Informatics at Aalto
– a university reinvented

Pekka Orponen
Information and Computer Science
Aalto University
ECSS 13.10.2014

Aalto University

1. The Aalto transformation
2. ICT at Aalto
3. Innovation and entrepreneurship
4. Key events and decisions
5. Future prospects

Aalto University

1. The Aalto transformation

Finnish university reform 2009

International evaluations:
In spite of excellent university-industry collaboration and links,
Finnish research and innovation system was losing ground

Parliament passed a new Universities Bill in June 2009,
enacted from Jan 2010 on

The new Universities Act extended the *autonomy* of universities
in order to strengthen their role within the system of *innovation*

Aalto University is a flagship project of the university reform. It is
governed as a *private foundation*

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Aalto University

A merger of three complementary universities in the Helsinki region

Helsinki University of Technology, est. 1849

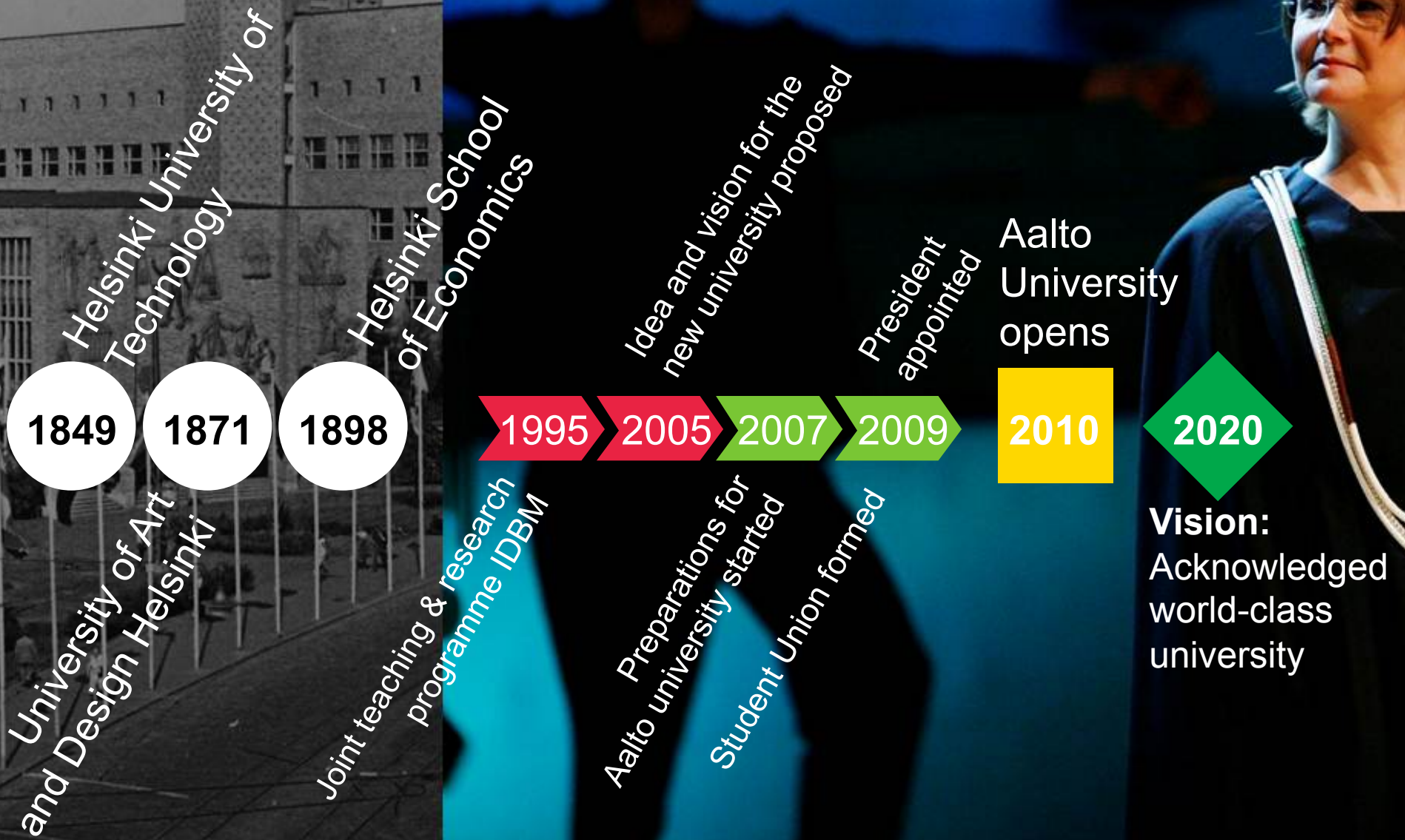University of Art & Design Helsinki, est. 1871

Helsinki School of Economics, est. 1911

Direct Government funding: PLUS 60-80 M€ pa until 2015

Endowment: Campaign 200M€ Government 500M€ Currently ~1000 M€

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Aalto University Timeline

Helsinki University of Technology

1849

University of Art and Design Helsinki

1871

Helsinki School of Economics

1898

Joint teaching & research programme IDBM

1995

Idea and vision for the new university proposed

2005

Preparations for Aalto university started

2007

Student Union formed

2009

President appointed

2010

Aalto University opens

2020

Vision: Acknowledged world-class university

Aalto: Basic facts

Community

- Second largest university in Finland after Univ. of Helsinki
- Over 5,000 faculty and staff, including 370 professors
- 20,000 students
- 75,000 alumni

Finances 2013

- Government budget funding 275 M€
- Supplementary (projects etc.)143 M€
- Endowment returns 33 M€

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Schools of Science*, Art, Technology* and Business

School of **Arts, Design and Architecture**

School of **Chemical Technology**

School of **Business**

School of **Electrical Engineering**

School of **Engineering**

School of **Science**

Budgets for 2014:

Science and Technology 67 %
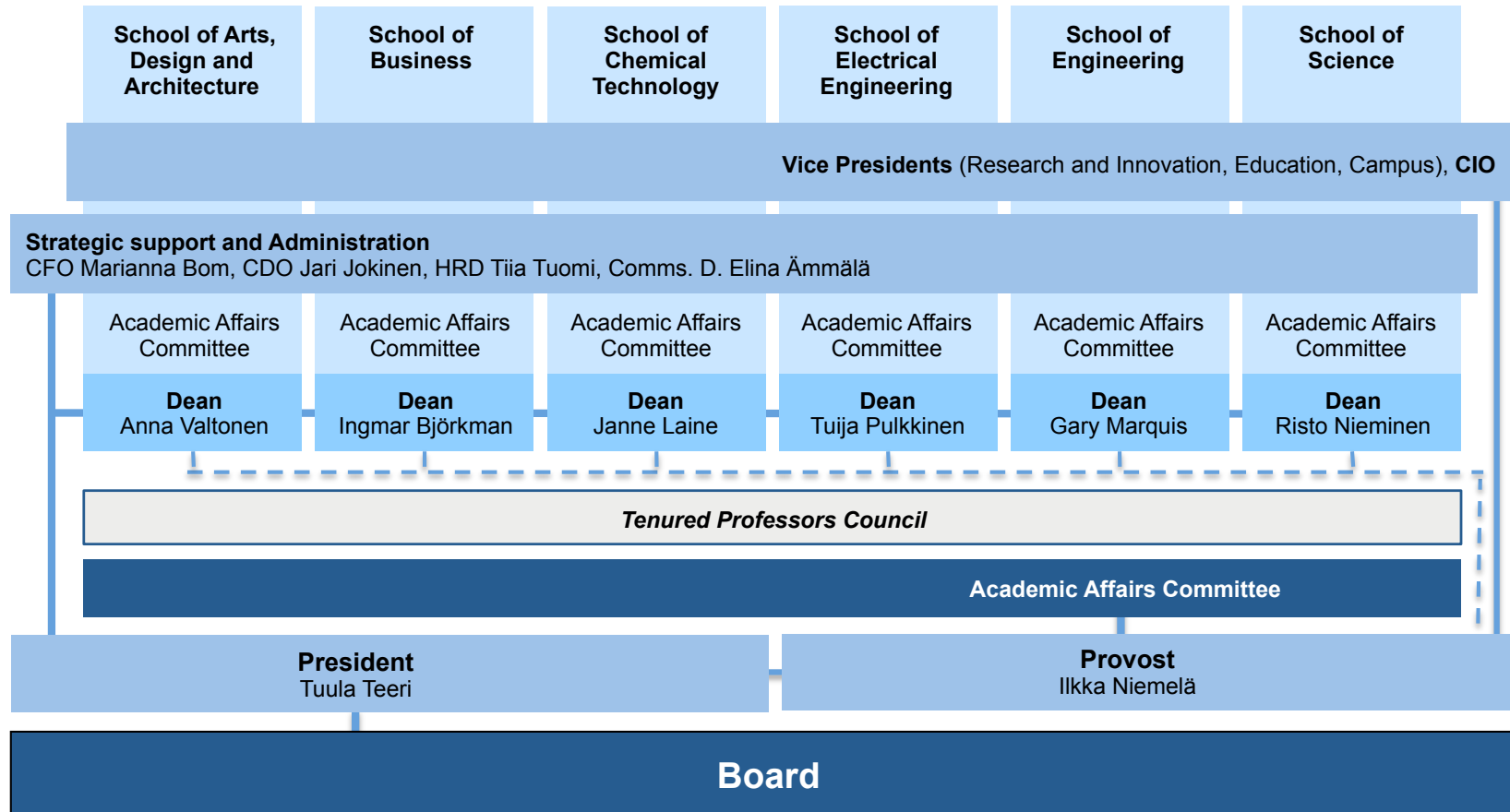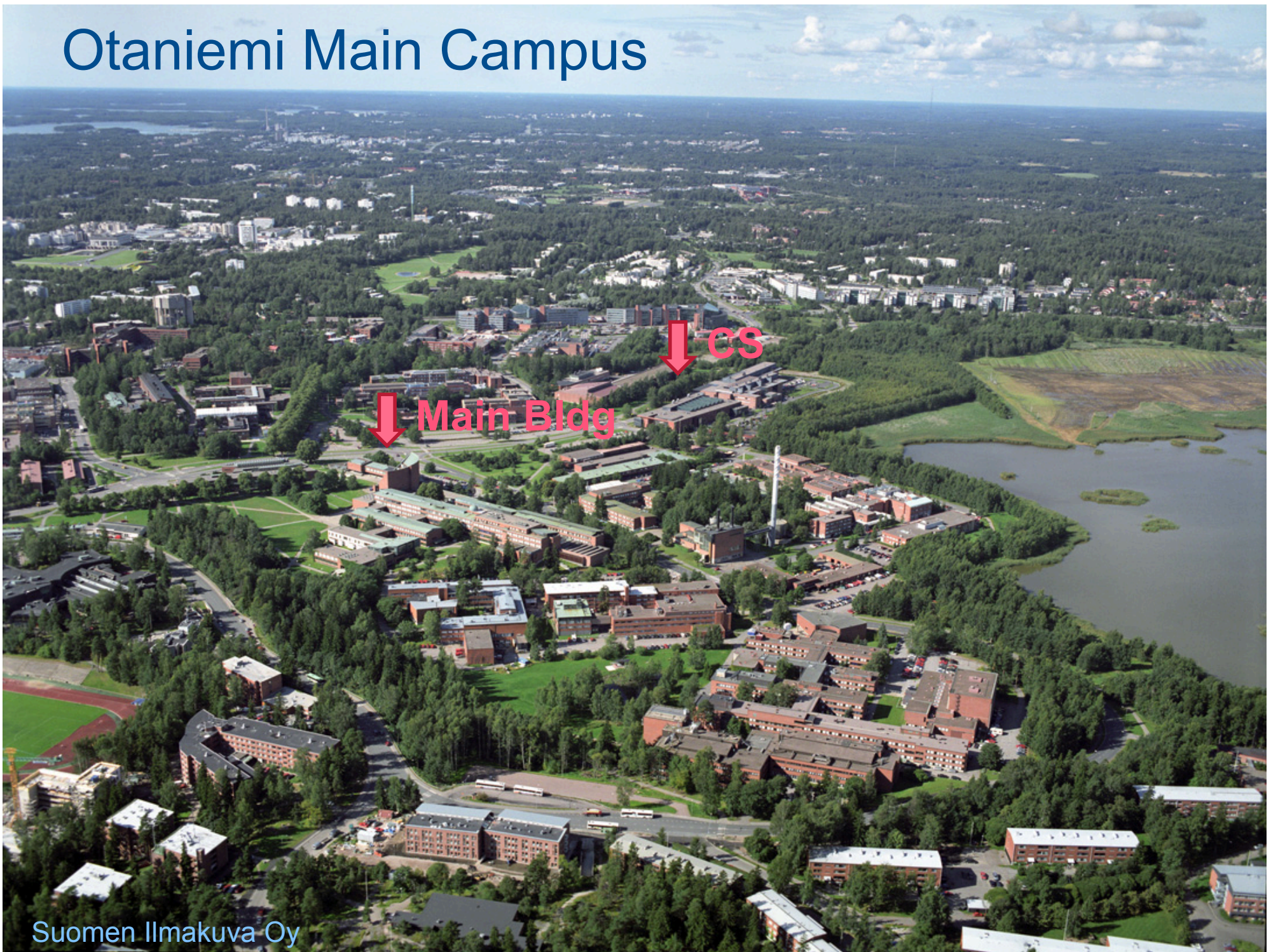
Art, Design and Architecture 18 %

Business 15 %

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* Four schools were built from the former Helsinki University of Technology.

Aalto University: *organisation*

School of Arts, Design and Architecture	School of Business	School of Chemical Technology	School of Electrical Engineering	School of Engineering	School of Science

Vice Presidents (Research and Innovation, Education, Campus), **CIO**

Strategic support and Administration
CFO Marianna Bom, CDO Jari Jokinen, HRD Tiia Tuomi, Comms. D. Elina Ämmälä

Academic Affairs Committee	Academic Affairs Committee	Academic Affairs Committee	Academic Affairs Committee	Academic Affairs Committee	Academic Affairs Committee
Dean Anna Valtonen	**Dean** Ingmar Björkman	**Dean** Janne Laine	**Dean** Tuija Pulkkinen	**Dean** Gary Marquis	**Dean** Risto Nieminen

Tenured Professors Council

Academic Affairs Committee

President Tuula Teeri	**Provost** Ilkka Niemelä

Board

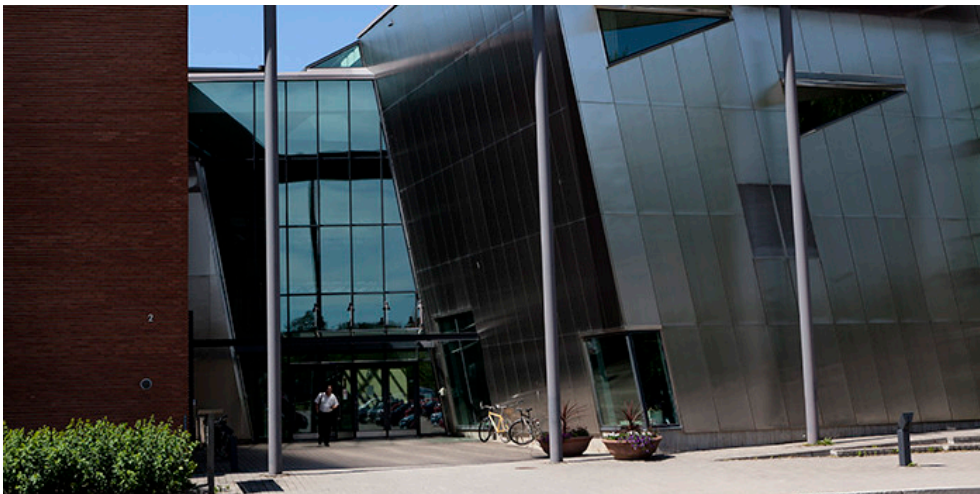Aalto University

Otaniemi Main Campus

CS

Main Bldg

Suomen Ilmakuva Oy

Otaniemi old Main Building, by Alvar Aalto

Entrance to CS Building

Goal: Research *excellence*
Building on strengths identified in RAE 2009

5 National Centres of Excellence in Research 2 ERC Advanced Grants 10 ERC Starting Grants 7 Academy of Finland professors and over 35 research fellows. Aalto is coordinator / partner in EU projects with total budgets of about 1 billion euros

PULL

Themes driving inter-disciplinary research

Digital society *Mobile technologies, services, media, games, entertainment*	Energy & sustainable use of natural resources *Bioeconomy*	Human-centred living environments *LivingPlus*		

World class potential

Global business dynamics	Process and systems competence	Architecture	Art	

World class

Computation and modeling	ICT	Materials	Design	New media

Based on extensive international research evaluation (RAE), 2009

PUSH

A? Aalto University

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Art

World class

Computation and modeling

ICT

Materials

Design

New media

Based on extensive international research evaluation (RAE) 2009

PUSH

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Research *excellence*

Key Performance Indicators:

- Publication quality (Crown Indicator)
- \# of ERC grants
- Competitive research funding
- Awards & recognition
- Quality and quantity of interdisciplinary projects
- Tenured professors (e.g. h-index; Hirsch index)

Emerging strength in Processes and Systems, Economic Systems and Management, Art and Architecture.

The current research strength in Computation and Modeling, Materials, Design, ICT and Media.

Interdisciplinary themes selected for future development of interdisciplinary programmes include Digitalisation, Services, Energy and Sustainable Use of Natural Resources and Human-Centric Living Environments.

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< Back to chart

Pioneering education

|		
	Students as co-creators	• Increasingly project based courses with real-life cases from the industry • Students as co-creators leads to new openings, increased motivation and self-confidence
	Crossing borders	• Risk-taking and diversity as resource • Multidisciplinary Master programs (IDBM, CCIS), Aalto mobility courses between disciplines, Factories, AALTOnaut minor • International links and collaboration
	Alignment of studies and gaining work experience	• Comprehensive set of transferable skills for working life • Integrating summer internships and external projects to the studies • Systematic coordination of thesis projects • **Easy access to industrial leaders, entrepreneurs**
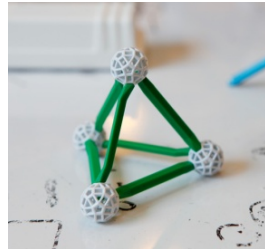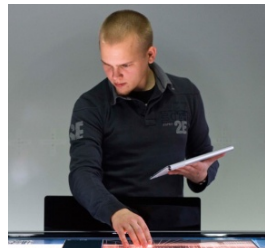
	Entrepreneur-ship	• Startup Sauna, Aalto Ventures Program, Aalto Centre for Entrepreneurship in collaboration with Stanford University
		  • Entrepreneurial culture, mindset and skills
		  • Business acceleration
		  • Ecosystem creation

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Pioneering education

Aalto University is an international and multicultural learning community.

KPIs:

- Teaching quality
- Student performance
- Alumni & employer satisfaction
- Multidisciplinary graduates
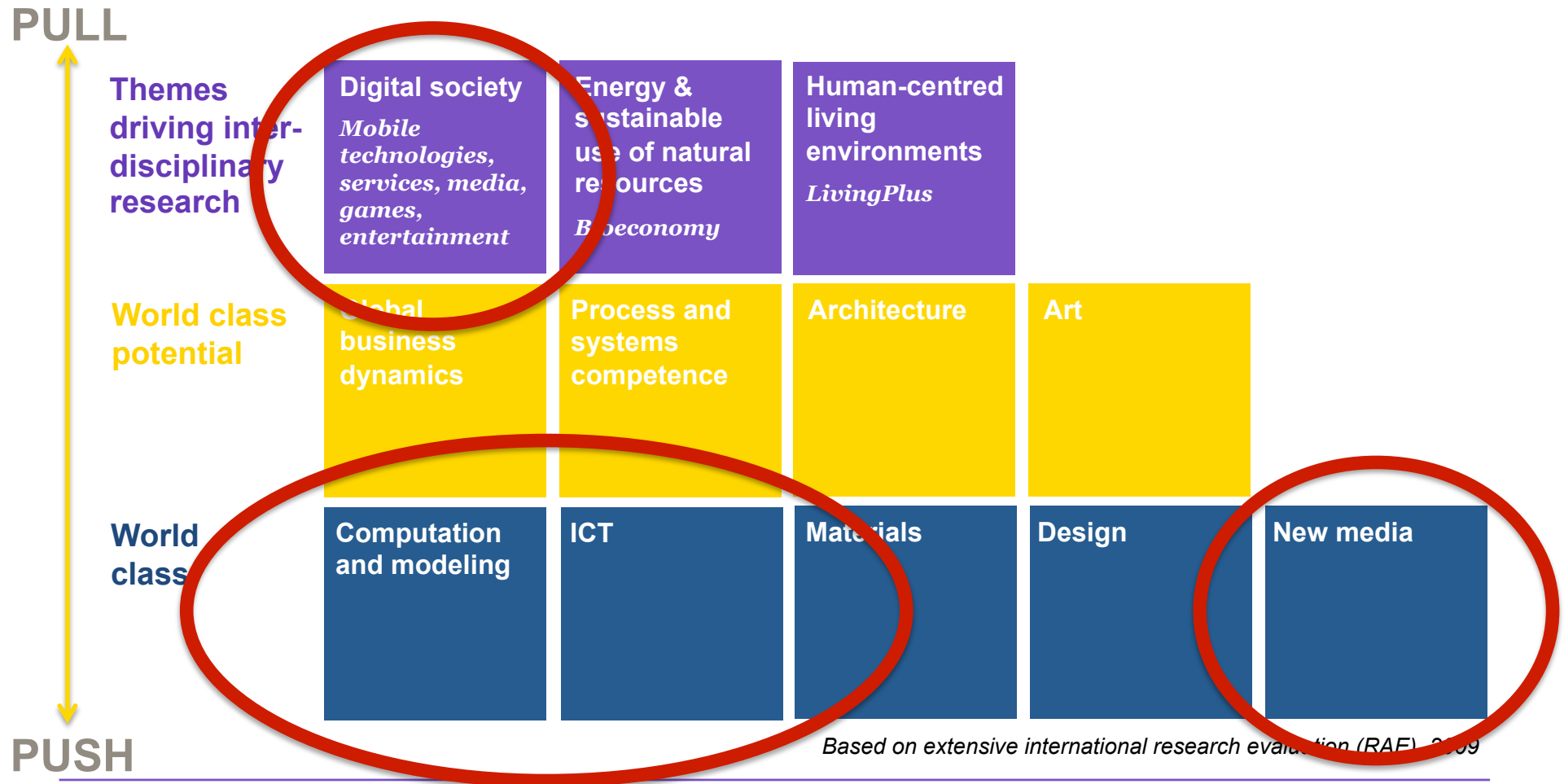
Over 15 000 applicants, only one in ten accepted

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2. ICT at Aalto

1. University view
2. Five core ICT departments
3. The ICT M.Sc. programme reform

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2.1 ICT at Aalto – the university view

PULL

Themes driving inter-disciplinary research

Digital society
Mobile technologies, services, media, games, entertainment

Energy & sustainable use of natural resources
Bioeconomy

Human-centred living environments
LivingPlus

World class potential

Global business dynamics

Process and systems competence

Architecture

Art

World class

Computation and modeling

ICT

Materials

Design

New media

PUSH

Based on extensive international research evaluation (RAE) 2009

Aalto University

National leader in digitalisation research

- Some 80 professors in ICT and another 80 in core applications
- Competitive research funding of 50+ M€ per year
- Annually 400+ M.Sc. degrees and some 100 PhD's
- Students make some 100.000 ECTS/a in digi-relevant courses
- Several National Centres of Excellence and other strategic competitive funding in the area
- ERC and other competitive personal grants
- Close collaboration with University of Helsinki
  - HIIT – Helsinki Institute for Information Technology
  - HICT - Helsinki Doctoral Education Network in ICT
- European level networks: EIT ICT Labs

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Challenges

- ICT activities are, for historical reasons, quite fragmented across (almost?) all of the six Schools, even within a single School
- Difficult to make strategic decisions and achieve critical mass
- Solutions?
- School restructuring? → Challenging
- Chosen approach: cross-school platforms
  - Aalto Digi-platform, Aalto Energy platform

Aalto Ecosystem for crossing borders

Covers research, education and societal interaction & impact

Joint vision creation

Multidisciplinary **Platforms**

Joint spaces to meet and act

Joint activities

Hubs

Programs

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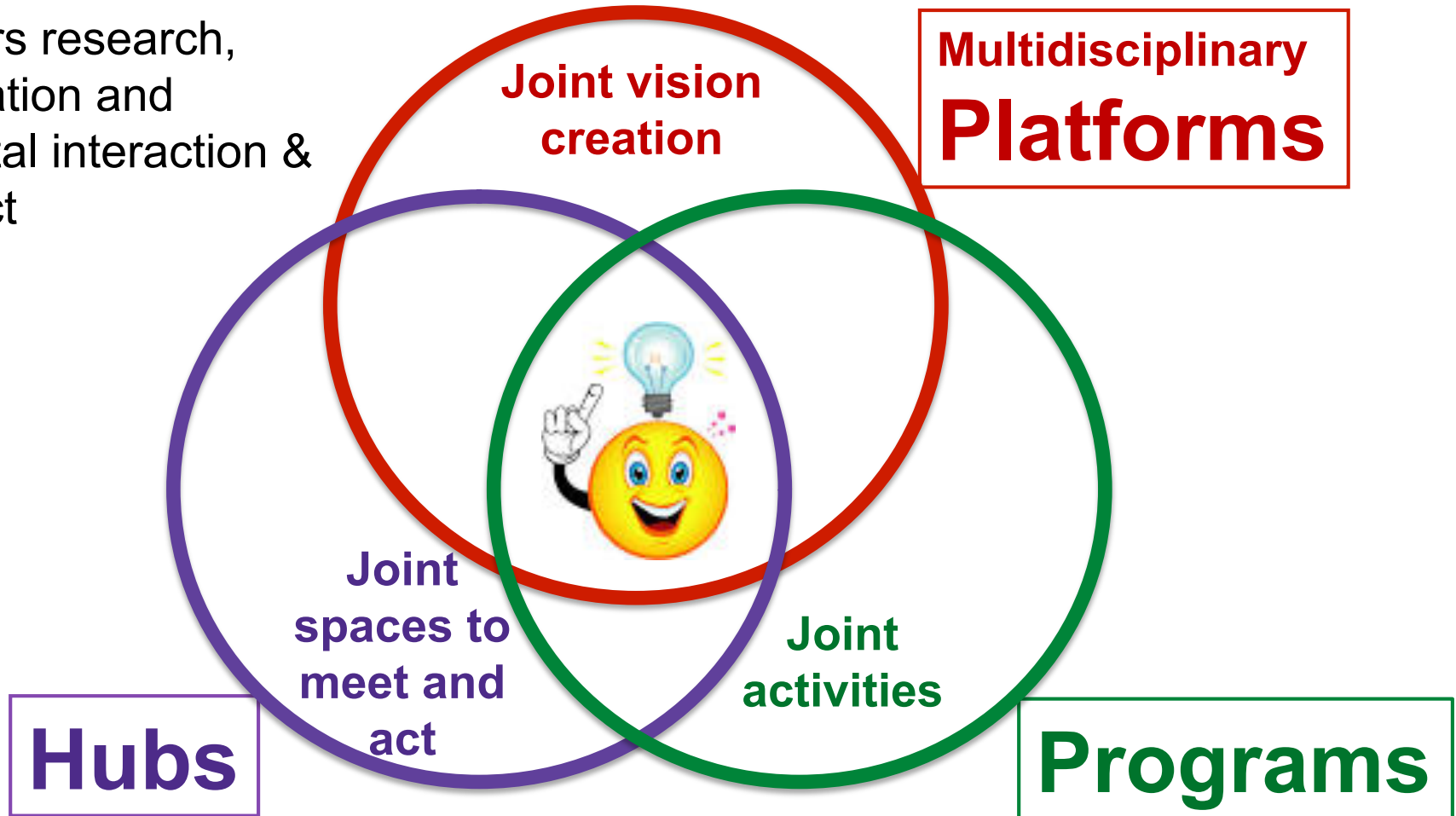
2.2 Five core ICT departments (1/5)

Department of Information and Computer Science (ICS, School of Science)

Head Pekka Orponen

Personnel 13 professors, ~120 FTE personnel, ~ 8.4 M€ total budget

Profile Methods: algorithms, machine learning etc., with advanced applications

Focus areas

1. Algorithms, logic and complexity
2. Machine learning and computational inference
3. Big data: data analysis, distributed computing
4. Smart society and sciences

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Five core ICT departments (2/5)

Department of Computer Science and Engineering (CSE, School of Science)

Head Prof. Heikki Saikkonen

Personnel 12 professors, ~130 FTE personnel, ~9.5 M€ total budget

Profile Software, systems, services

Focus areas

1. Distributed pervasive data-intensive systems
2. Applications:
   a) Industrial Internet
   b) Pervasive mobile applications
3. Empirical software engineering
4. Systems security
5. Learning technologies

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Five core ICT departments (3/5)

Department of Media Technology (MT, School of Science)

Head Prof. Lauri Savioja

Personnel 7 professors, ~57 FTE personnel, ~4 M€ total budget

Profile Efficient computational methods for media

Research directions

1. Computer science of human movement
2. Material capture and realistic rendering
3. Optimal acoustic conditions
4. Web 4.0

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Five core ICT departments (4/5)

Department of Communications and Networking (COMNET, School of Electrical Engineering)

Head Prof. Riku Jäntti

Personnel 9 professors, ~110 FTE personnel, ~7.7 M€ total budget

Research areas

1. Advanced radio systems
2. Evolving Internet
3. Information theory
4. Network architectures, protocols, and services
5. Network economics
6. Network security and trust
7. User interfaces

Five core ICT departments (5/5)

Department of Signal Processing and Acoustics (SPA, School of Electrical Engineering)

Head Prof. Jorma Skyttä

Personnel 10 professors, ~100 FTE personnel, ~7.5 M€ total budget

Research areas

1. Audio signal processing
2. Communications acoustics: spatial sound and psychoacoustics
3. Metrology
4. Speech communication technology
5. Speech recognition
6. Speech technology

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2.3 The ICT M.Sc. programme reform

• As of Autumn 2015, the five core ICT departments will join together to offer a common cross-school (SCI + ELEC) M.Sc. degree programme on Computer, Communication and Information Sciences (CCIS)

• The programme will merge together all the former 10+ M.Sc. programmes in which the departments were previously participating

• The programme is expected to host ~350 students and graduate ~150 M.Sc. degrees per year

• Two broad majors
    – Computer Science
    – Communications Engineering

• Six specialised majors

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The CCIS M.Sc. programme

- Joint Master's Degree Program organised by Aalto Schools of Science (SCI) and Electrical Engineering (ELEC)
- Eight majors and altogether 16 tracks
- Faculty includes over 40 professors
- All teaching in English
- Majors:

  - *Computer Science (broad, six tracks)*
  - *Communications Engineering (broad, four tracks)*
  - *Software and Service Engineering*
  - *Mobile Computing, Services, and Security*
  - *Acoustics and Audio Technology*
  - *Machine Learning and Data Mining*
  - *Speech and Language Technology*
  - *Game Design and Production*

Example: The Computer Science major

Organised jointly by four departments:

- *Computer Science and Engineering*
- *Information and Computer Science*
- *Media Technology*
- *Communications and Networking*

Six different tracks (broad major)

Faculty includes 24 professors

Structure of Computer Science major

Core Courses (choose at least 2)

- Computer Graphics
- Discrete Models and Search
- Information Security
- Machine Learning: Basic Principles
- Operating Systems
- Principles of Algorithmic Techniques
- Web Software Development
- User Interfaces

Tracks (can specify further core courses)

- Algorithms, Logic, and Complexity
- Big Data and Large-Scale Computing
- Interactive Technologies
- Secure Systems
- Software Systems and Technologies
- WWW Technologies, Applications, and Science

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3. Innovation and Entrepreneurship

1. Corporate collaboration
2. Student-driven entrepreneurship
3. EIT ICT Labs

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The Otaniemi peninsula & bay area: a hub for technology, business and arts

CS & OIH

5 billion euros to be invested in the area

Suomen Ilmakuva Oy

3.1 Corporate collaboration

The university has built a number of long-term strategic partnerships with significant Finnish and international enterprises.

pwc

Microsoft®

tieto

eit
EIT ICT Labs

NOKIA
Connecting People

KONE

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The university has an extensive network of partnerships in corporate collaboration and research-based entrepreneurship.

3.2 Student-driven entrepreneurship

Aalto Center for Entrepreneurship and **Aalto Venture Garage**

Aalto ecosystem – a European startup hotspot

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Venture Garage

Where **New Technologies** Meet **Ambitious Entrepreneurs**

AALTO VENTURE GARAGE
aaltovg.com

50 Startups
Community of **3000** Entrepreneurs

AALTO**ENTREPRENEURSHIP**SOCIETY

Garage Coaches:
VC Funding Raised $**200M**
20 Exits Made

m / twitter.com/KristoOvaska

A! Aalto University

- The actual place where Android Aalto, Startup Sauna, etc., are happening
- On Otaniemi hitech hub campus
- Coaches include the founders of Angry Birds and MySQL
- Very exciting place and concept
- **In the middle of a campus of 32,000 hitech professionals and scholars from 110 countries**

Startup Sauna
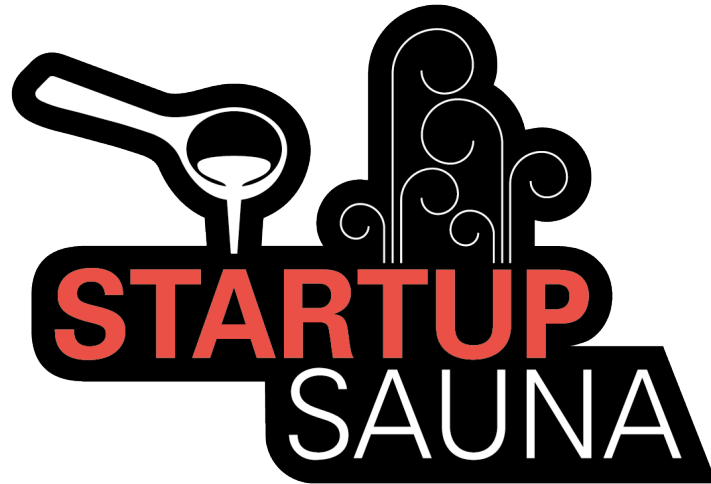
"Student-run growth entrepreneurship catalyst in Aalto University."

aaltoes.com

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- New breed of startup development (formerly known as "incubation" in some places)
- Based on the question: **Do you have a scalable, product-based global success story or not?**
- If yes, then you're developed. Hard!
- Not only Finland, but the whole Baltic Rim
- Initiated and operated by a student-run "Aalto Entrepreneurship Society" (AaltoES)
- Supported by Aalto University
- Of course in Otaniemi, just like Android Aalto, etc.
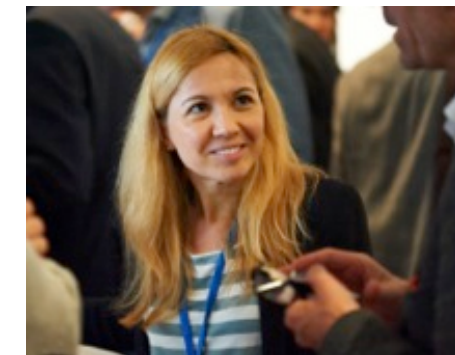
3.3 EIT ICT Labs

EIT ICT Labs' mission is to drive European leadership in ICT-related innovation to foster economic growth and enhance the quality of life of European citizens..

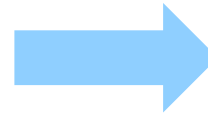# A Pan-European Innovation Ecosystem
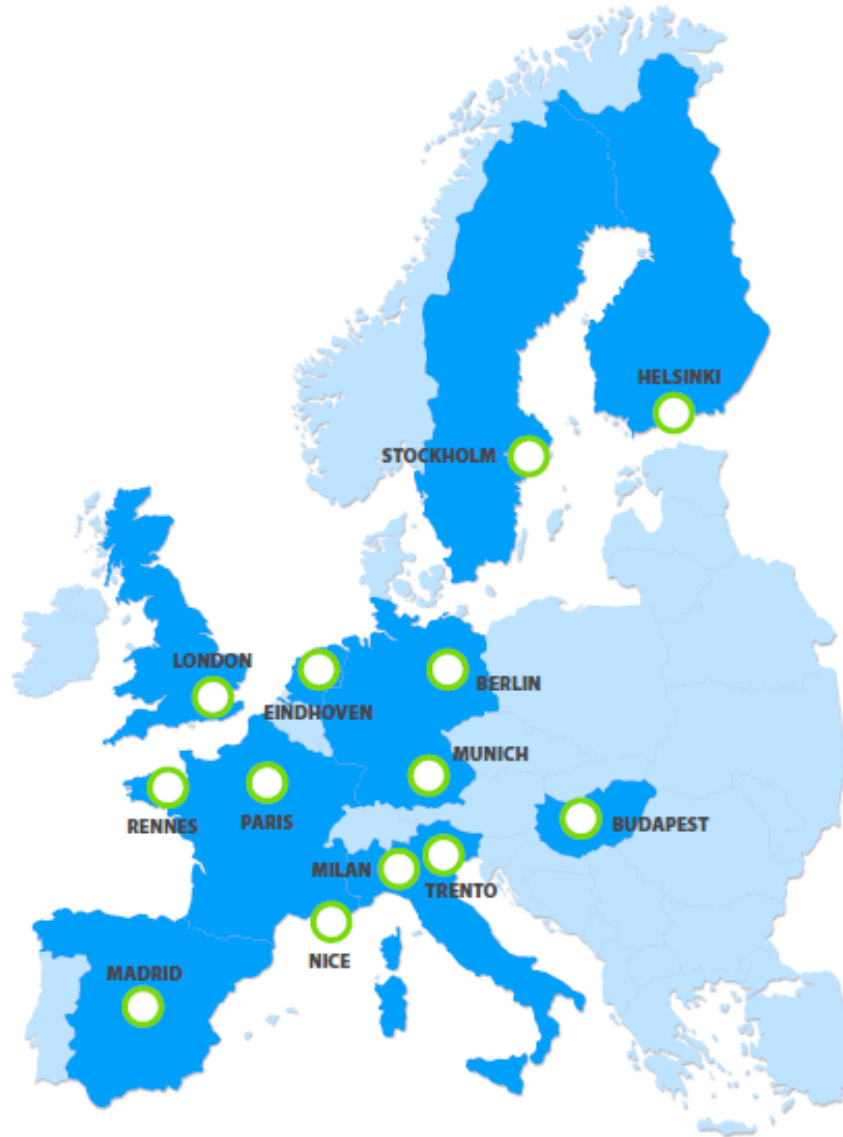
Core Partners

Affiliate Partners

Action Lines

Deploy ICT in the European environment and industry (innovation **with** ICT)

- Quality of life in our cities
- Intelligent environments
- A healthy life
- Sustainable energy supply
- Made in Europe and secured critical infrastructures

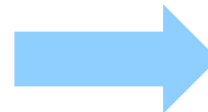**CYBER-PHYSICAL SYSTEMS**

HEALTH & WELL-BEING

SMART ENERGY SYSTEMS

SMART SPACES

URBAN LIFE & MOBILITY

Create a safe and competitive European ICT infrastructure (innovation **in** ICT)

- Future Communication
- Service and Data Infrastructures
- Safe Cyberspace

FUTURE CLOUD

FUTURE NETWORKING SOLUTIONS

PRIVACY, SECURITY & TRUST

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EIT @ Otaniemi Open Innovation House

4. Key events and decisions

1. Window of opportunity
2. Three radical changes
3. Tenure-track system and internationalisation

Universities *can* change
Reforms in action 2010-2013

Research excellence
- *International research papers +28%*
- *Competitive research funding +31% (EU R&D-funding +82%)*

Attracting talent
- *International faculty +62% (over 30% of new tenure track professors)*

Pioneering education – students as our partners in learning
- *PhD degrees+24%*
- *Interdisciplinary education (e.g. Design Factory, AaltoNaut), transferrable skills*

Entrepreneurship – students driving change
- *Aalto Ventures program with Stanford University, partnering with Tongji*
- *AaltoES, Start-up Sauna, SLUSH*
- *Recent report by MIT identifies Aalto University as one of the 5 "Rising Stars" among 200 university-based innovation ecosystems*

Professor
N. Asokan
Secure Systems

Associate Professor
Aristides Gionis
Machine Learning and
Data Mining

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4.1 Window of opportunity

New operational concepts and higher level of ambition called for from Finnish universities

State and private money available!

But not for conventional models

Learning outcomes needed to match global job market & global and national challenges

Interdisciplinarity is commonplace in industry – why not in Academia?

The three universities acknowledged a need for renewal, as well as a need to decentralise itse administration and focus more on research (science and art) and teaching.

The government wanted to reduce the number of universities and pool its resources.

(In 2009 there were 20 universities. The evident long-term goal is less than 10.)

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Opportune timing

The new Universities Act was under preparation. Novel ideas were called for. The idea of an "innovation university" was launched. The concept of foundation universities was accepted.

In 2007 and 2008, industry made a commitment to finance the ambitious exercise.* In 2009, the economy entered a recession!

The new Finnish government approved the idea in the Spring of 2008.

(* The target of collecting 200 million euros in private money and 500 million euros in public money for the foundation endowment was historic from the standpoint of previous Finnish targets!)

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4.2 Three radical changes

Merger of three universities (and 3+ cultures!)

- This was the most visible change, but perhaps not even the most profound one.

Radical change in governance model

- The management of the university as a private foundation, detached from the state bureaucracy and governed by a strategic board of trustees has been crucial for pursuing rapid and far-reaching changes. There are also risks in moving away from the traditional university model of collegial decision-making.

Radical change in mission and ambition level

- From educators of professional labour for the Finnish economy to an aspiring world-class university. The change is a challenge, but is happening, with strong support from the industry and Aalto board.

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Key elements in implementation

Focusing

- Good resources on a Finnish scale, marginal resources on a global scale. (The budget of MIT > the sum of the Finnish universities budgets! It is realistic to compete with "MITs´" only within a very limited scope.) **Intensity** of activities **must be high**.
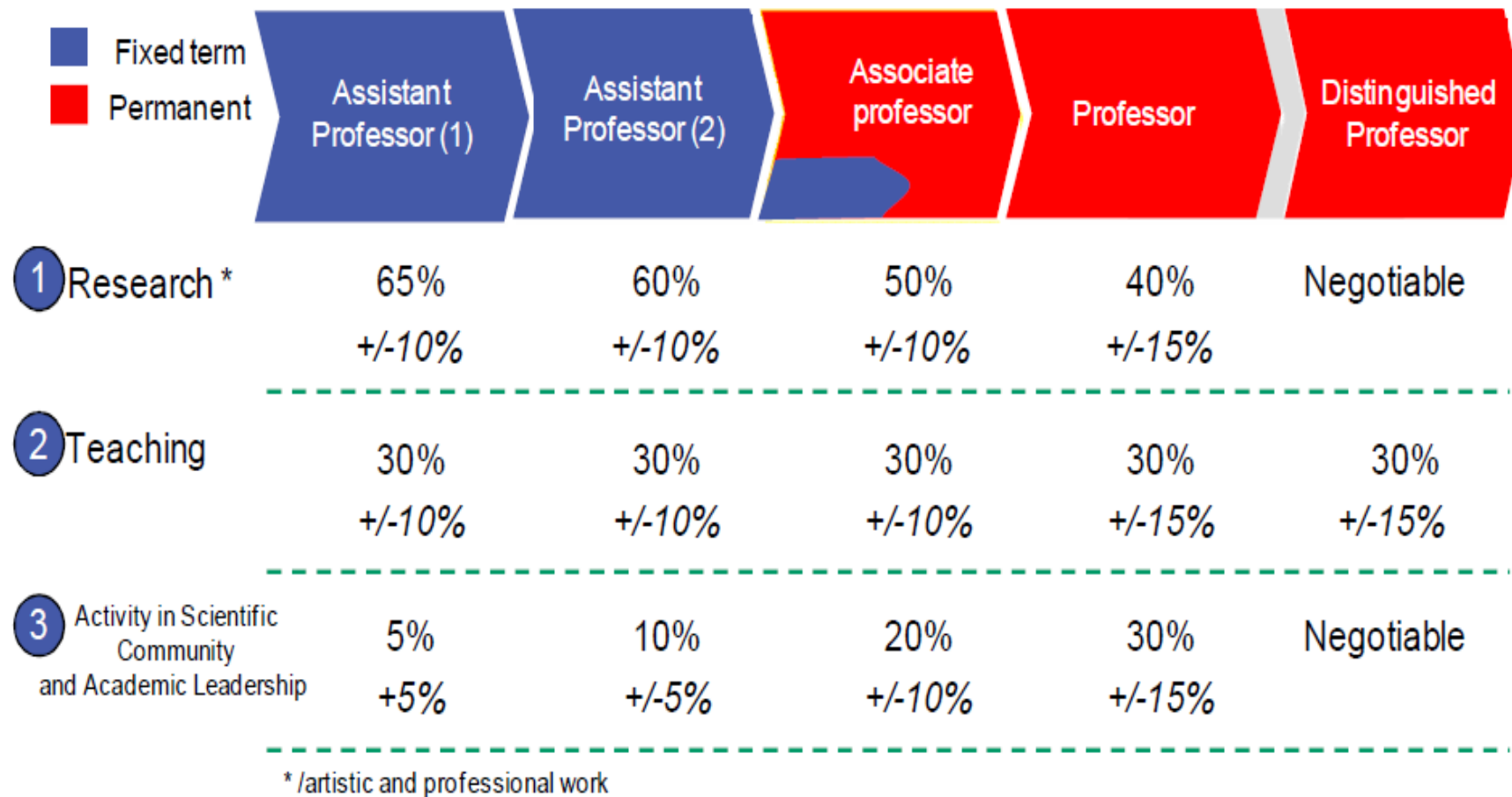
Tenure-track career system

- Huge success! Innovative and productive junior professors in focus.

Pioneering

- Traditional paths to the top are crowded. Aalto tries to find new ways via societal impact & innovation. The productive energy unleashed in student entrepreneurship and co-creation has been incredible! (E.g. **http://aaltoes.fi/**, **http://aaltodesignfactory.fi/**)

4.3 The Aalto tenure-track system

	Assistant Professor (1)	Assistant Professor (2)	Associate professor	Professor	Distinguished Professor
1 Research *	65% +/-10%	60% +/-10%	50% +/-10%	40% +/-15%	Negotiable
2 Teaching	30% +/-10%	30% +/-10%	30% +/-10%	30% +/-15%	30% +/-15%
3 Activity in Scientific Community and Academic Leadership	5% +5%	10% +/-5%	20% +/-10%	30% +/-15%	Negotiable

Fixed term
Permanent

* /artistic and professional work

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The tenure-track system and internationalisation

- The tenure-track system was introduced full-scale at the beginning of Aalto 2010, and has been a huge success in raising the quality and internationalisation of faculty.

- By Aug 2014, 193(!) new faculty had been recruited to the tenure track. This is > 50% of all Aalto professors!

- Of the applicants, 70% have been international, and of the appointed professors 30%.

- At least in CS, typically the most attractive candidates have been at the Assistant Professor (2) and Associate Professor levels.

HC of international personnel
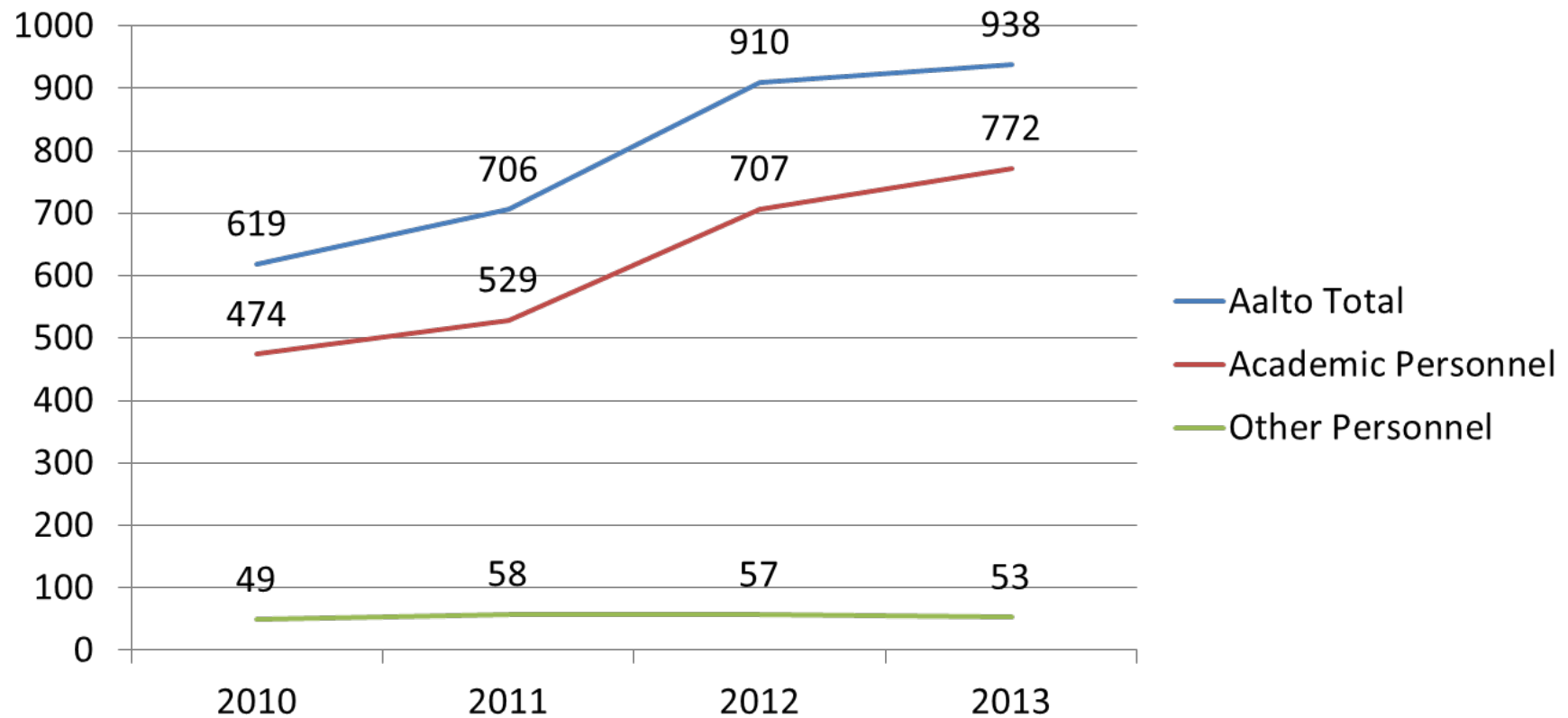
5. Future prospects

1. Campus development
2. School/department structure renewal

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5.1 Campus development

Metro

- A new subway line will connect Otaniemi to downtown Helsinki and the eastern Helsinki residential areas in 2016. Connection time to downtown 10 minutes.

Campus renewal

- The university is investing at least 300 M€ in new construction on campus in the next few years. All Aalto activities will be gathered to Otaniemi and a new central building will be constructed, with premises for the ARTS School, student services, and direct connection to the Metro. The core campus will become a pedestrian zone.

a *Re-imagined* campus in Otaniemi

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Campus vision 2020

5.2 School/department structure renewal

- The present School structure for Aalto is the result of a certain historic development, and is certainly not optimal. There have been initiatives for e.g. a distinct *School of ICT* and a *School of Life Science Technologies*.

- However, revising the school structure is a major operation because it changes the organisation which supports the present Aalto reforms, so requires careful thought.

- A merger of the three computing-related departments at the present School of Science to a single Department of Computer Science is proposed to happen in the beginning of 2015.
  - *The new CS department would have ~35 professors, a staff of ~400 persons, and an annual budget of ~25 M€.*

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Thank you for your attention !
pekka.orponen@aalto.fi

www.aalto.fi

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