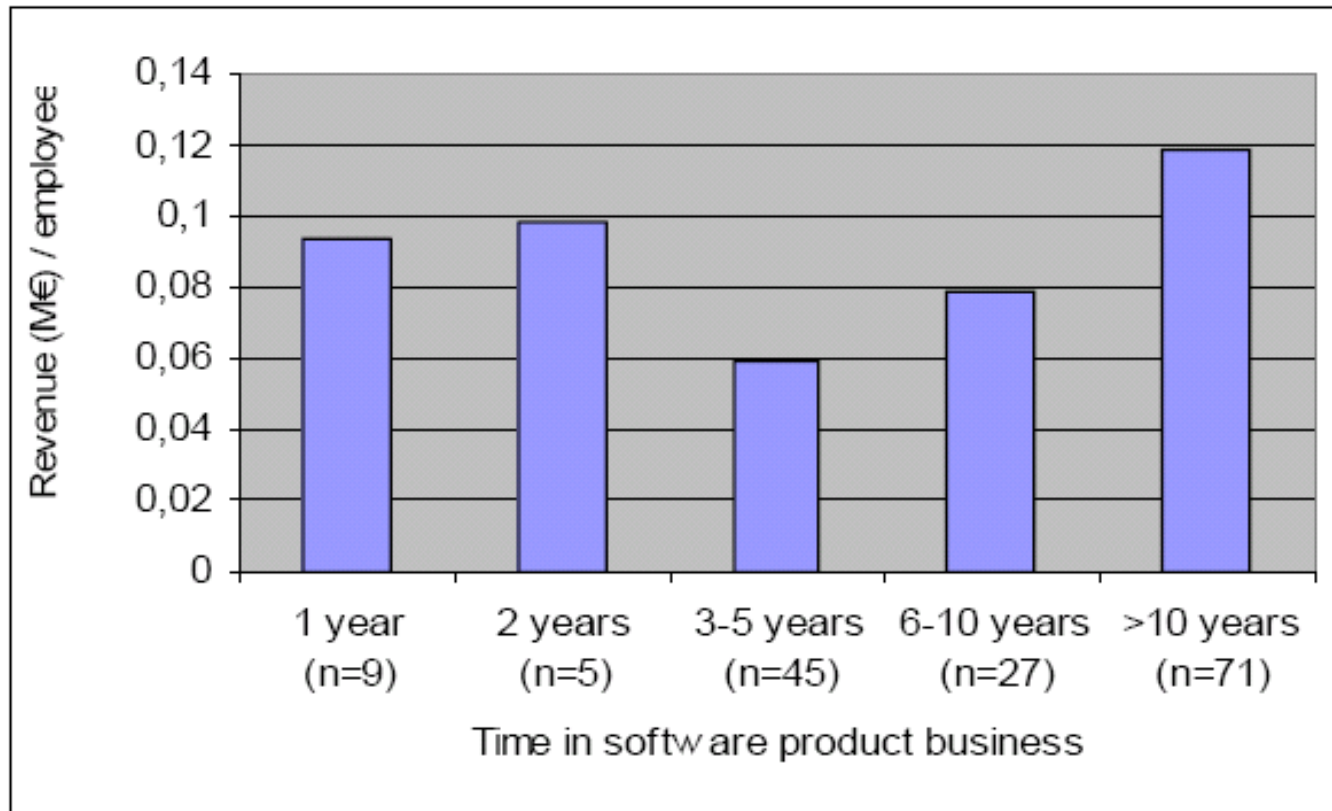


Figure 14. Distribution of Overall Personnel in Software Product Companies in 2004 (n=198)

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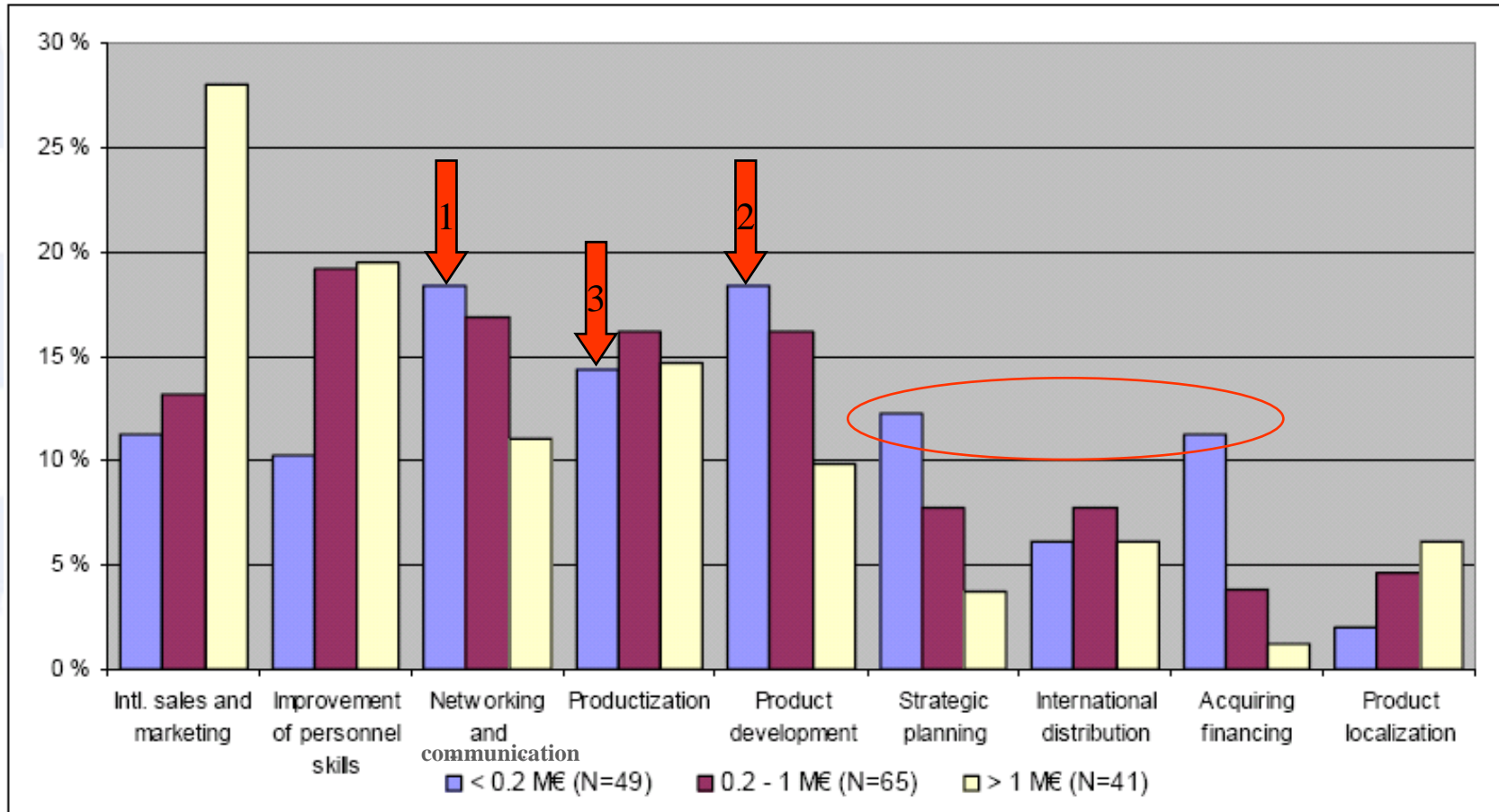
# Revenue per person

per age of the company



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# Improvement areas by size of company



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# Conclusion of the statistics

- An average software company is reasonable small
- Small companies do not have own resources for company practice development
- Niche products – if any
- Business scope local – nationwide - international
- Often subcontracting – atleast a part of the activities
- Owners in a key operational role
- Future after 10 years
  - Bought by a bigger company
  - Growth to the next size category (or bigger)
  - Do not exist
- Path from Micro to Medium is not widely studied – worth of doing?

# Because of that

- We concentrate in the problems of small software organisations
- We provide them services necessary to improve their productivity and growth
  - Information services and training
- We provide them information and knowledge necessary to adopt to survive in the business and to grow
  - Managing the growth over the chasm of the death
- We push (co-operating) companies to put focus in the (right kind of) improvement activities
  - Assessment based approach
- We are building up a network of software companies – exchange of experiences

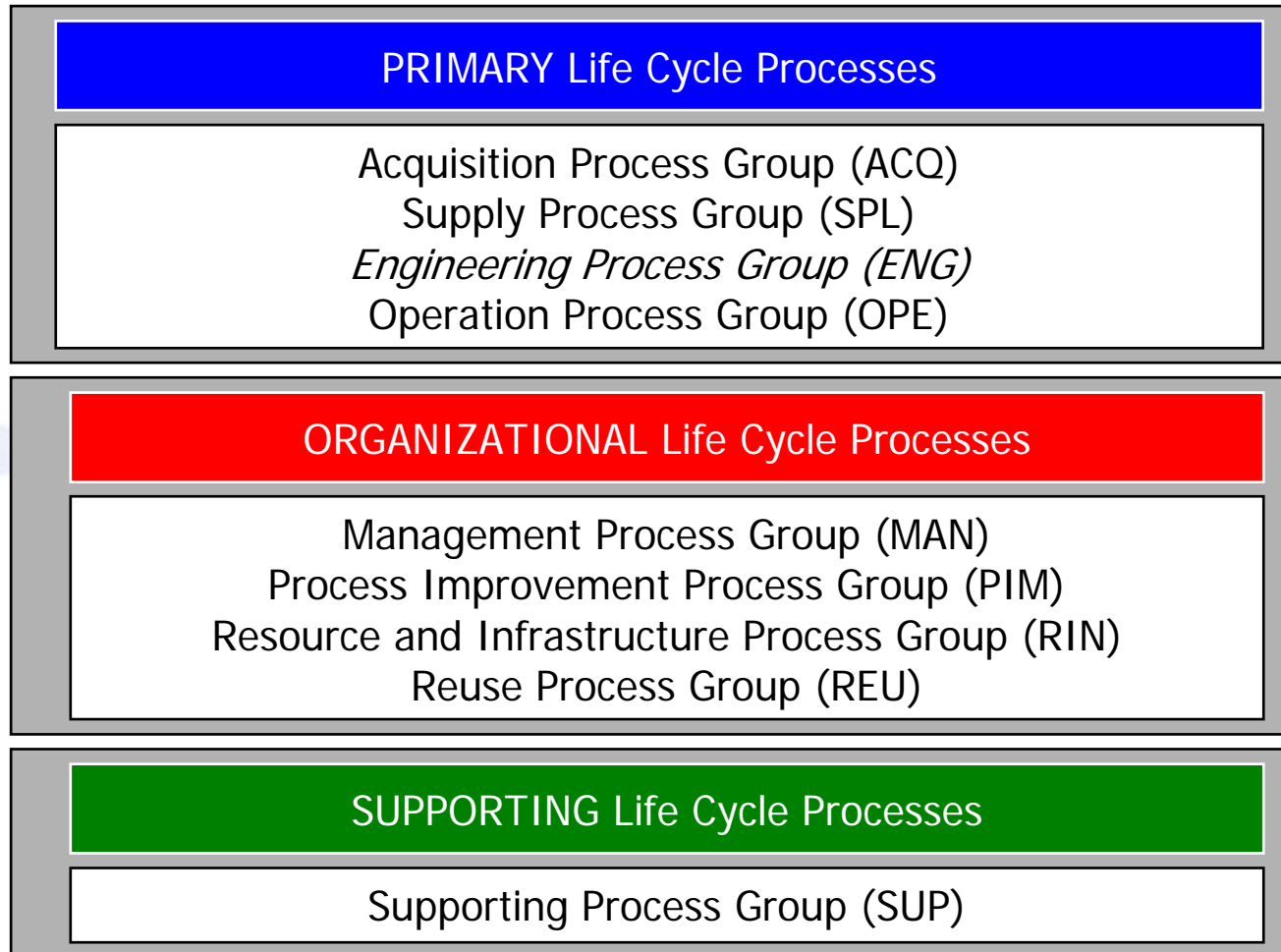
# To the current state (10 years)

From university laboratory to education, training, research and development organisation – role diversion

1. **Step:** Clarify ourself, what we are (1998) and what we want to become (future, strategy)
  - evaluation of the existing skills
  - development path of the skills – assesment, process oriented, standard based, open minded co-operation
  - re-engineering of SE education contents and structure – from **courses to reusable modules**
2. **Step:** motivation push – how to commit companies in the co-operation
  - open the easiest door
  - training – wide training programme for companies
    - subvented prices (European Social Fund)
    - until now: appr. 5.000 person training days
  - organized process assesments in key companies
    - as a part of the company based improvement projects
    - key (lead) companies recognized – good practices, good experiences
3. **Step:** Networking – SataSPIN network
  - University as an accelerator in establishment of the inter-company co-operation
  - From competing companies to co-operating companies – same problems join
4. **Step:** From training and Improvement orientation to the research co-operation
  - company based research problems, key companies
  - applied academic research
5. **Step:** Networking of CoSE – national and international co-operation in projects

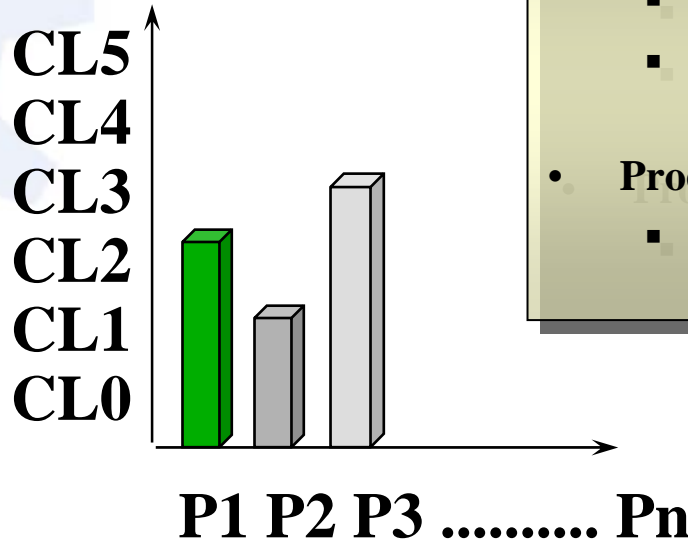
# Process oriented approach in SE

SPICE  
ISO 15504



# Continuous Improvement

## Software Process Improvement and Capability dEtermination



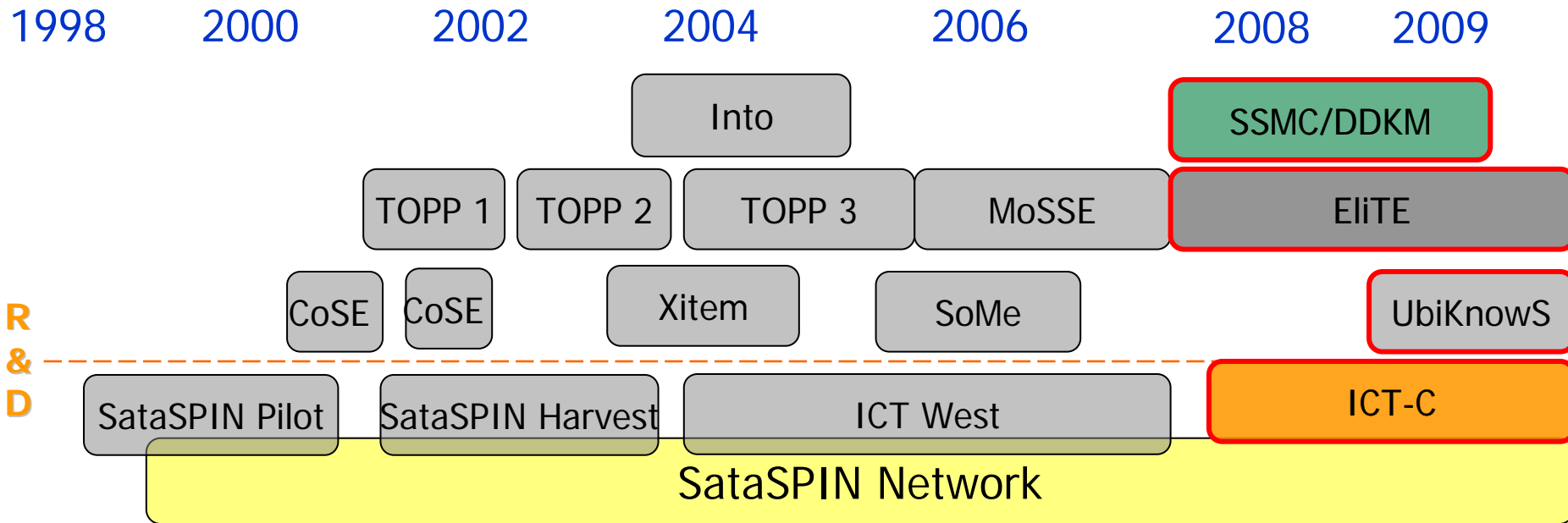
### Two Dimensional assesment model

- **Capability (CL1, ...)**
  - Process capability
  - Existence of base practicies and process properties are measured
- **Process groups or Processes (P1, ...)**
  - The processes measured

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# Research and Industry Co-operation

## Process Improvement to support Software Industry



Increase competitiveness: productivity, profitability, quality

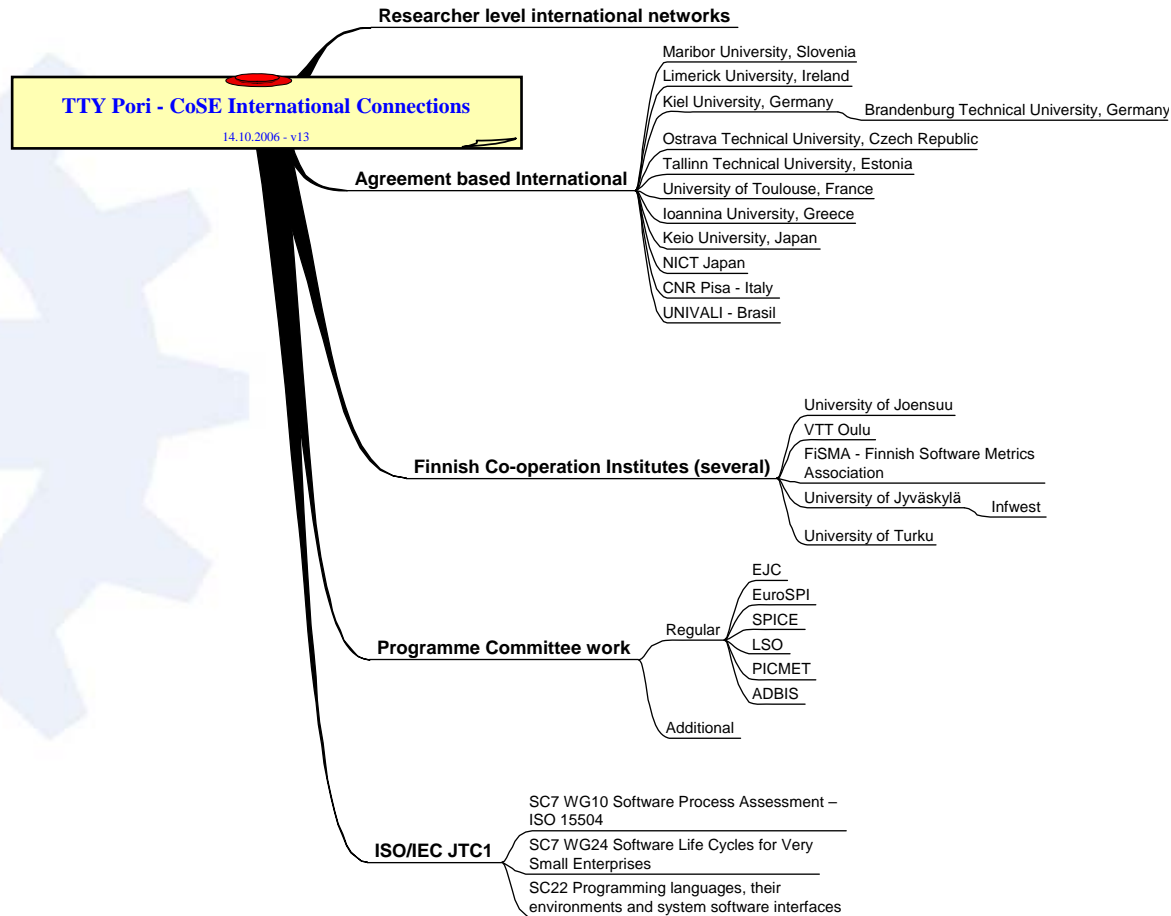
Target: Supportive environment for Software Industry

# Projects – funding

- SataSPIN [1.8 M€]
  - A network to promote co-operation between TUT Pori, software companies, and service providers in Satakunta region
  - Strengthens the regional software industry and disseminates experiences by providing training and expert services
- TOPP 1,2,3 [780 k€]
  - Research co-operation with software producing enterprises, research institutes and universities nationally and internationally
  - Support services for process improvement in software industry; method development
- X-item [230 k€]
  - Experience and knowledge repository utilization in SPI
- Into [215 k€]
  - Innovative co-operative technology transfer platform for WFA ICT-sector
- ICT West [1.8 M€]
  - Regional ICT sector development and dissemination in West Finland
  - Focus on method development and creation of long-term services
- SoMe [250 k€]
  - Software product and process measurement support
- MoSSE [360 k€]
  - Modelling and simulation in software engineering; Continuation to TOPP
- EliTE [700 k€]
- SSMC [800 k€]
- ICT-C [700 k€]
- UniKnowS [180 k€]

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# TUT Pori - International



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# International Co-operation

- Maribor University, Slovenia
- Limerick University / LERO-The Irish Software Engineering Research Centre, Ireland
- Kiel University, Germany
  - Brandenburg Technical University, Germany
- Ostrava Technical University, Czech Republic
- Tallinn Technical University, Estonia
- University of Toulouse, France
- Keio University, Japan
- Kanagawa Institute of Technology, Japan
- Tokyo Institute of Technology, Japan
- Komazawa University, Japan
- NICT, Japan
- CNR Pisa - Italy
- University of the Valley of Itajaí (UNIVALI) – Brasil
- Fraunhofer Institute, Germany
- Ioannina University, Greece
- Centre de Recherche Public Henri Tudor, Luxemburg
- Centre of Excellence in Information and Communication Technologies, Belgium

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# Finnish Co-operation Institutes

- University of Joensuu
- University of Jyväskylä
- VTT Oulu
- FiSMA - Finnish Software Metrics Association
- University of Turku
- Åbo Akademi
- ...

# Regular Conference Activities

- EJC
- EuroSPI
- SPICE
- LSO
- PICMET
- ADBIS
- ..

# ISO/IEC JTC1

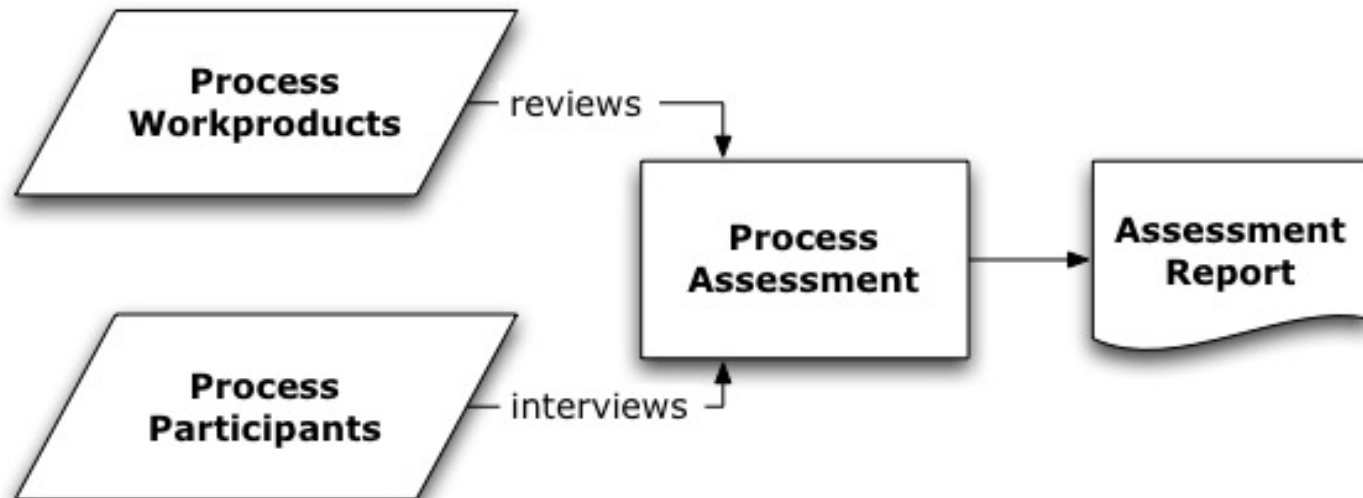
- SC7 WG10 Software Process Assessment – ISO 15504
- SC7 WG24 Software Life Cycles for Very Small Enterprises
- SC22 Programming languages, their environments and system software interfaces

# Research - projects focused in

- Software Process Improvement Studies
- Understanding the Problems of Small Software Organisations
- Software organisations in Multi-Cultural Context
- Growth Path of Software Organisations
- Software Systems Interoperability

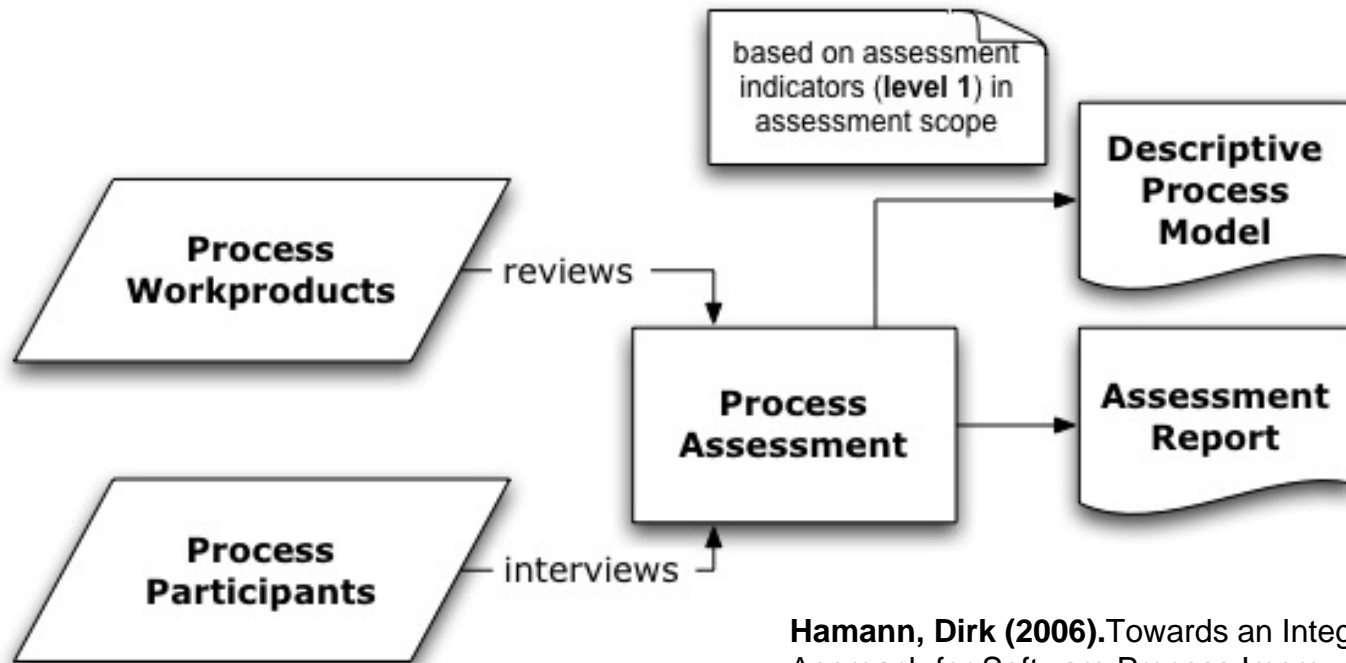
# TOPP

## Traditional Process Assessment Approach



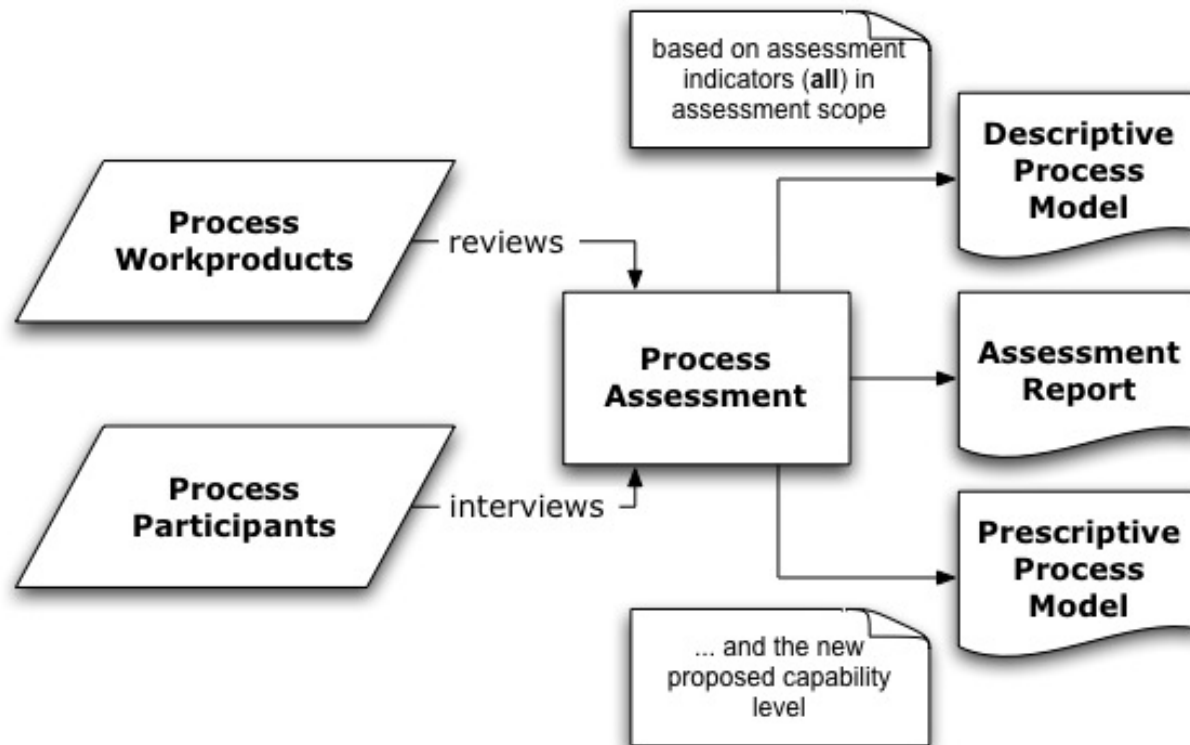
# TOPP

## Assessment Combined with Process Modeling



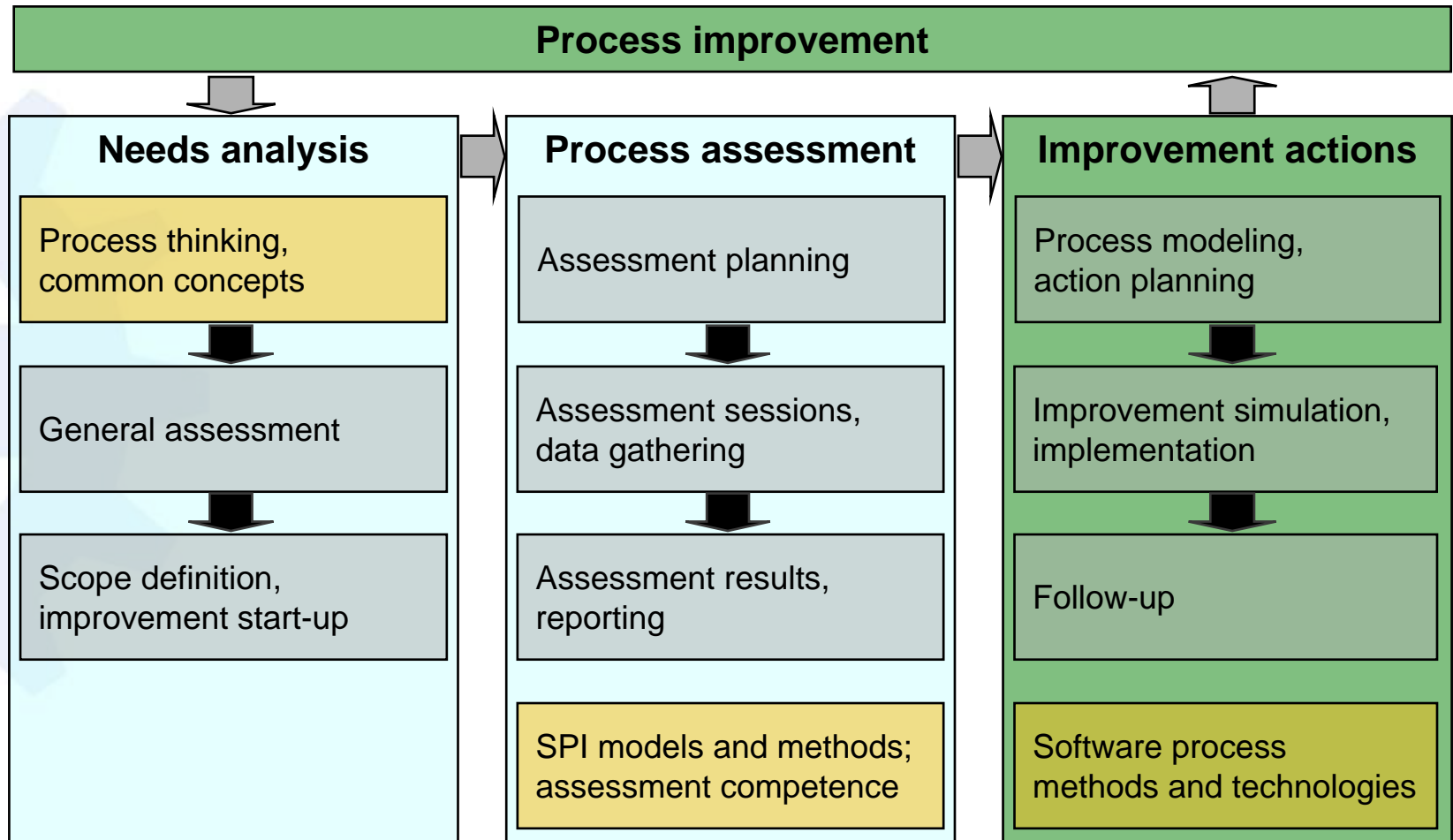
**Hamann, Dirk (2006).** Towards an Integrated Approach for Software Process Improvement: Combining Software Process Assessment and Software Process Modeling. (PhD Thesis)

# *TOPP* Enhanced Combination of Process Assessment and Modeling



# Process Improvement: SPINI approach

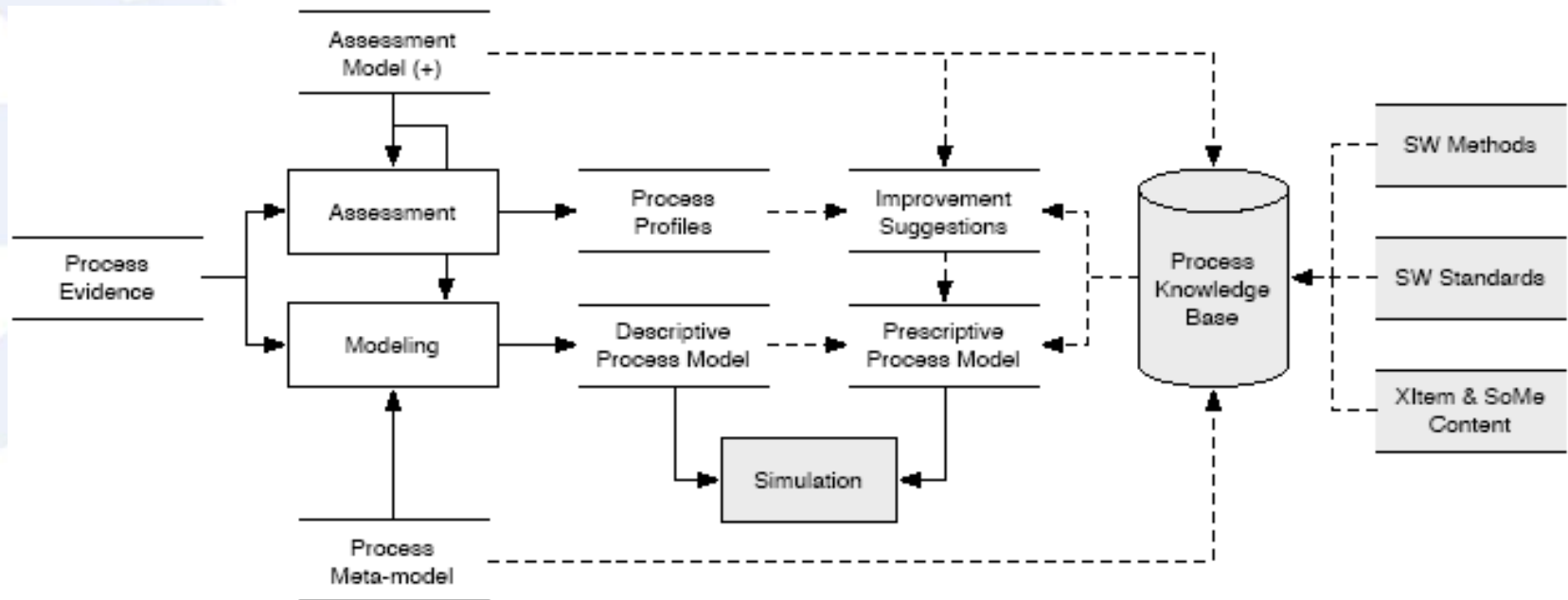
(Software Process Improvement INitiation)



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# *ELiTE* Process improvement



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# SSMC

Tampere Univ. of Tech.,  
(Finland)



Christian Albrechts Univ.  
at Kiel (Germany)



VSB-Technical Univ.  
of Ostrava (Czech Rep.)



As of March 2007



NICT



Keio Univ. SFC



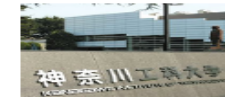
Saga Univ.



EEPIS-ITS



Kanagawa Inst. of Tech.



- Interoperability
- Models as a joint language
  - Situational knowledge and process models
  - Modelling the situational knowledge
- Mobile connectivity
  - Mobile terminal as an information distributor and as a sensor

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# ICT West - ICT-C

- ICT West assisted local **companies** to:
  - Implement new technologies, methods or procedures.
  - Strengthen the expertise of their employees.
  - Develop the business culture.
  - Improve the performance of the company
- Themes through the years
  - Open software frameworks
  - Agile methods
  - Software testing
  - Software engineering (general topics)
  - Software product business and marketing
  - Mobile software development (Symbian)
  - Linux programming and administration
  - Programming (Java, Perl, Python, PHP, etc.)
  - Information security
- Results: appr 4.000 participant training days; in addition consultation and studies in topics in focus

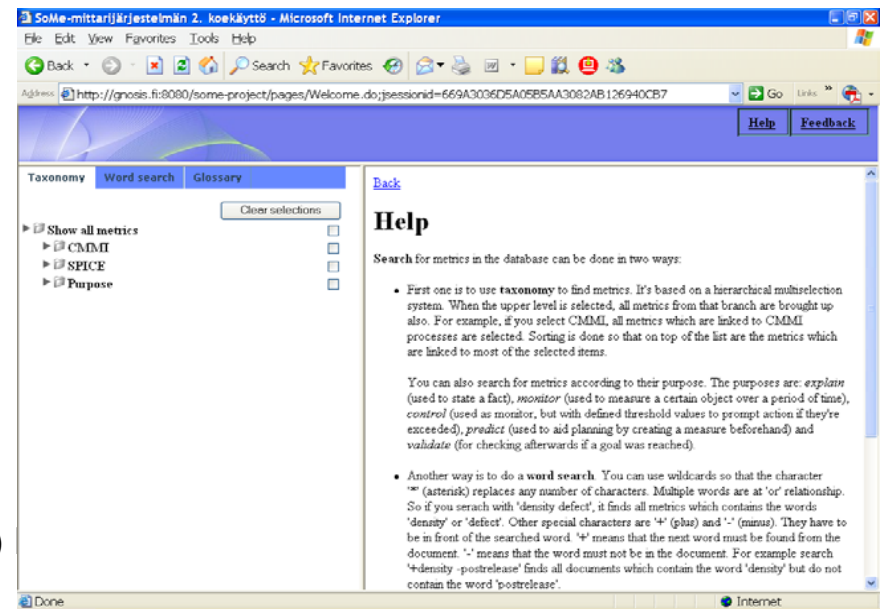
# Xitem Project

- Xitem - Experience and knowledge repository utilization in SPI
- Results
  - **explicit expertise** in SPI to be managed in repositories
  - utilized solutions developed in an European research project PATTERNS
  - provided **tools** (Gnosis) and guidance to participating companies
  - validated the solutions and analyzes feedback
- in co-operation with University of Joensuu, CS and tSoft

# SoMe Project

- SoMe – Software Measurement
- Research and development project
  - developed software engineering measurement and measures
  - provided a validated support system for **process and product quality measurement**
- in co-operation with University of Joensuu, CS and tSoft and VTT Electronics, Oulu

(c)



# CoSE Current Projects

- **ELiTE – Elicitation Technologies for Process Improvement (TEKES) 2008 (-2010): Methods and Tools for SPI**
  - Evolution chain of projects since 2002: (1) TOPP 1-3 [assessment] (2) XiTeM [process knowledge] (3) SoME [measuring] (4) MoSSe [process modelling and simulation]
  - International standardization: ISO JTC1 / SC7 WG10 Software Process Assessment; SC7 WG24 Software Life Cycles for Very Small Enterprises; ITIL
  - International: Czech Republic, Germany, Ireland, Brasil
- **SSMC/DDKM – Seamless Solutions and Mobile Connectivity (TEKES/Turva) 2008-2009**
  - Software architectures and Mobile solutions supporting interoperability in disasters
  - International: Japan, Czech Republic, Germany
- **Multi Cultural Collaboration - UbiKnowS (Academy of Sciences in Finland, Japan Society for Promotion of Science) 2008-2010**
  - Distributed collaboration technologies and Practices over Cultural borders
  - TUT Pori, University of Jyväskylä, Keio University, Kanagawa Institute of Technology, Komazawa University

# CoSE – Current Projects

- CERFAS – Certification of Safety Critical Software 2008 (SAFIR 2010) [VYR, VTT, etc.]
- ICT-C 2008-2010
  - Software Industry Development
- Disaster Knowledge Management and Data Mining – DiDaM 2008 (Maribor University, Slovenia)
- Architecture-Driven Modeling Methodologies 2008-2009 (Christian Albrechts University at Kiel)
- Conferences
  - Since 1988 European Japanese Conference on Information Modelling and Knowledge Bases
  - In addition in 2008: (1) The 2nd International Workshop on Knowledge Cluster Systems (March); (2) International Workshop on Ubiquitous and Knowledge Computing (August) (3) ADBIS 2008 (September)
- Research topics of the permanent teaching staff: conceptual modelling; genetic algorithms; process ontologies



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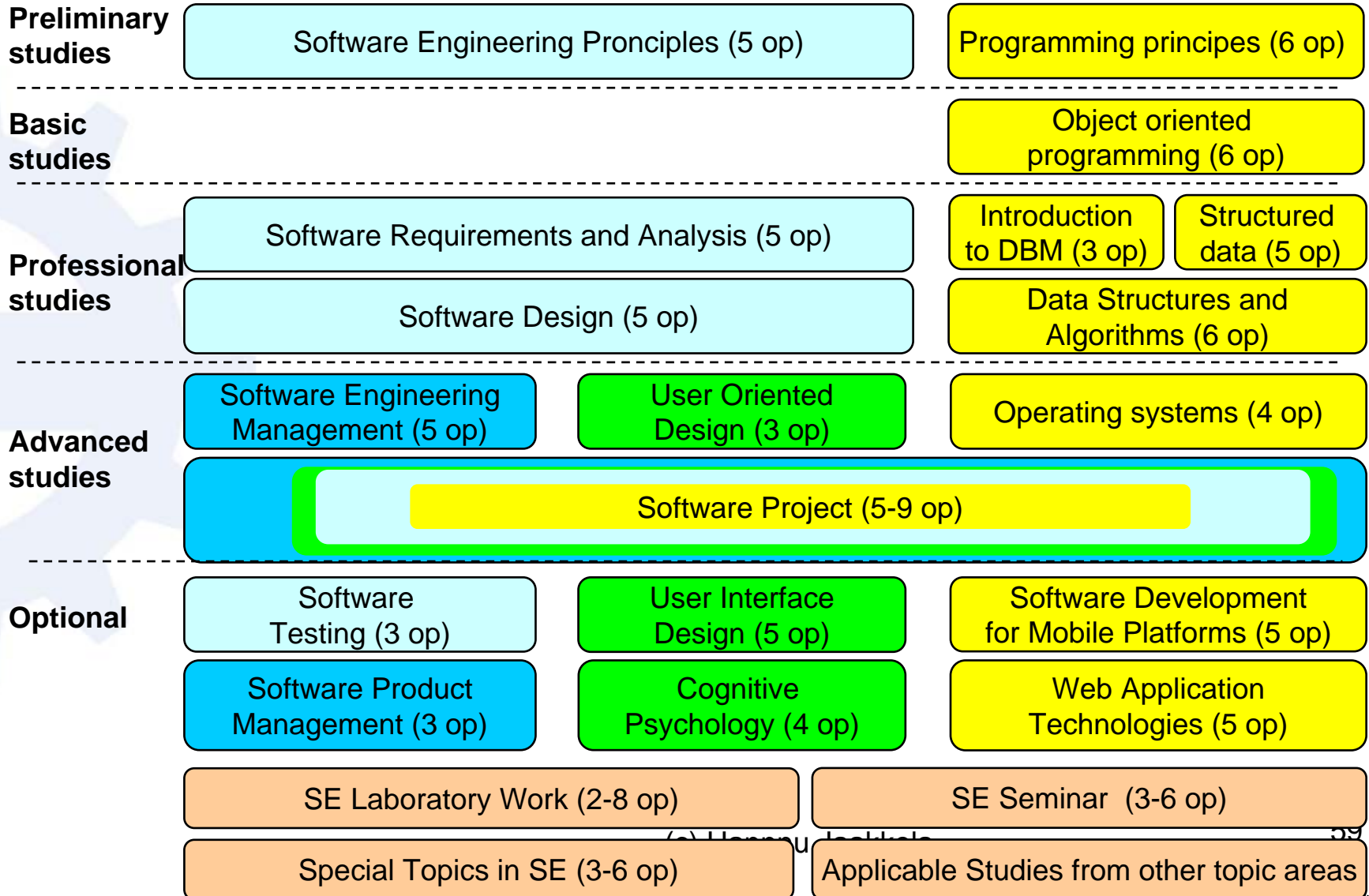
*Pori*



# Curriculum Items

# SE: structure 2008 - 2009

## Software Engineering / User oriented SE / Software Development Methodss



# MSc in Engineering

- Basic Studies
  - BSc
  - Mathematics
- Two (minimum) Professional Study topics
  - One in major level
- Thesis
  - Theory + application
  - Usually in work

# Contact

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