POLISH CHAMBER OF COMMERCE

IDN INTERNATIONAL DEVELOPMENT NORWAY

POLNORECO

Regional Network projects as a way to introduce innovation to SMEs

Experience from Norwegian programs

POLISH NORWEGIAN COOPERATION
FOR ENVIRONMENTAL FRIENDLY
AND INNOVATIVE SOLUTIONS
IN SMES - POLNORECO

Leif Anders Estensen, 28th of November 2017

POLNORECO

Knowledge transfer, networking and innovation

November 2017

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Contents

- NTNU
- Competence brokering in single company
- Competence brokering and innovation in network
- Experience and results
- Case studies/examples

Active participation and the same understanding
Foto: Solveig Svardal, Telemarksforsking

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This is also Norway

Plus 25 degrees Celsius

Minus 25 degrees Celsius

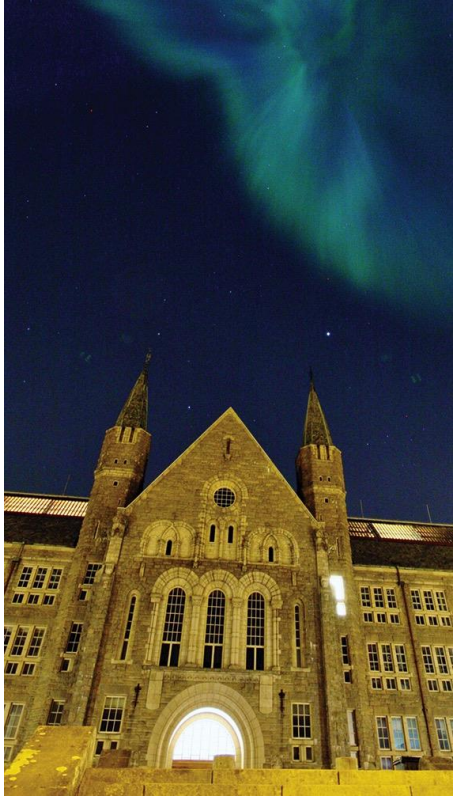
This is Trondheim

Photo: Bård F. Gimnes, NTNU

NTNU Kunnskap for en bedre verden **Knowledge for a better world** Photo: Fjellanger Widerøe Foto AS

NTNU

Norwegian University of Science and Technology
Trondheim, Norway



- 9 faculties and 56 departments with a broad selection of programmes and disciplines
- 6700 employees, of which 4053 are in teaching and research
- 40 % are female
- Approx. 39.000 students, of which 3.000 are from abroad
- 44-45 % are female
- Employees and students from more than 90 countries
- 340 – 375 PhD doctoral degrees yearly, of which 41 % are by international students
- Close cooperation with SINTEF (2000 employees) and St. Olavs Hospital, and others
- Cooperate with more the 200 other universities
- www.ntnu.no

Use of students from the University in project work

Biology students at field work

Photo: Kim Nygård, NTNU

Department of Building and Environment Technology

Photo: Arild Juul, NTNU

Students develop and build cars

Photo: Leif Estensen, NTNU

Students develop and build new bicycles

Photo: Rune Petter Ness, NTNU

The students work on specific projects and learn team work

Anatomical collection

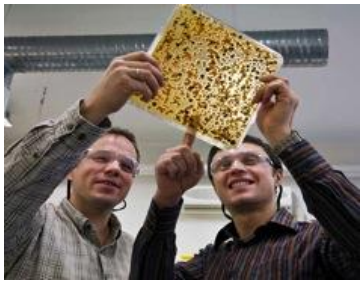
Photo: Geir Mogen , NTNU

Many different disciplines and groups

Partnership between NTNU and SINTEF is strategic and operative

NTNU
Det skapende universitet

SINTEF



Strategic interaction

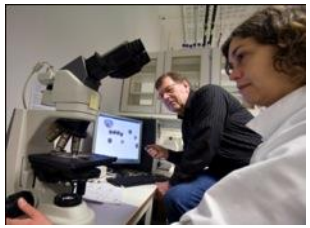
50 %

50 %

NTNU-staff
work on SINTEF-projects

SINTEF-staff
teach at NTNU

"The industrial ring"



Common use of laboratories
and equipment

Collaboration NTNU - SINTEF has been developed through 60 years

Knowledge transfer to companies participating in a single project 1 or in innovation networks 2

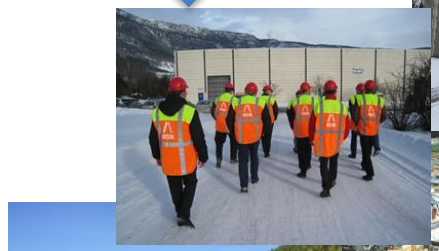
Competence => Knowledge + Experience

Experience from Norway

- Knowledge transfer to single company
- Competence transfer and innovation in network
- Experience, results and effects
- Case studies and examples

1

2



History of Knowledge Transfer in Norway

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1977-
Meeting places
1982-1984
Regional Pilot
Norway-Sweden
1984-1988
Pilot in one
Norwegian county

1989-1993
DTS-programme
9 of 19 counties
9 brokers
2135 SMEs
1011 projects

1994-2003
TEFT-programme
Nationwide
12 brokers
3732 SMEs
1560 projects

2004-2006
R&D-based
brokering
25-35 brokers

2007-2016
VRI-programme
More SMEs
and business
sectors
> 50 brokers

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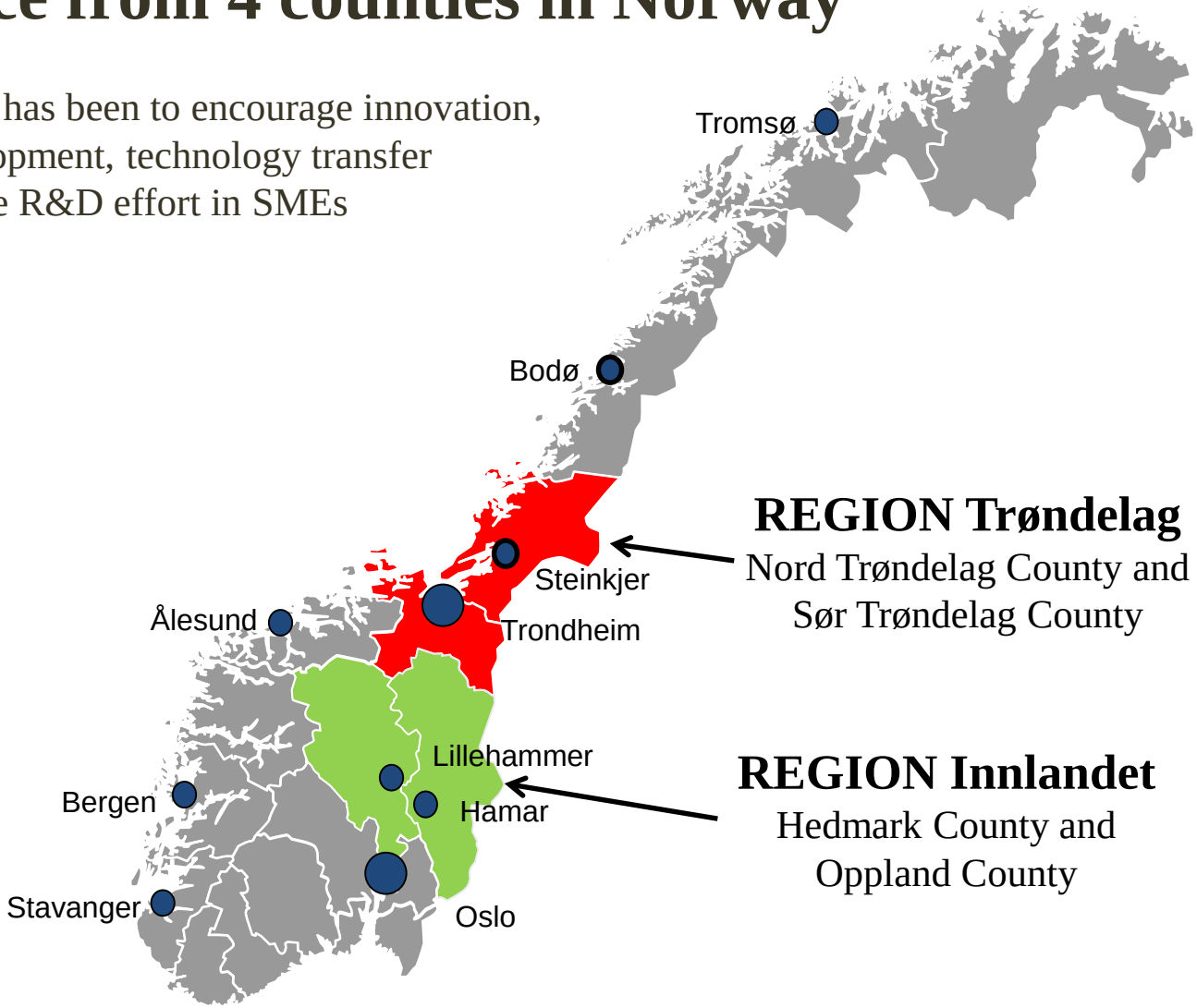
Experience from 4 counties in Norway

The primary goal has been to encourage innovation, knowledge development, technology transfer and strengthen the R&D effort in SMEs



REGION Trøndelag
Nord Trøndelag County and
Sør Trøndelag County

REGION Innlandet
Hedmark County and
Oppland County

Competence brokering and knowledge transfer to single company (face to face project)

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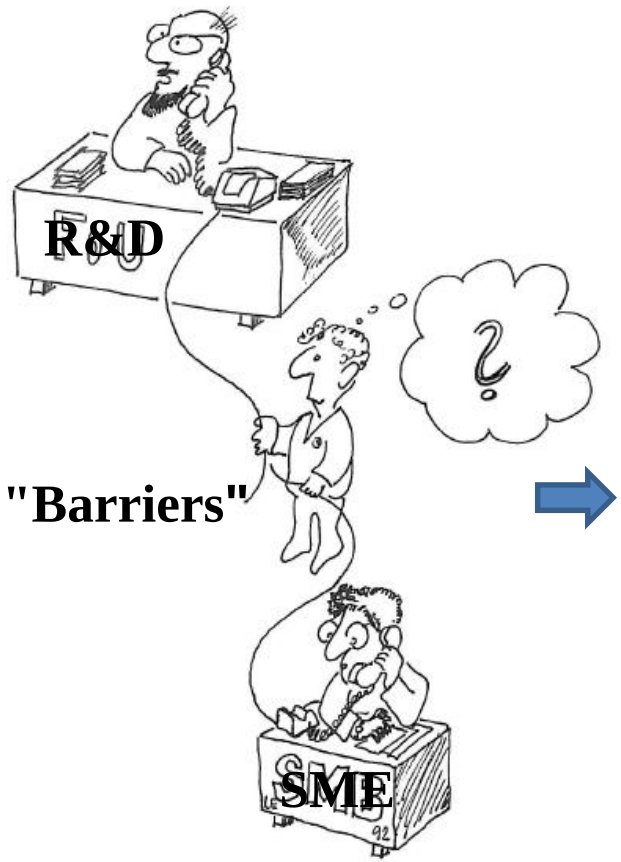

The broker connects SME and R&D

The scientist explains technology to the company when a student is watching.

Active participation and the same understanding

R&D based brokering and project development

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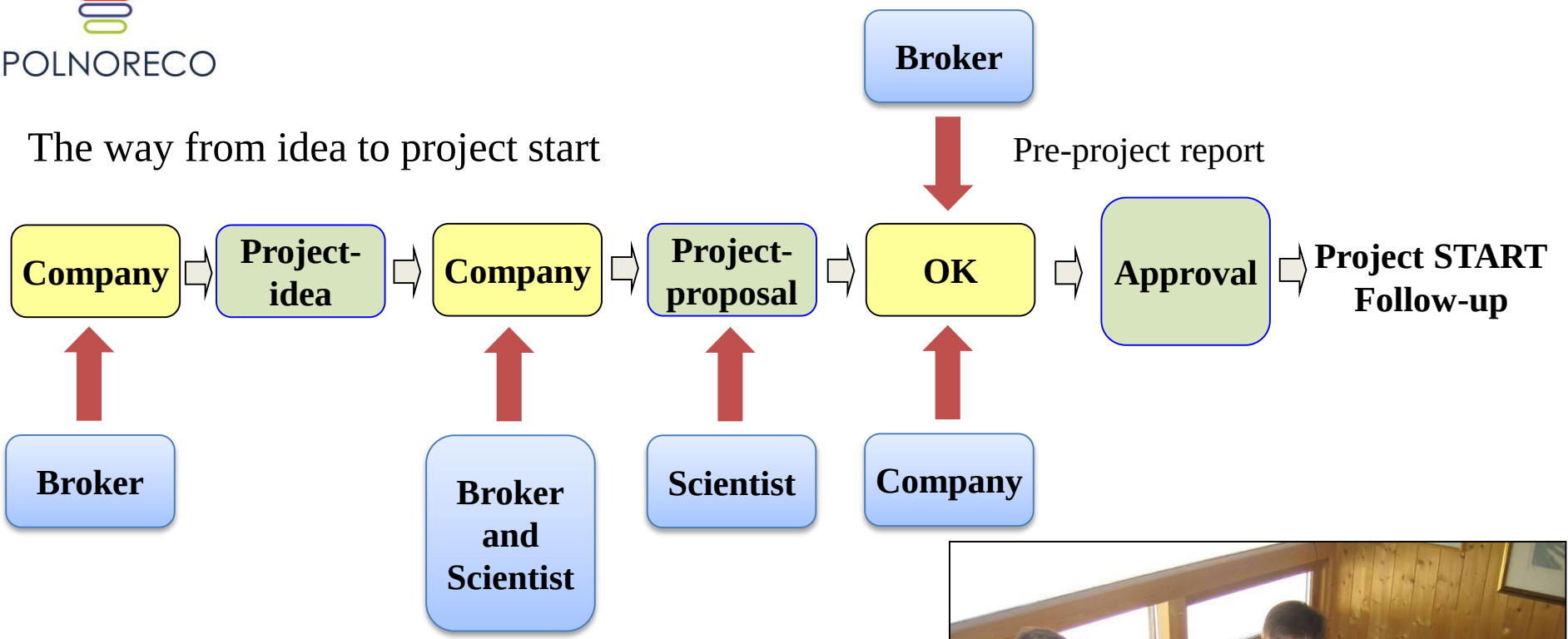
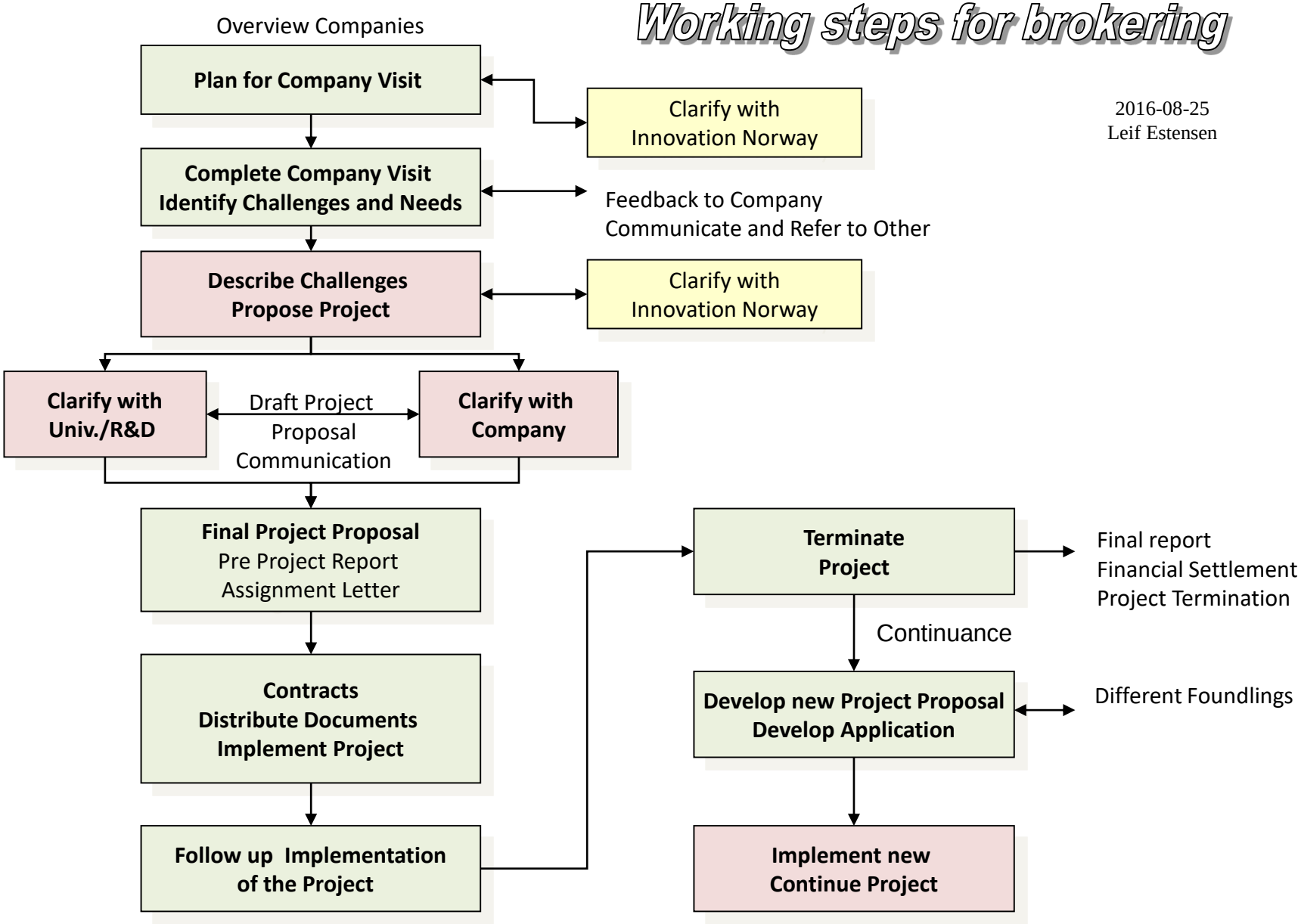
The way from idea to project start



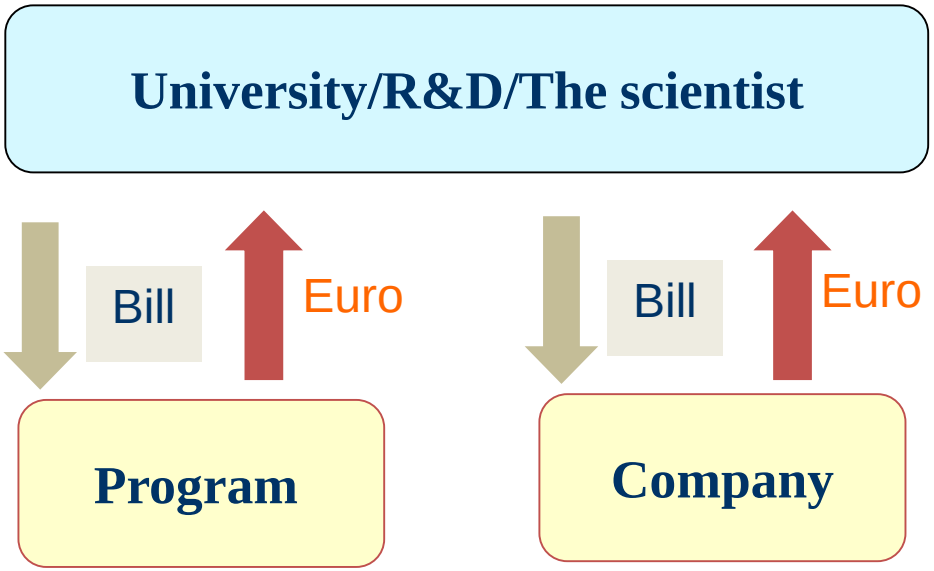
Working steps for brokering

2016-08-25
Leif Estensen



Research based competence brokering

- The money flow



- The motivation is build in this mechanism due the fact that
  - The scientists are the receiver of the money
  - 100 % of the total financing is paid after the project is finished

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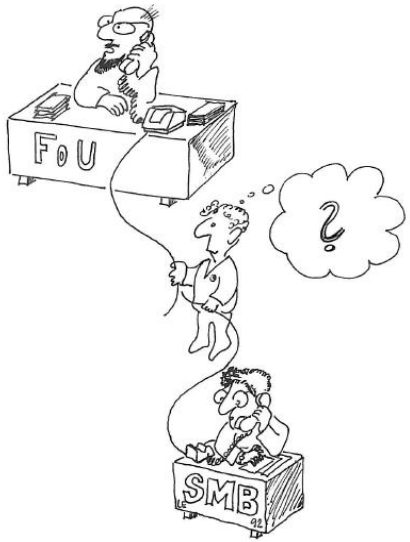
The competence broker



- Be a link between companies and Universities/R&D
- Have a good overview over
  - The SMEs and businesses in the region where working
  - The knowledge and contact persons at Universities and R&D-institutes
  - The political instruments for financing
- Have professional and personal qualifications and characteristics seen in the light of the target group (businesses and companies)
- Be able to speak “two languages”
- Be proactive and willing to travel and visit many companies
- Background from university/R&D-institute, and experience as researcher

Core business for the competence broker

- Map, select, and visit companies (SMEs)
- Clarify and identify R&D challenges, needs and possibilities
- Establish contact with relevant University, R&D-institution or other parties matching the challenges
- Develop proposal, plan, and initiate company specific projects
- Follow-up and conclude projects

- Cooperate with regional parties for innovation projects
- Cooperate with the regional public support system for signposting and additional support
- Provide contacts and competence through national and international networks (EEN)

www.elmico.no www.rorsystemer.no www.treski.no



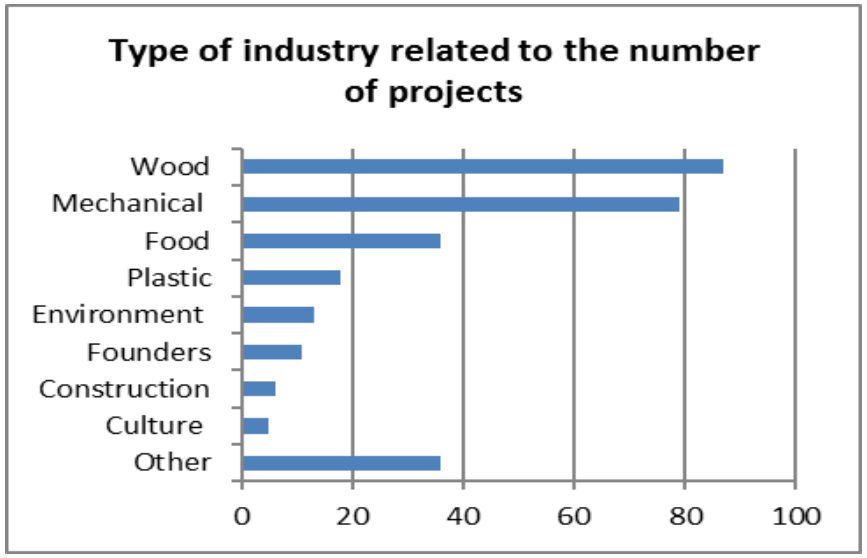
Experience and results from region Innlandet

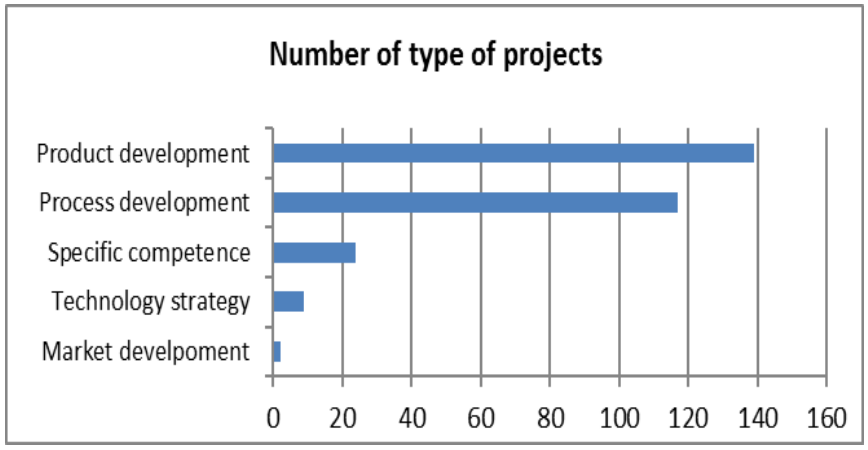
Hedmark county and Oppland county

- 50-60 companies are visited yearly
- About 55-60 % of the company visits are based on initiative of the competence broker
- Other contacts
  - More and more companies take contact themselves
  - Suggestions from public regional administrations
  - Researchers and even students give input
- More then 300 projects in the last 12 years

Number and type of industry and projects

Experience from Region Innlandet





30 % of 316 projects are in the woodworking industry. Product (48 %) and process development (41 %)

27 % of 316 project in mechanical, and 12 % in food industry. Only 9 projects in SMEs with more than 100 employees

Concluding remarks

Competence transfer to single companies

- Effects (case interview after ended project)
  - Change in attitude regarding cooperating with Universities/R&D
  - Valuable input of knowledge to the company
  - Solving company relevant problems with external knowledge gives rapid and better results
  - Mostly small projects
  - Use of students in the projects are valuable and inexpensive
  - Possibility to recruit and employ educated students
  - The broker is important in project development and finding the right knowledge

- Master studies by students (in-depth interviews of companies in 2015)
  - There are clear differences between the companies (Yes and No Companies)
  - Education and background affect the basis for collaboration with Universities/R&D
  - Interaction and good communication (face-to-face) affect the collaboration
  - Relations and in-house knowledge are important
  - An active board with external members initiate the “best projects”
  - Attitude and capability to absorb, use and manage the knowledge is vital
  - Use of students are highly welcome

Bring companies and researches together for innovation

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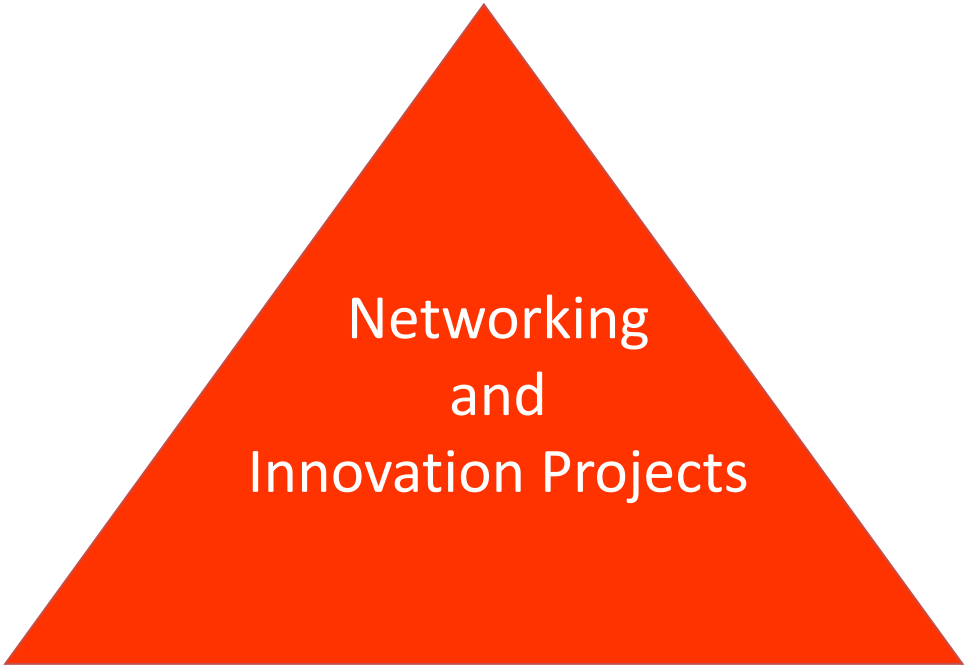
Concept of Innovation in Network

Competence brokering, teamwork and knowledge management between more companies, Univ./R&D and policy instruments

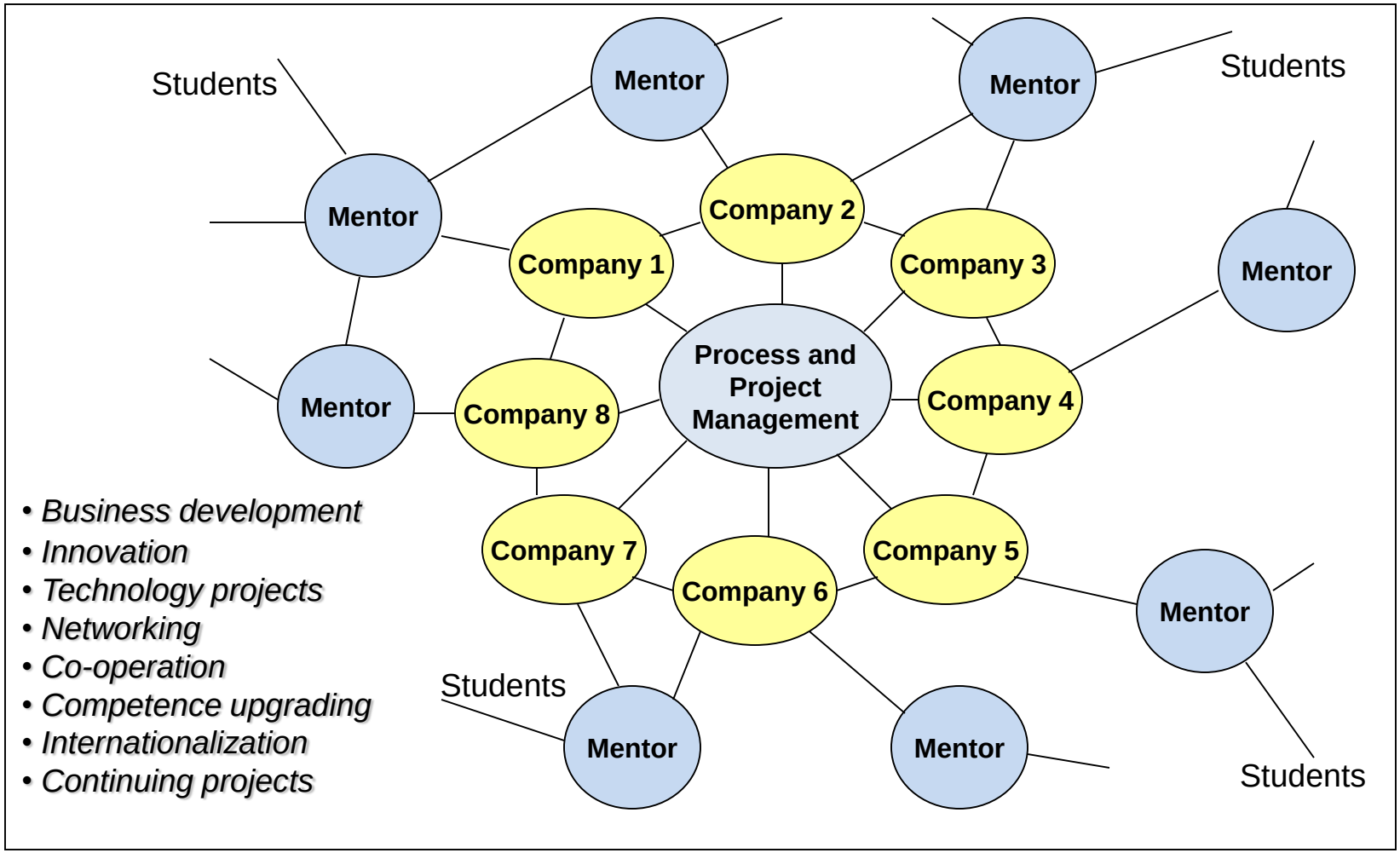
Companies



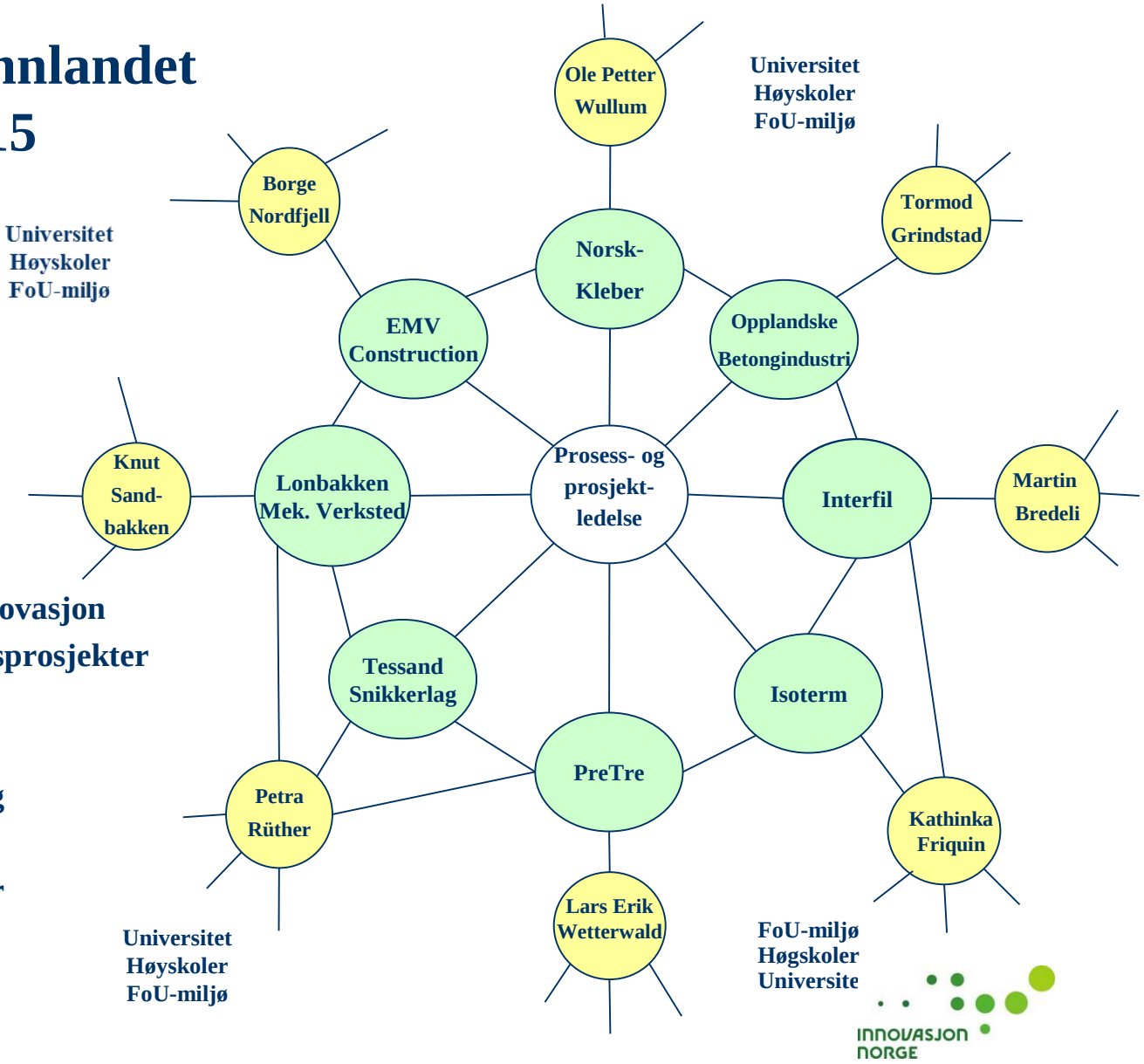
Universities, R&D and knowledge communities

Innovation Norway

Innovation in Network



IDÉSØK10 – Innlandet 2014-2015



- Bedriftsutvikling og innovasjon
- Teknologi- og utviklingsprosjekter
- Nettverksbygging
- Samarbeid
- Kompetanseoppbygging
- Internasjonalisering
- Videreføringsprosjekter

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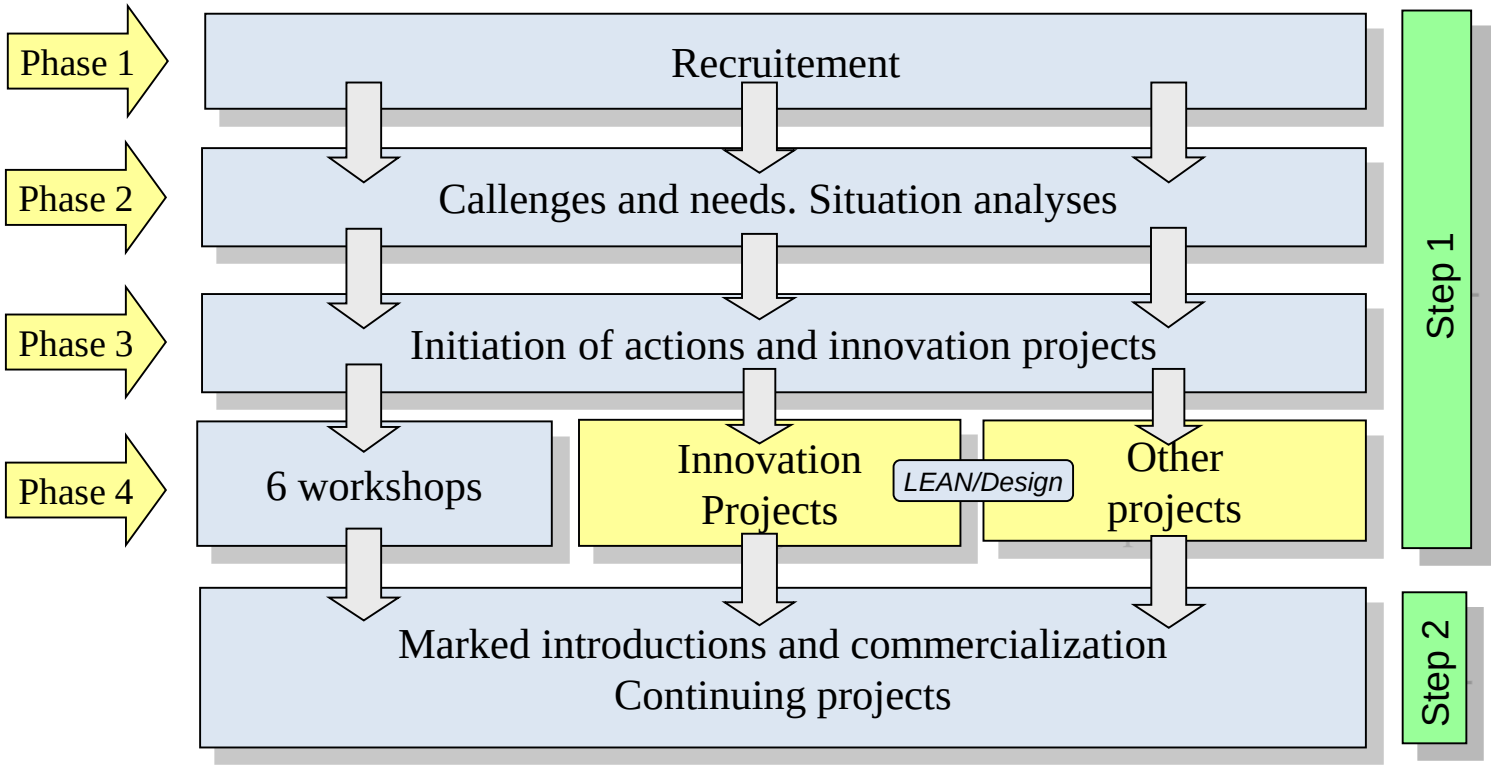
The project model



Leif Estensen, NTNU-IPK, Norway, MAY 2016

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Presentation and discussion in groups

Special theme at each workshop
“Visit and guided tour in RobotLab”

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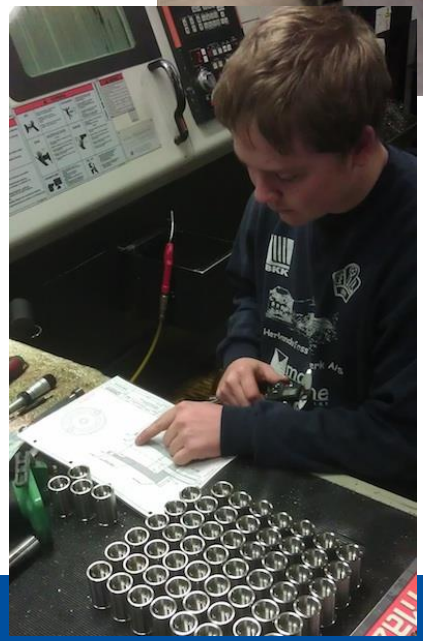
Group of students in company specific projects

From the Hydropower Department at NTNU

Trainees from colleges

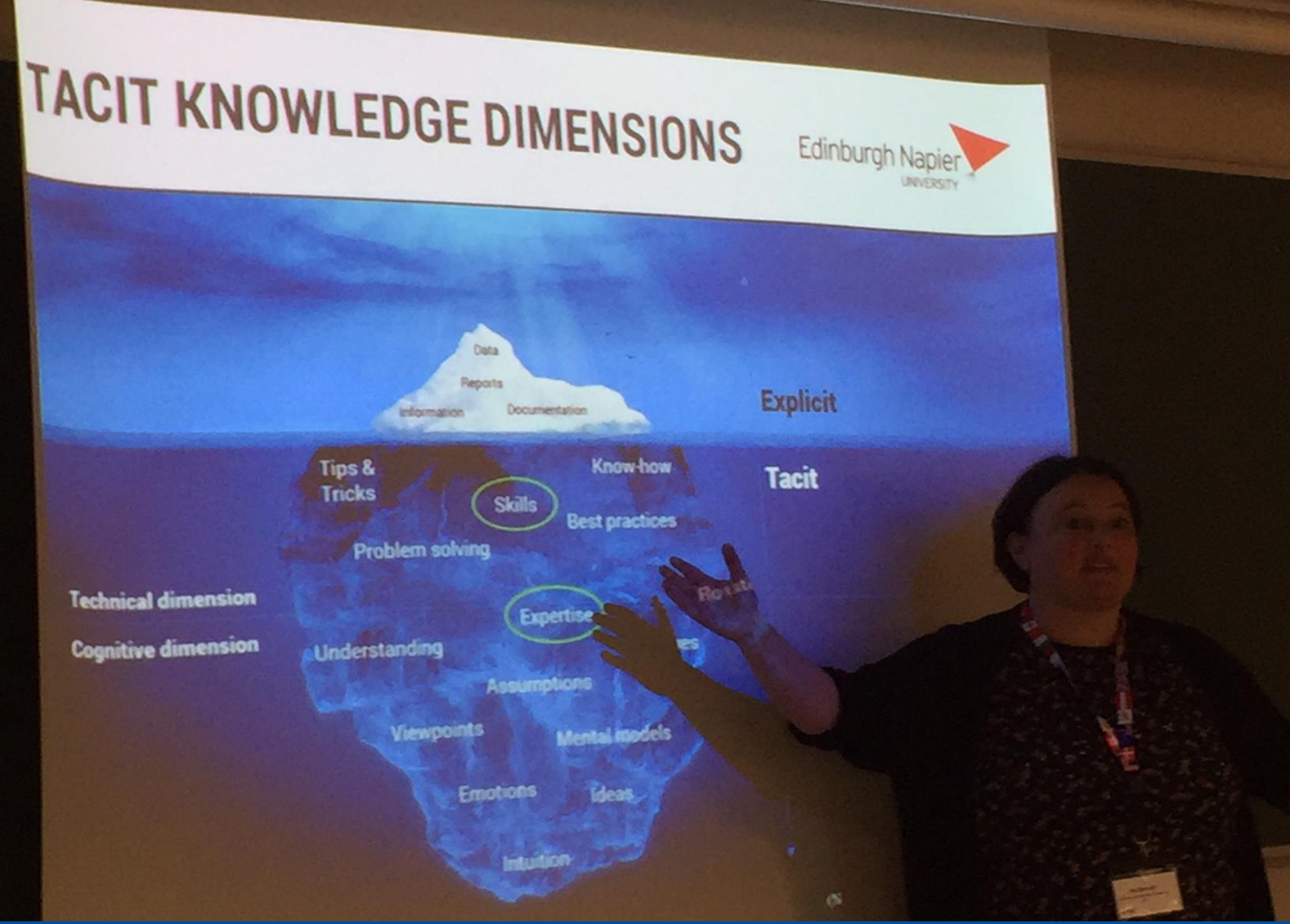


Lack of CNC operators in Norway

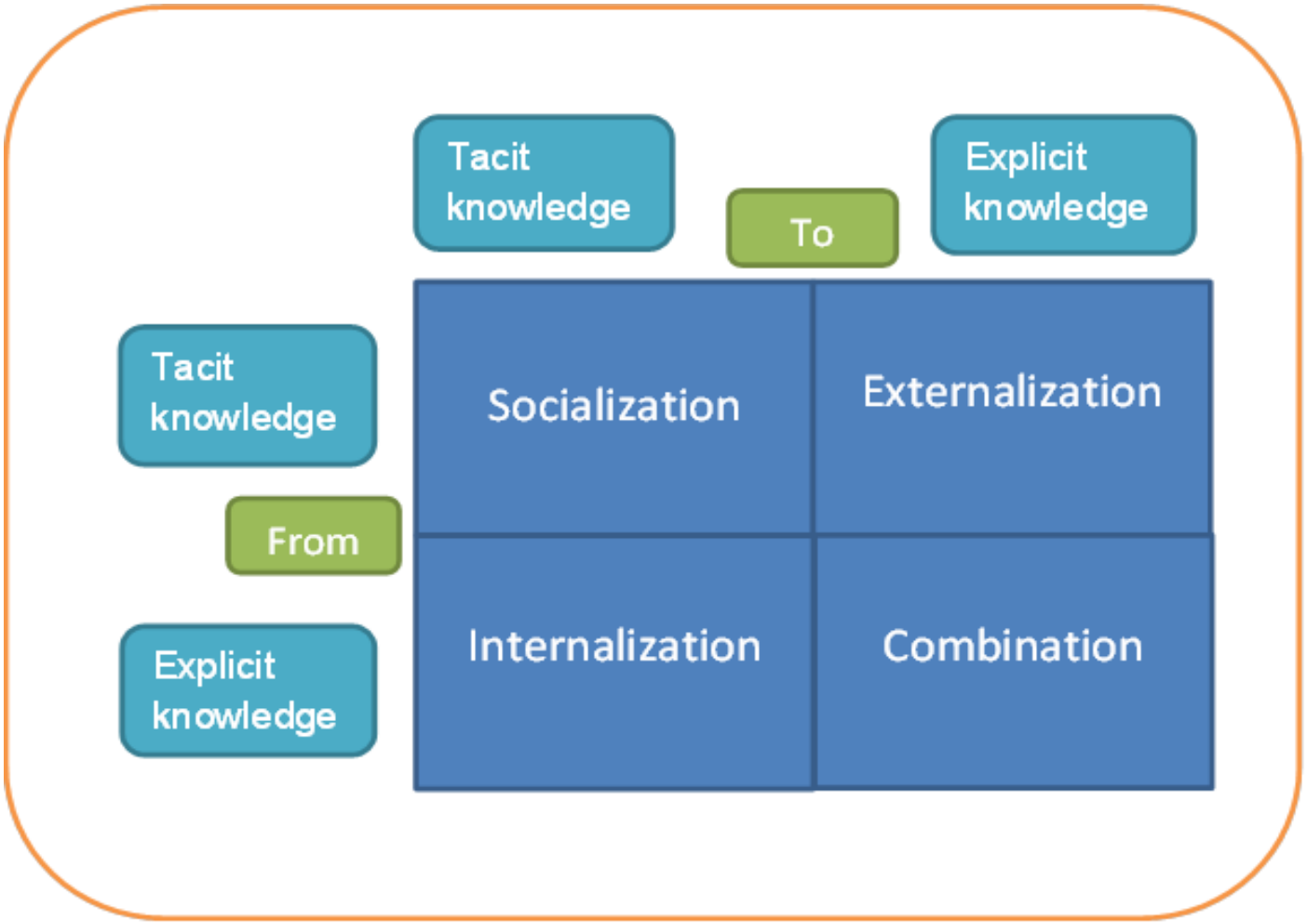
Concluding remarks

Knowledge transfer to SMEs in Network

- Each company has their own mentor (researcher, professor, etc.) for the whole project period
- The creative environment in networks introduces many new ideas and innovative projects (3 to 6 projects in each SME)
- Mostly big projects
- Established networks last several years
- Use of R&D knowledge for solving specific challenges
- Use of students as trainees, in bachelor and master's theses/projects
- Increased knowledge in the SME's, and also in the institutes


TACIT KNOWLEDGE DIMENSIONS
Edinburgh Napier UNIVERSITY
Data
Reports
Information
Documentation
Explicit
Tacit
Tips & Tricks
Know-how
Skills
Best practices
Problem solving
Technical dimension
Expertise
Cognitive dimension
Understanding
Assumptions
Viewpoints
Mental models
Emotions
Ideas
Intuition

The knowledge creation model



Source: Nonaka and Takeuchi (1995)

Localization of the project in Poland

Targeted industries

Industrial processing
- Food
- Fruits/vegetables
- Wood/furniture
- Mechanical
- Public/private health facilities

Koncepcja podziału administracyjnego Polski wraz z zasięgiem obecnego woj. mazowieckiego

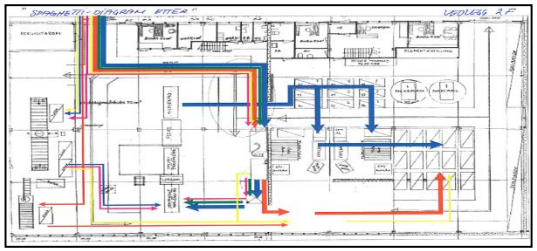
PODLASKIE VOI

LUBELSKIE VOI

NTNU

Company visits in Bialystok

Company visits in Lublin



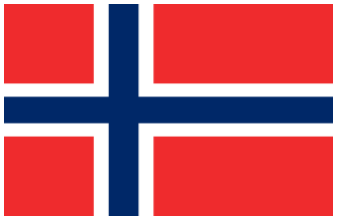
Polish companies visit Norwegian companies

Sandvik Teeness AS 17. November 2016

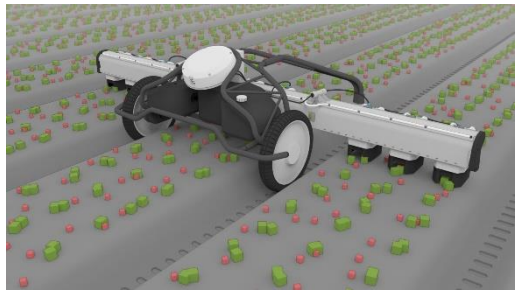
Concluding remarks

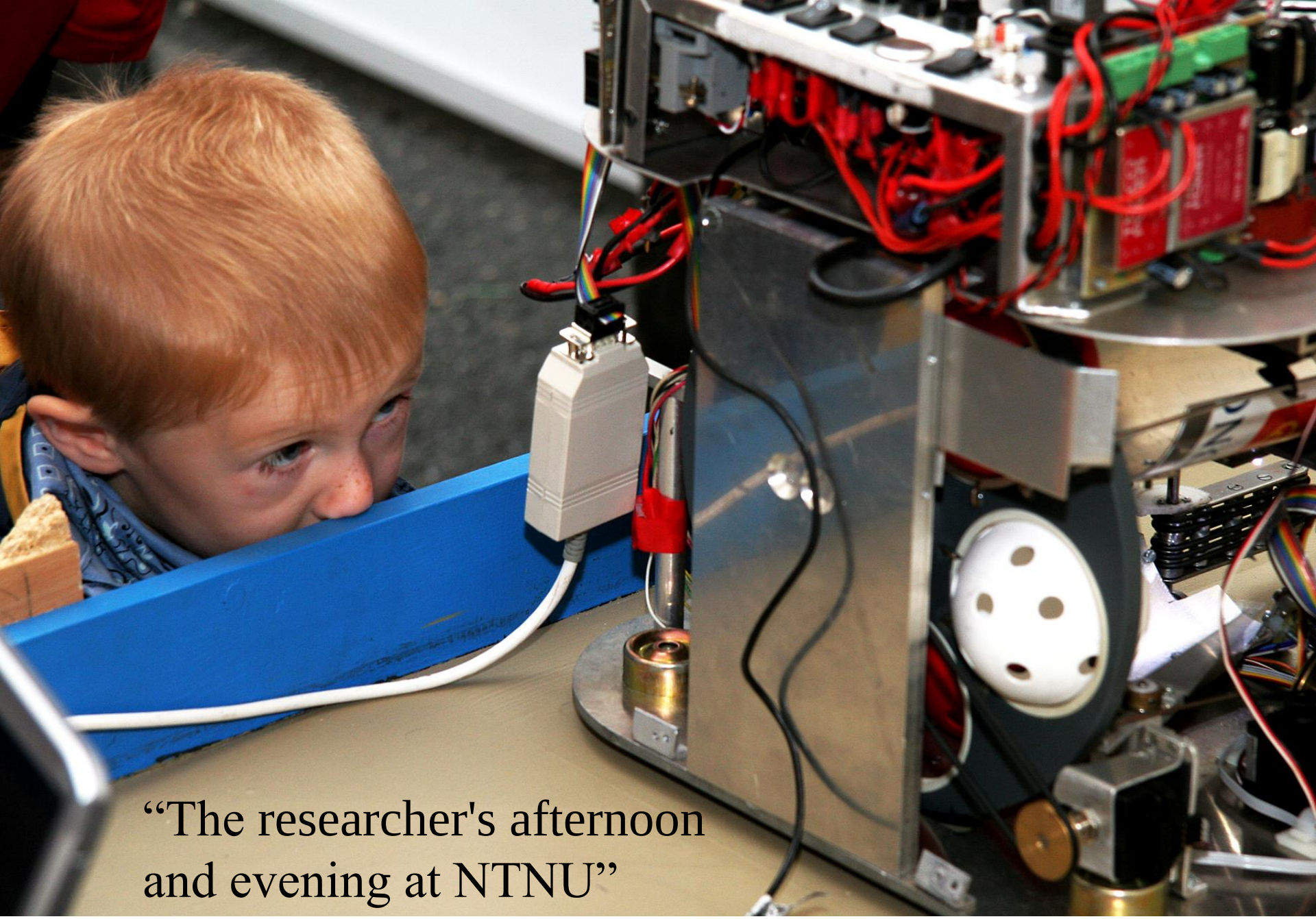
- Knowledge transfer between two countries generates both opportunities and challenges
- Several cultural factors can affect the knowledge transferring process
- Challenges regarding languages
- Need time to develop and strengthen trust
- Strong focus on creating a common ground of understanding
- Exchange of experience on more levels:
  - Institutional in both countries
  - Between the companies
  - Between the experts involved in the project
  - In the organization of support systems for SMEs
- Use of students are highly welcome

Aspects that characterize Norwegian SMEs



- Short distance between employees and management
- Employees who largely take responsibility
- Well educated people and high competence
- Use of students in the project work are valuable and inexpensive
- Culture for collaboration within the company - and also between companies
- Strong focus on sharing knowledge and experience
- There are very many SMEs in the Norwegian production industry
- Advisory board with external members
- High labor costs
- Great focus on automation and efficiency
- High IT competence in the Norwegian population





Young man study new technology

Photo: Menzt Indergaard, NTNU

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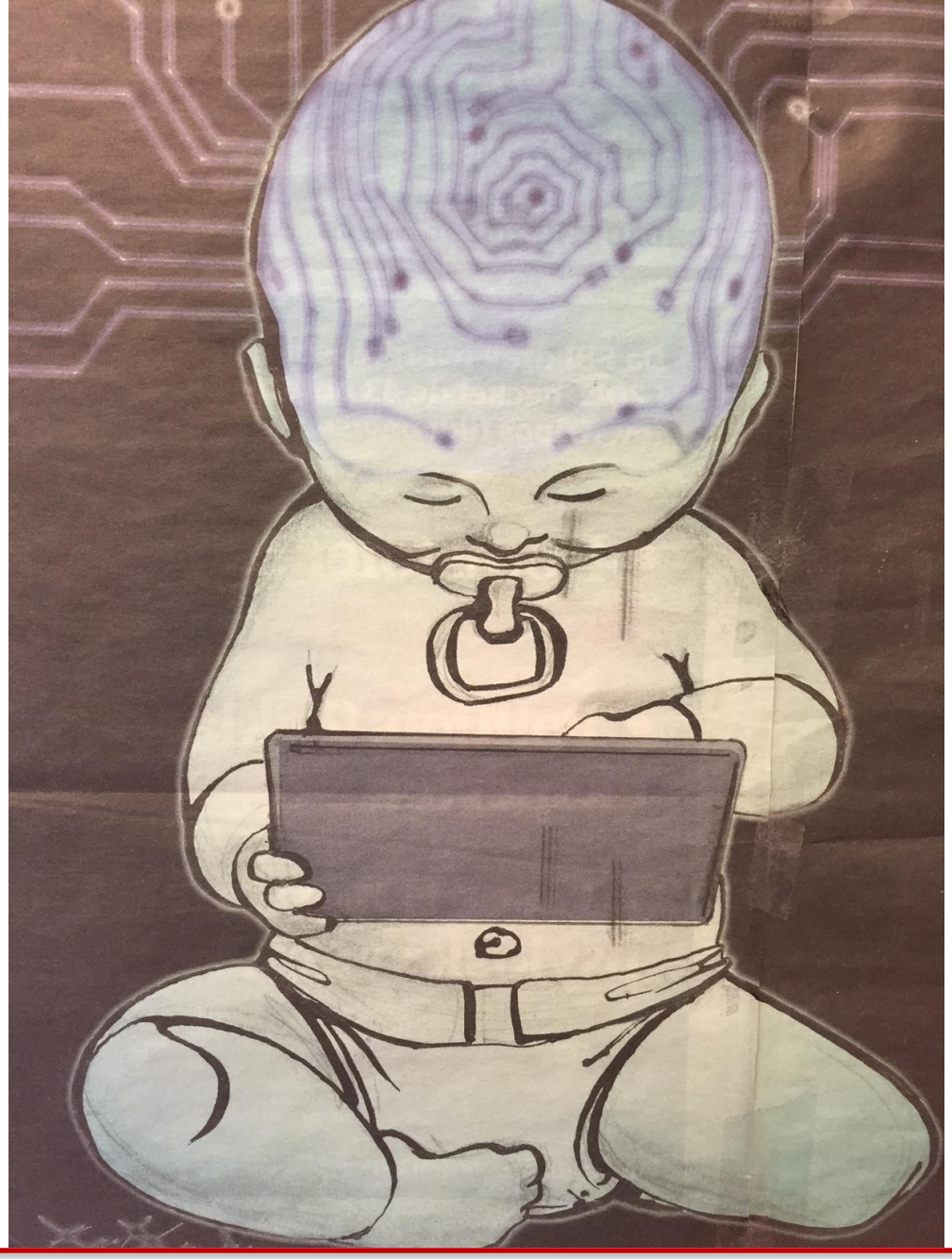

"Those who use ipad in early age benefit from it. They are better prepared for adulthood than the parents were"

Trygve Lundemo
www.adressa.no

Trends for the future

- Young people and IT
- Technological innovations
- More and more information
- Knowledge explosion
- Digitalization
- Network society
- Globalization
- And so on -------

Illustration: Karl Gundersen

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Labor cost per hour for industrial workers

Norwegian NOK in 2011

Automation and efficiency in production

Process development and automation

Analysis of 117 projects

Type	Classification of projects	%
A	New concept – new process	24
B	General automation and efficiency	18
C	Automation analysis/robotics	14
D	Logistics/material flow	10
E	Machining	10
F	Maintenance	9
G	Continuous improvement with 5S	9
H	Production planning and management	6

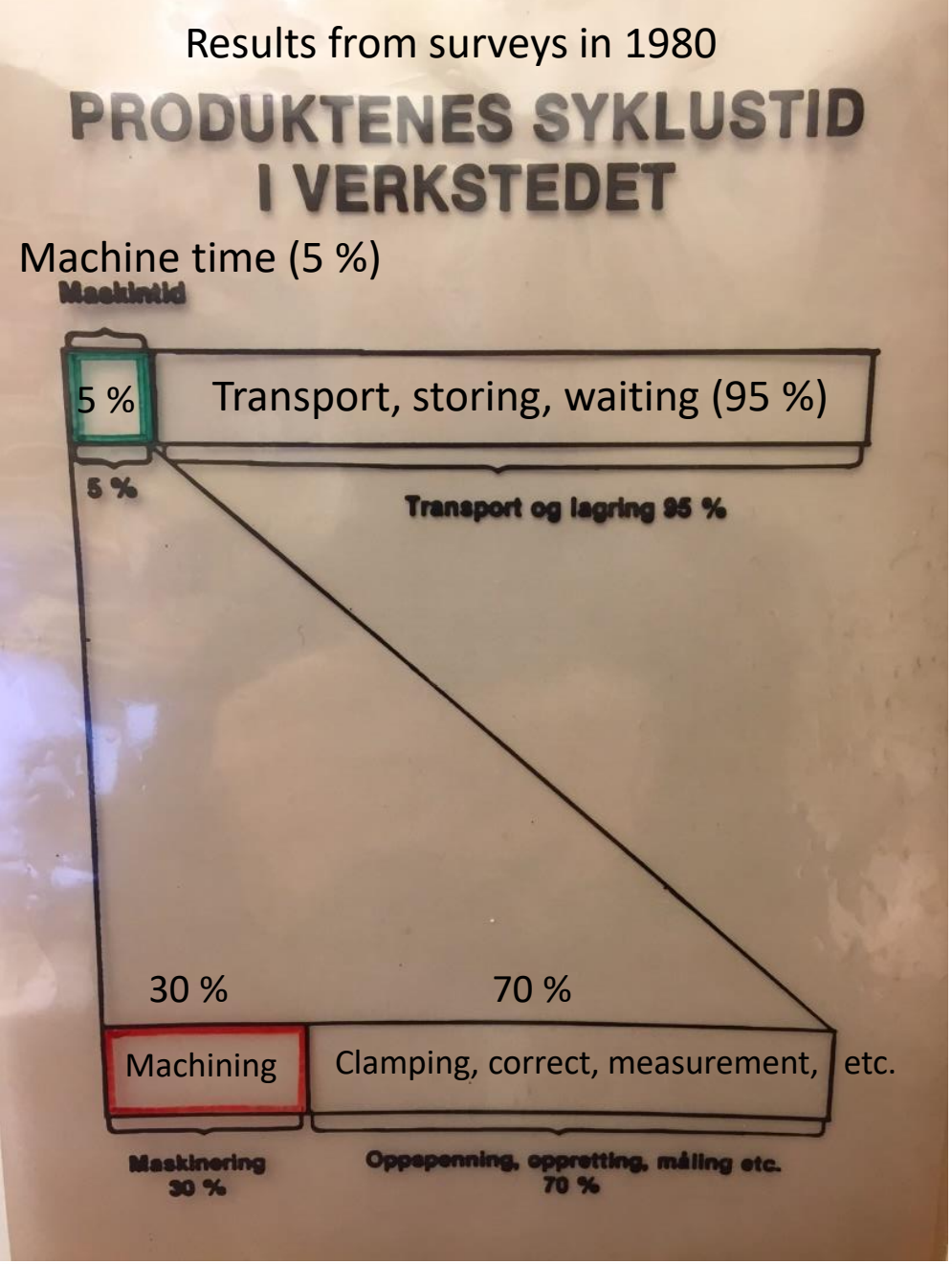
“Analysis of the potential for automation”

Process and product development

"Gluing of complex wood constructions"

Typical project within the food industry

Results from surveys in 1980



Cycle time for products in the workshop

“Processing of reindeer lichen/moss and development of new products”

“Evaluation of an idea”

NTNU

Concluding remarks

A national study in Norway

- 94 % of the participated SMEs would like to cooperate with Universities and R&D institutes again
- 92 % of the participated scientists would like to cooperate with SMEs again

Thank you for your attention

The Production Process and The Hidden Factory

Ideas

Needs

Product development
Design

What

Product
Spec.

Demands

Technology
planning

MRP

How

Production
Spec.

Internal
orders

How much
When

Raw materials

Production

Finish
products

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WASTE IN THE FACTORY

	Examples of waste	Definition/or the question is
1	Overproduction	Is it necessary to spend time to produce more than you can sell?
2	Storing	How much do you really need to have in stock? Remember that goods in stock is a cost driver
3	Transportation	How much time is spent on internal transport? (Materials, parts, products, people, etc.?
4	Over-processing	Is it necessary that the chassis under your car is shiny?
5	Waiting	How much time is spent on waiting?
6	Unnecessary movements	It is used unnecessarily much time to move around? Where are things located?
7	Rework	How much time is spent on correcting mistakes and errors? (Defects, rejects and scrap)
8	Unused creativity	Are the human resources adequately utilized?

Source: Olga and Marta

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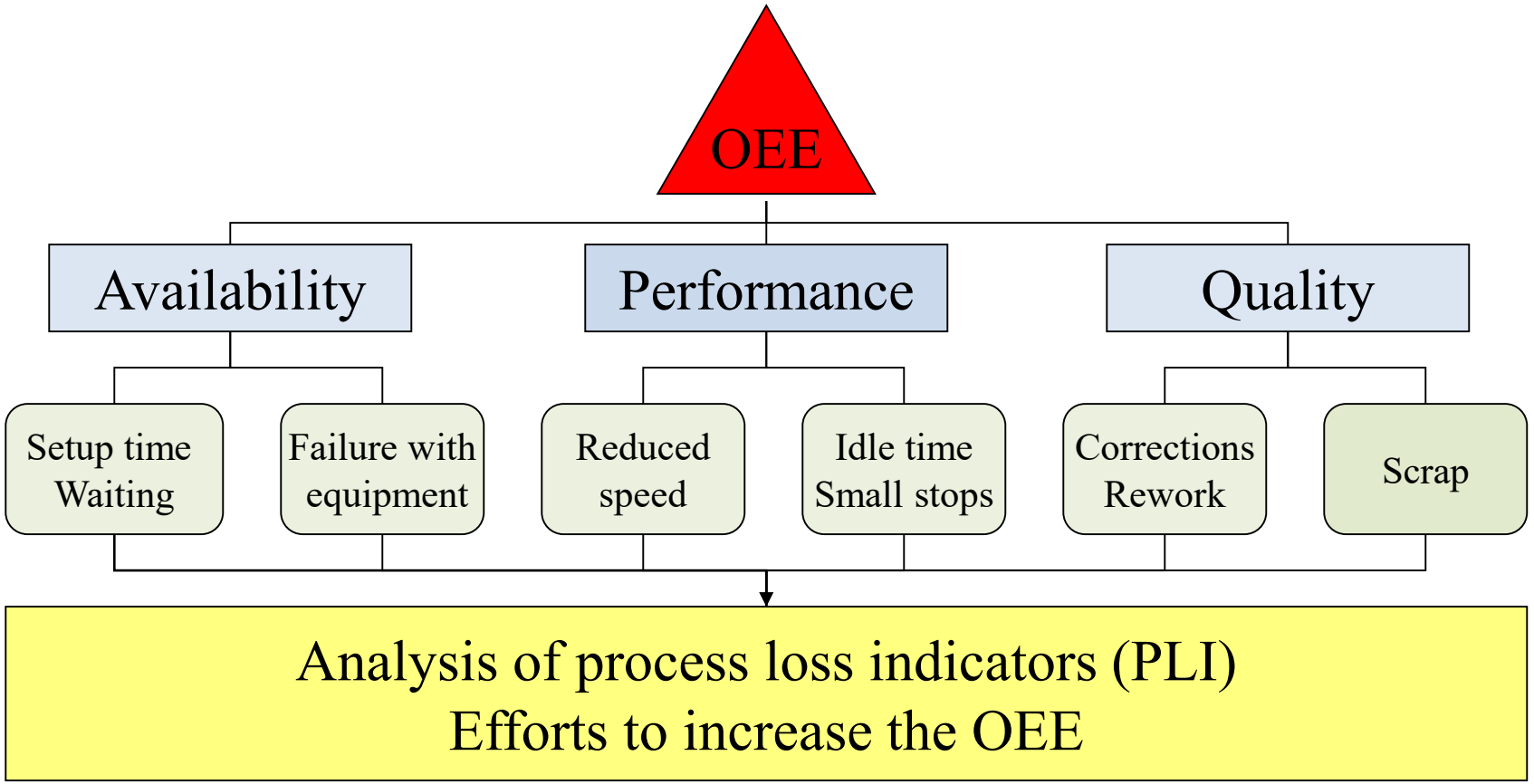
OEE – Overall Equipment Efficiency

A measurement parameter used to monitor and improve
the efficiency of manufacturing processes



The OEE-Model

Total operation time			
Availability	A: Potential production time		No production scheduled
	B: Actual production time	Availability losses, like breakdowns, waiting, changeover	
Performance	C: Theoretical output		
	D: Actual output	Performance losses, like minor stops, reduced speed	
Quality	E: Actual output	*Effectiveness loss*	
	F: Good product	Quality losses like, scrap, rework, corrections etc.	
OEE = Availability rate x Performance rate x Quality rate			
OEE = B/A x D/C x F/E			

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OEE – Overall Equipment Efficiency

A standard measure for reporting business performance to management and business owners

Example: Manufacturing Company's plant is scheduled to operate for 16 hours (960 minutes) per day, 5 days a week, 50 weeks per year. Last year, the plant produced an average of 480 units per day, of which 460 met the quality specifications. The plant had on average of one product changeover per day, lasting 30 minutes, and experienced an average of 100 minutes per day of unplanned downtime. The plant was designed to produce 40 units per hour. Daily theoretical output = 40 x 16 = 640 units

Availability: Scheduled Time = 960 minutes per day. Available Time = 960 minutes scheduled minus (100 minutes unscheduled downtime + 30 minutes' changeover) = 830 minutes/day. Availability = 830 available minutes/960 scheduled minutes = 0,865

Performance: Actual output/theoretical output = 460 units/640 units = 0,750

Quality: 460 good units/480 produced units = 0,958

OEE = Availability x Performance x Quality = 0,865 x 0,750 x 0,958 = 0,622 => **62,2 %**

Toyota has the highest OEE output in the world, with an OEE-factor at 90 %. In Europa OEE average was around 42 % in the early 2000s.

Normally, less than an OEE at 65 % should be considered unacceptable, since it represents a very low competitiveness and a great number of economic losses (PLI)

Music and football are “communication languages”

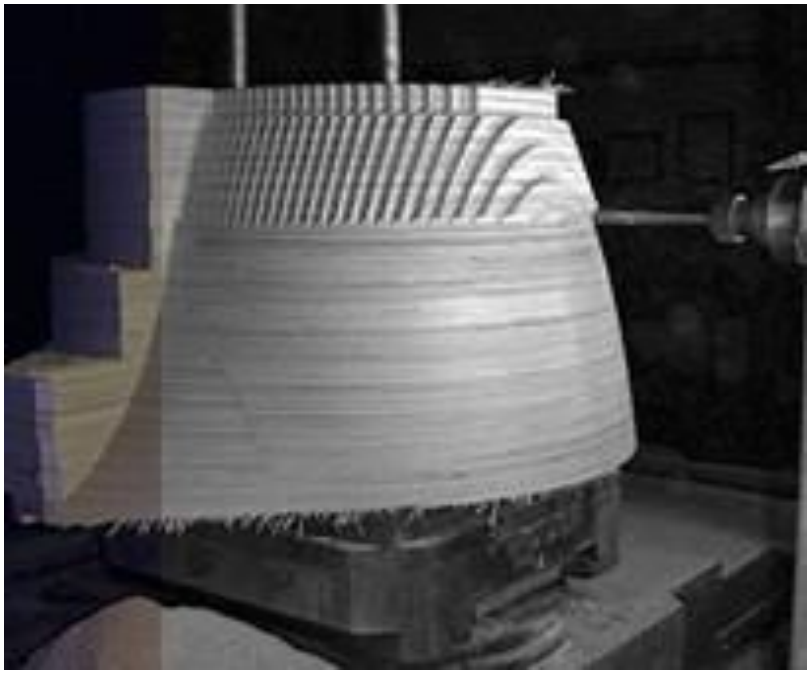
https://www.youtube.com/watch?v=bAdqazixuRY

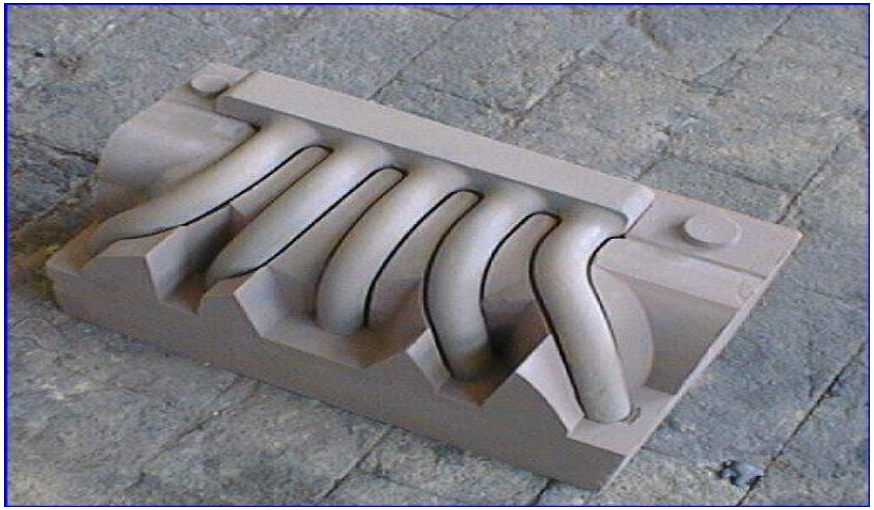
https://www.youtube.com/watch?v=Es3Vsfzdr14

Mechanical industry

Processing and preventive maintenance

Competence for advanced machining





Modelling and foundry techniques

Megatrends

Knut Erik Solem, professor ved NTNU

Megatrends are important, however the development is not linear. Many basic conditions changing faster than these megatrends.

Some earlier example of predictions for the future:

- Aircrafts heavier than air is impossible (Lord Kelvin, president Royal Society, U.K. 1895)
- Stock prices seem to have reached a permanent high level (Irving Fisher, economy professor at Yale, 1929)
- I think there is a world market for maybe five computers (Thomas Watson, President at IBM, 1943)
- We do not like their sound, and moreover guitar music is on the way out (Decca Recording Co about the Beatles, who was dismissed in 1962)
- The Wall will still be there in 50 years, yes, even in 100 years (Erich Honnecker, DDR in February 1989)

Aspects that characterize Polish SMEs in the project

- Centralised management style – most of the companies in the project have one or two owners which are also responsible for daily management
- Companies are also in relevant part family companies where at least to generations are involved in daily operation
- Small culture for external cooperation
- The business culture is low trust culture, which is also the result of the historical set up
- Approach towards sharing knowledge and learning is initially reluctant. It takes time to build up the trust and convince the participants that delivered knowledge may be relevant and useful
- There is a strong and visible difference in approach towards learning and sharing between young (up to 45) generation and older managers, who are rather reluctant to change
- No practice of hiring external advisory board members
- Low labour costs, especially in Eastern regions

Thank you for your attention