



Innovation in and with ICT

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Outline

- Introduction
 - Innovation
 - ICT
 - Societal challenges
- Innovation in ICT
 - Leading Enabling and Industrial Technology
 - Key Enabling Technologies
- Innovation with ICT
 - ICT for societal challenges
- Conclusion



Introduction



• An **innovation** is the *implementation of a new or* significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.





 Information and communication technology, abbreviated as ICT, covers all technical means used to handle information and aid communication. This includes both computer and network hardware, as well as their software.





- Health, demographic change and wellbeing
- Food security, sustainable agriculture, marine and maritime research and the bio-economy
- Secure, clean and efficient energy
- Smart, green and integrated transport
- Climate action, environment, resource efficiency and raw materials
- Inclusive, innovative and reflective societies
- Secure societies



Innovation



Invention and innovation





Innovation activities

- Innovation activities are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations.
- A common feature of an innovation is that it must have been *implemented*.



Product innovation

- A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
- If the innovation involves new or significantly improved characteristics of the service offered to customers, it is a product innovation.



Process innovation

- A *process innovation* is the implementation of a new or significantly improved production or delivery method.
- Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.
- If the innovation involves new or significantly improved methods, equipment and/or skills used to perform the service, it is a process innovation.



Marketing innovation

- A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.



Organisational innovation

• An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.



Innovations in Innosoc Case Studies

Please suggest the type of innovation resulting from your case study:

- Product (and/or service provided by a product)?
- Process?
- Organisation?
- Marketing?

If you are not sure, you can provide two options, not more!

You will have the opportunity to discuss and correct your opinion on Friday 19th May and at the end of the workshop!



Case studies 1-4

Case study	Product	Process	Market ing	Organi sation
 1 – Innovations in 3D Printing for Sustainable Food Production, Maritime Preservation and Bioeconomy 				
2 – RFID Operation, Applications, and its Limitations in Agriculture/Food Sector				
3 – Innovative Applications of ICT inthe Energy Sector:An Industry Perspective				
4 – Innovating Border Protection Systems with Modern Sensors				



Case studies 5-8

Case study	Product	Process	Market ing	Organi sation
5 – High-Reliability Healthcare Systems				
6 – Re-Invention of the Role of Sound in Education				
 7 – Issues and Challenges of Corporate Social Responsibility and Sustainability in the ICT Sector: New challenges for Engineers in the 21st century 				
8 – Promoting STEM Studies among Young Students				



Case study – next step

Innovation potential of all case studies will be (re)evaluated on Friday, 19th May 2017, Session: 18:00-19:00 Workshop 1st week wrap-up

Please confirm (or change) the type of innovation resulting from your case study (product, process, marketing, organization) to:

vedran.podobnik@fer.hr

Hard deadline: Thursday, 18th May 2017, 22:00



Innovation Union Scoreboard

The performance of Croatia and Spain:

"Moderate innovator"



European Innovation Scoreboard 2016





Innovation equation

Innovation = Building Creativity x Risk-Taking

Source:

J. Byrd, P. L. Brown, "The Innovation Equation: Building Creativity and Risk-Taking in Your Organization", John Wiley & Sons, 2003.





Skills

Top 10 skills

in 2020

- 1. Complex Problem Solving
- Critical Thinking
- 3. Creativity
- People Management
- 5. Coordinating with Others
- 6. Emotional Intelligence
- 7. Judgment and Decision Making
- 8. Service Orientation
- 9. Negotiation
- 10. Cognitive Flexibility

in 2015

- 1. Complex Problem Solving
- 2. Coordinating with Others
- 3. People Management
- 4. Critical Thinking
- 5. Negotiation
- 6. Quality Control
- 7. Service Orientation
- 8. Judgment and Decision Making
- 9. Active Listening
- 10. Creativity

The ICT Engineer of the 21st Century: Mastering Technical Competencies, Management Skills,_ and Societal Responsibilities



Source: Future of Jobs Report, World Economic Forum







ICT



ICT origins ...

Koji Kobayashi: C&C (Computers & Communications)

IEEE Spectrum JANUARY 1969

In a small country such as Japan, where the most important natural resource is the talents of its people, "knowledge industry" technologies, especially telecommunications and electric data processing, can play a major role in the nation's economy

Koji Kobayashi Nippon Electric Company, Ltd.



- K. Kobayashi, C & C とソフトウェア:人間を軸にした発展 ("C & C (computers and communications): The Software Challenge A Human Perspective"), 1982.
- K. Kobayashi, IEEE Founders Medal: "For leadership in the development of computer and communications technologies, their integration into modern networks, and the worldwide expansion of electronics.", 1984.
- K. Kobayashi, <u>"Computers and Communications: A Vision of C&C"</u>, MIT Press, Cambridge, Mass., SAD, 1986.





The expression Information and communication technology was first used in 1997 in a report by Dennis Stevenson to the UK government and promoted by the new National Curriculum documents for the UK in 2000:

 "Information and Communication Technology in UK Schools, An Independent Report", D. Stevenson et al., 1997.

. . .



Research and innovation in ICT

Horizon 2020

The Programme for Research and Innovation

- Excellent science
 - Frontier research
 - Future and Emerging Technologies (FET)
 - Research infrastructure
- Industrial leadership
 - Leading Enabling and Industrial Technologies (LEIT)
 - Key Enabling Technologies (KET)
- Societal challenges





"A guide to ICT-related activities in WP2016-17, ICT in H2020 – an overview", European Commission



ICT in Horizon 2020





ICT – Leading enabling and industrial technology

- Future Internet
 - 5G and networking beyond 5G, software, collective awareness platforms, experimentation, ...
- Advanced Computing
 - cloud computing, ...
- Content technologies and information management
 - big data, media & content convergence, accessibility, gaming, ...
- Cyber-Security and Trustworthy ICT
- Internet of Things and Platform of Connected Smart Object



ICT in Horizon 2020 (LEIT)





Research and innovation with ICT

Human-Centric Digital Age

- ICT for Societal Challenges
 - Internet of Everything, Web of Everything, ...

Factory of the Future

• Industry 4.0



ICT in Horizon 2020 (Digital Age)









ICT in Innosoc 2017





Economics of ICT (1)

ICT sector (ICT manufacturing and service industry):

- represents 4.8% of the European economy (GDP);
- generates 25% of total business expenditure in research and development (R&D);
- investments in ICT account for 50% of all European productivity growth

(https://ec.europa.eu/programmes/horizon2020/en/area /ict-research-innovation)



Economics of ICT (2)

	USA 1995- 2007	EU 1995- 2007	Innosoc country	SAD 2006- 2011	EU 2006- 2011	Innosoc country
GDP growth	3,1%	2,2%		0,7%	1,1%	
Labour productivity growth (LP)	2,0 %	1,3%		1,2%	0,9%	
ICT contrib. to LP growth	1,3%	0,7%		0,5%	0,3%	

• Source: "Unlocking the ICT growth potential in Europe: Enabling people and businesses, Using Scenarios to Build a New Narrative for the Role of ICT in Growth in Europe", Final Background Report, A study prepared for the European Commission DG Communications Networks, Content & Technology, The Conference Board, 2013



Economics of ICT (3)

Employment in EU: ~ 6 milion (~ 3 % of total)

- ~ 85 % service industry (telecommunications, computer programming, data processing, web portals, ...)
- ~ 15 % manufacturing industry (electronic components and boards, computers and peripheral equipment, communication equipment, consumer electronics, ...)



ICT Business Expenditure

EU ICT SECTOR R&D EXPENDITURE

E Sector R&D EXPENDITURE (ICT BERD)

17% OF TOTAL EU BUSINESS ENTERPRISE R&D EXPENDITURE IN 2012

BERD. (BUSINESS ENTERPRISE R&D): EXPENDITURE MADE BY ICT SECTOR PRIVATE ENTERPRISES



ICT R&D Public Funding (1)



6.8% OF TOTAL OF TOTAL PUBLIC R&D FUNDING IN 2013

GBAORD. (GOVERNMENT BUDGET APPROPRIATIONS OR OUTLAYS ON R&D): ICT R&D EXPENDITURE BASED ON GOVERNMENTS BUDGETS



ICT R&D Public Funding (2)

PUBLIC FUNDING DEVOTED TO ICT R&D IN EU COUNTRIES 2013

EU ICT R&D PUBLIC FUNDING INTENSITY





Conclusion



Disruptive technologies 2008



The Internet of Things

Source:

Disruptive technologies Global Trends 2025, SRI Consulting Business Intelligence, 2008.

Disruptive technologies 2013



Automation of knowledge work

Internet of

Things

Mobile Internet



Autonomous and nearautonomous vehicles

Next-

generation genomics

Source:

"Disruptive technologies -Advances that will transform life, business, and the global economy", McKinsey Global Institute, May 2013.





Disruptive technologies

Autonomous Vehicles.....

Graphene

3D printing

Massive Open Online Courses (MOOCs).

Virtual currencies (Bitcoin)

Wearable technologies.....

Drones.....

Aquaponic systems

Smart home technologies

Electricity storage (hydrogen)

9. Smart home technologies

Ten technologies which could change our lives

Potential impacts and policy implications

The Internet of Things now increasingly includes electronic devices operating in our homes. How will our everyday behaviours and personal relationships change as a result?

UROPEAN PARLIAMEN



2030

ELEMENTS OF POWER OF LEADING COUNTRIES IN 2030



Percent share of global power

Source:

"Global Trends 2030: Alternative Worlds", National Intelligence Council, 2012.



ICT future is here ...



Literature

- S. Scotchmer, "Innovations and Incentives", The MIT Press, 2004.
- J. Fagerberg, D.C. Mowery, R.E. Nelson, "The Oxford Handbook of Innovation", Oxford University Press, 2005.
- S. Conway, F. Steward, "Managing and shaping innovation", Oxford University Press, 2009.
- P. Trott, "Innovation Management and New Product Development", Fifth Edition, Prentice Hall, 2012.





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