



# FuturICT

[www.futurict.eu](http://www.futurict.eu)



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# The Age of Information

- Hyperconnectivity: billions of connected components
- Exascale computing



- Big data: more information generated in the next 2 years than in the past 1000 years

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# Implications of the Information Age

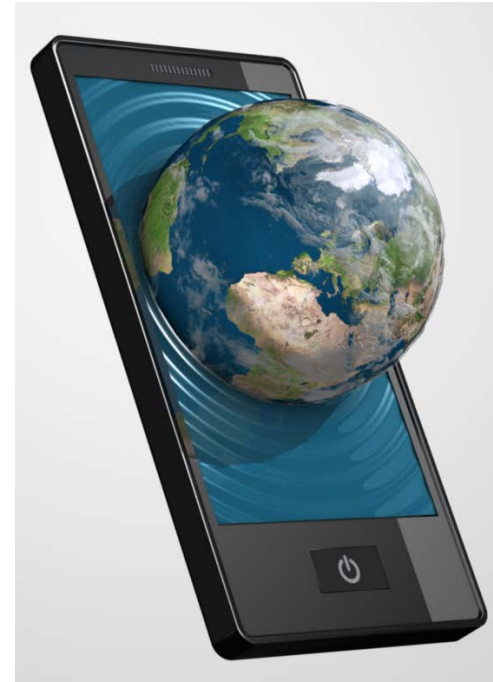
- Boundaries between the real and the digital world are increasingly blurred
  - real world events have a “digital shadow”
  - digital information drives real events



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# Implications of the Information Age

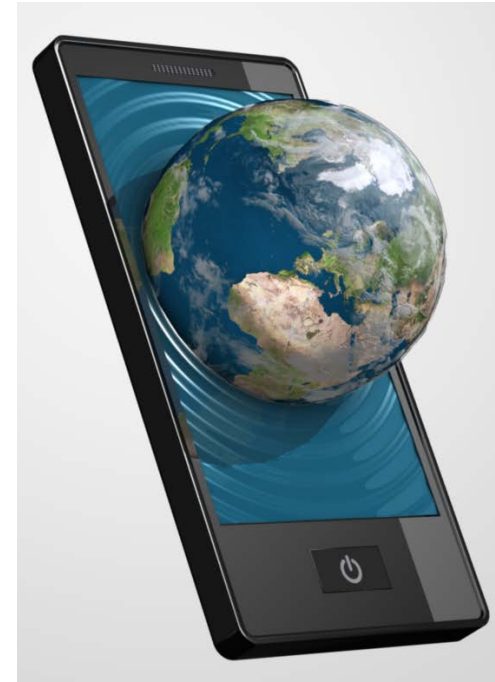
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- Society and global ICT are becoming a single, interweaved system
  - neither can be modelled on its own



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  - **most complex artifact ever**



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# Importantly

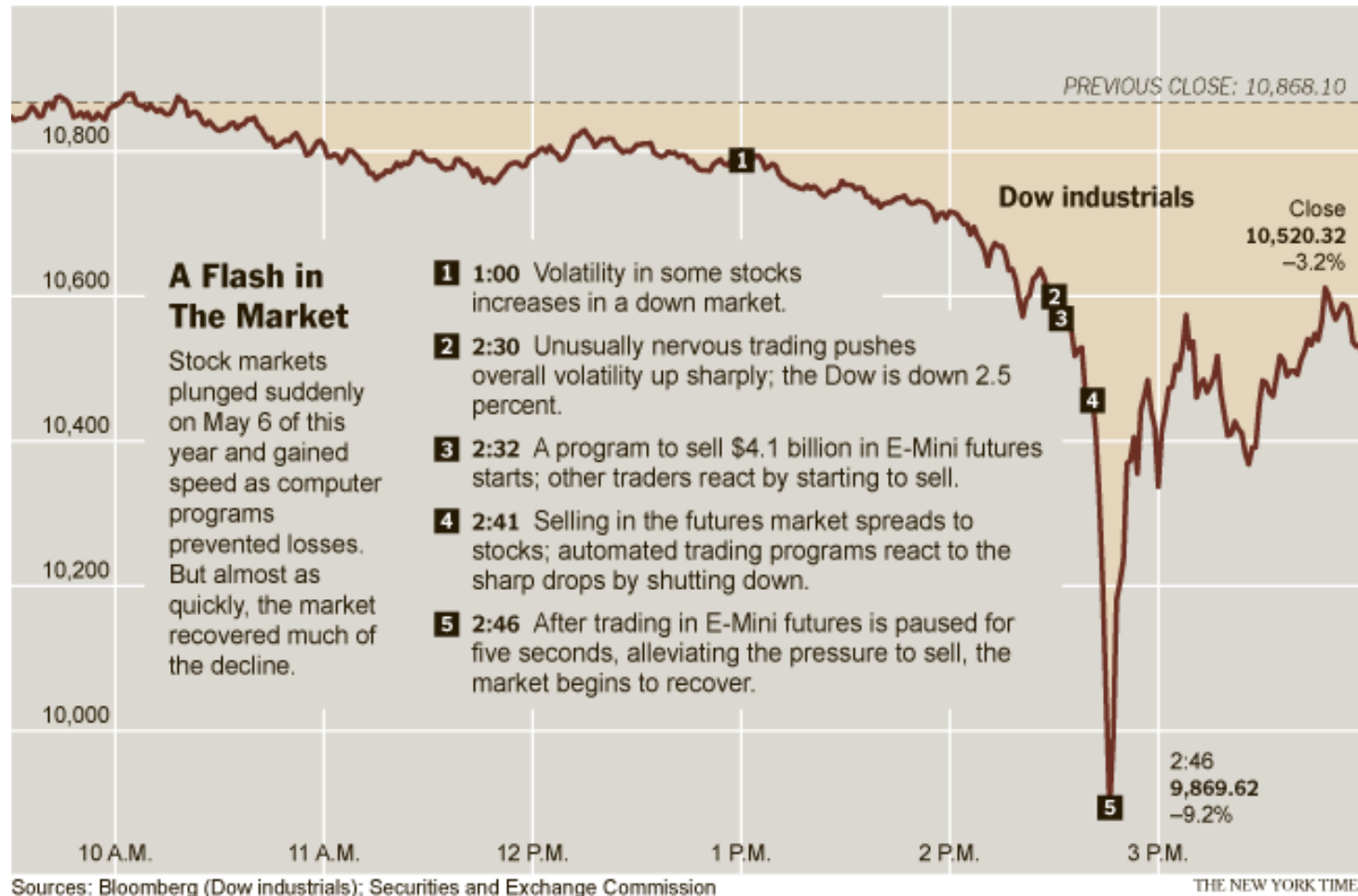
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- Society and global ICT are becoming a single, interweaved system
  - neither can be modelled on its own
  - most complex artifact in existence

We lack a proper understanding and methods for the management of both: our society and global ICT infrastructure !



# The Flash Crash of May 6, 2010

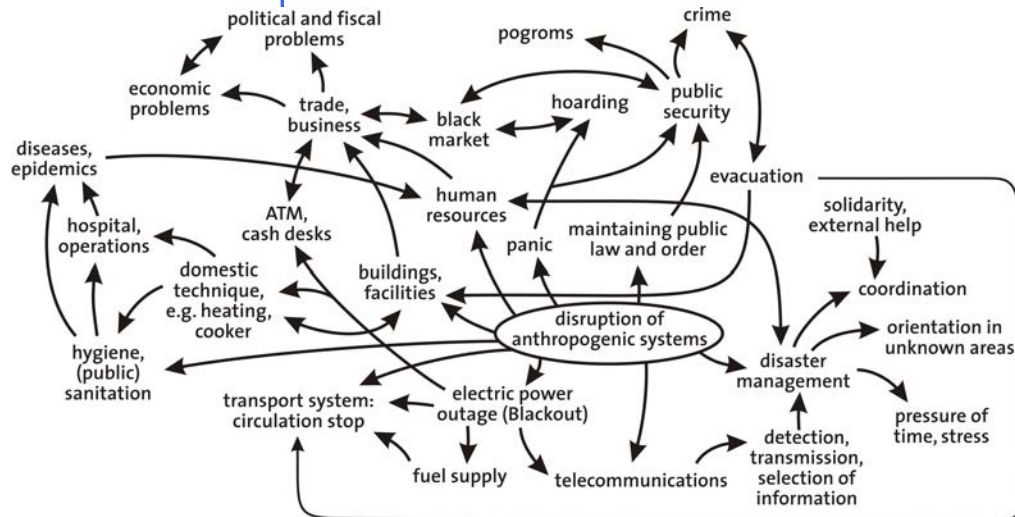
600 billion dollars evaporated in 20 minutes



No criminal act, 'fat finger', or error but an interaction effect.

# Networking is Good ... But it Promotes Cascading Effects

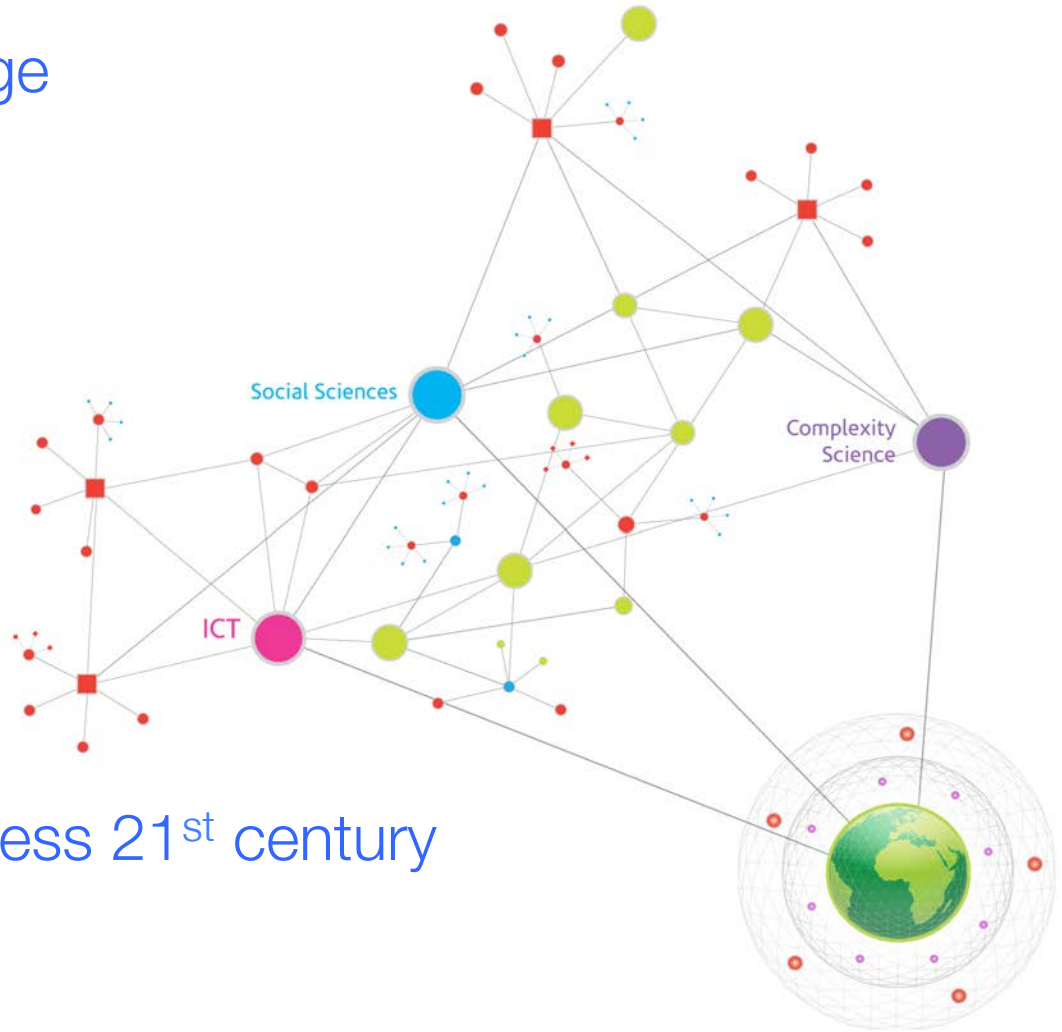
- We now have a global exchange of people, money, goods, information, ideas...
- Globalization and technological change have created a strongly coupled and interdependent world



Network infrastructures create pathways for disaster spreading!  
Need adaptive decoupling strategies.

# FuturICT Vision: Integrating Different Fields of Science to:

- Create new knowledge
- Create new ICT
- Leverage this to address 21<sup>st</sup> century challenges



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# Impact: Develop New Science

For 30 years or so have we globalized our world and pushed for technological advancements, but the **global systems science** to understand the resulting complex systems is lacking.



1. Science of systemic risks
2. Theory of complex systems with real-world impact
3. New data science
4. Integrated systems design to manage complexity
5. Coevolution of ICT with society

# Example: Global Epidemic Spreading



CHARTING THE NEXT PANDEMIC



GLEAMViz.org

Thanks to our FuturICT partner Alex Vespignani et al.

# Shedding Light on the Data Shadow

twitter, blogs, mobile phones, ubiquitous sensing,....



probabilistic predictions (“credit crisis likely”)



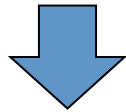
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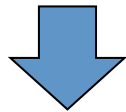
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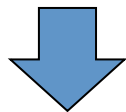
data fusion, pattern analysis and reasoning



measurement of the “state of the world”  
(e.g. opinion shifts, mobility patterns, ...)



complex social models and simulations



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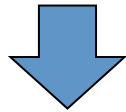


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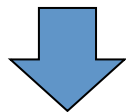
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# Shedding Light on the Data Shadow



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PNS

measurement of the “state of the world”  
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complex social systems and simulations

LES

probabilistic predictions (“credit crisis likely”)



„Google-like“ high-level queries



# Impact: Leverage Advances in ICT and Science to Address 21<sup>st</sup> Century Challenges

- Extract useful information from **Big Data**, and gain a theoretical understanding
- Create **new ICT instruments** to manage our complex world in a more resilient and sustainable way
- **Innovations from information**: new jobs dependent on the ability to harness data and technology



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# Impact: Develop a New ICT Paradigm

Fundamental transformational effect on ICT and  
Computer Science

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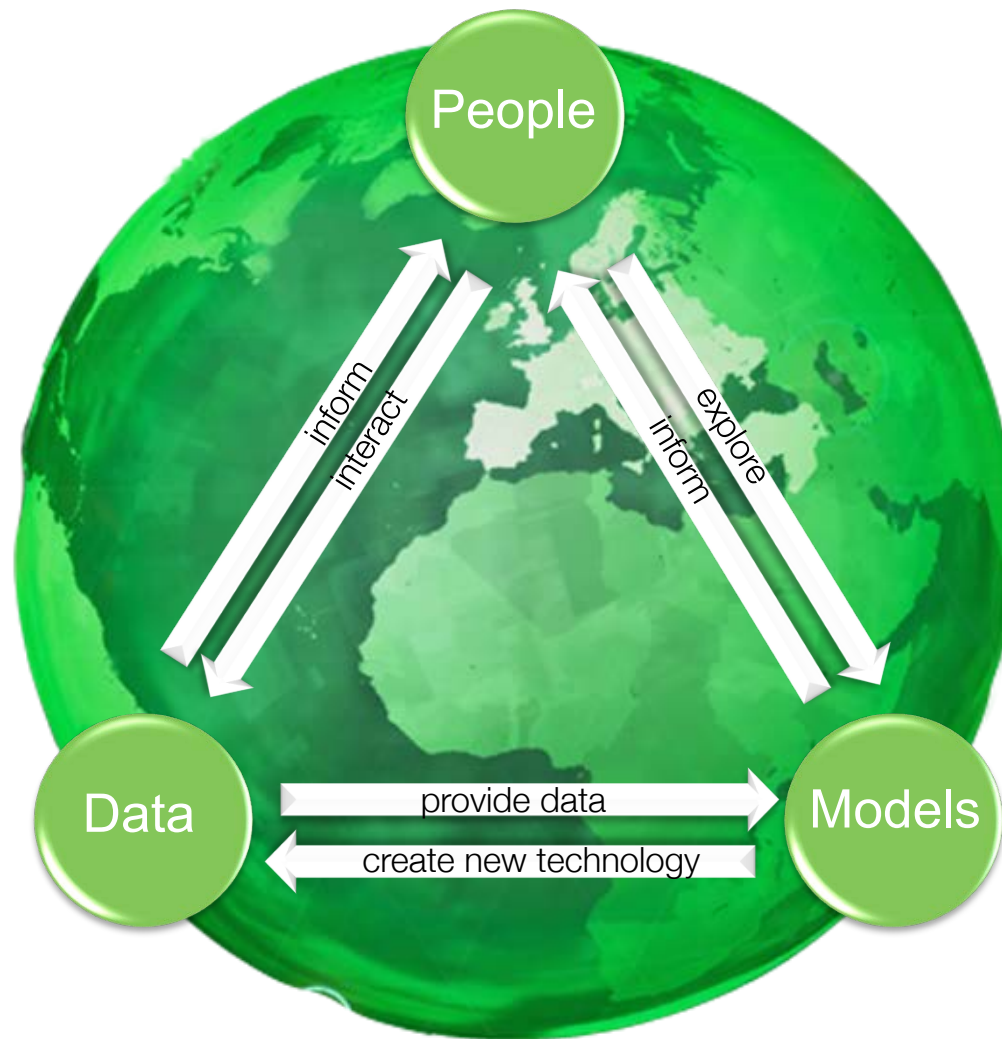
1. Collective awareness

2. Socially interactive  
systems

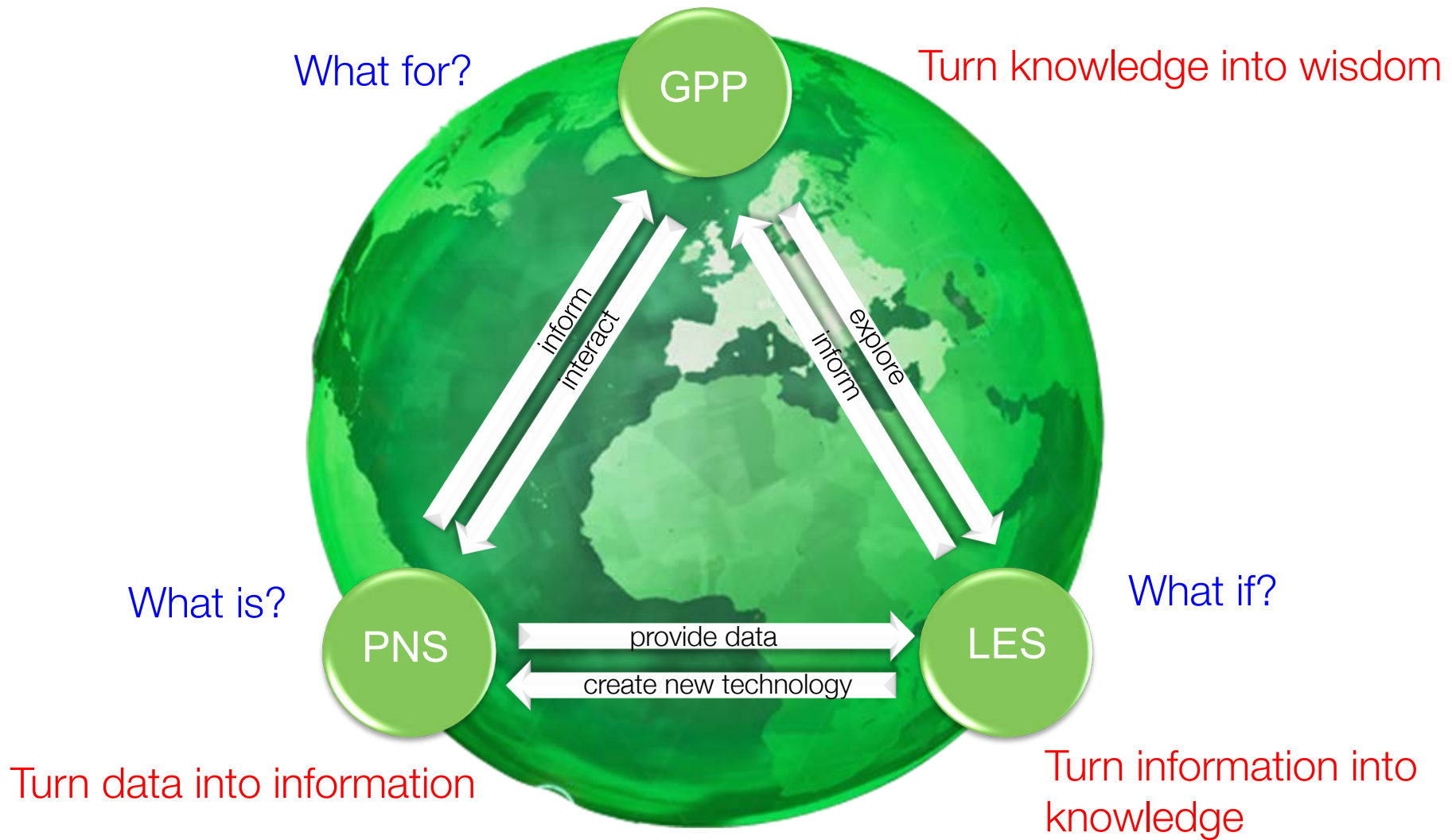
3. Socio-inspired,  
bottom-up  
self-organization

- Develop **value-sensitive technology** for our information age
- Ensure the **reliability** of critical ICT systems

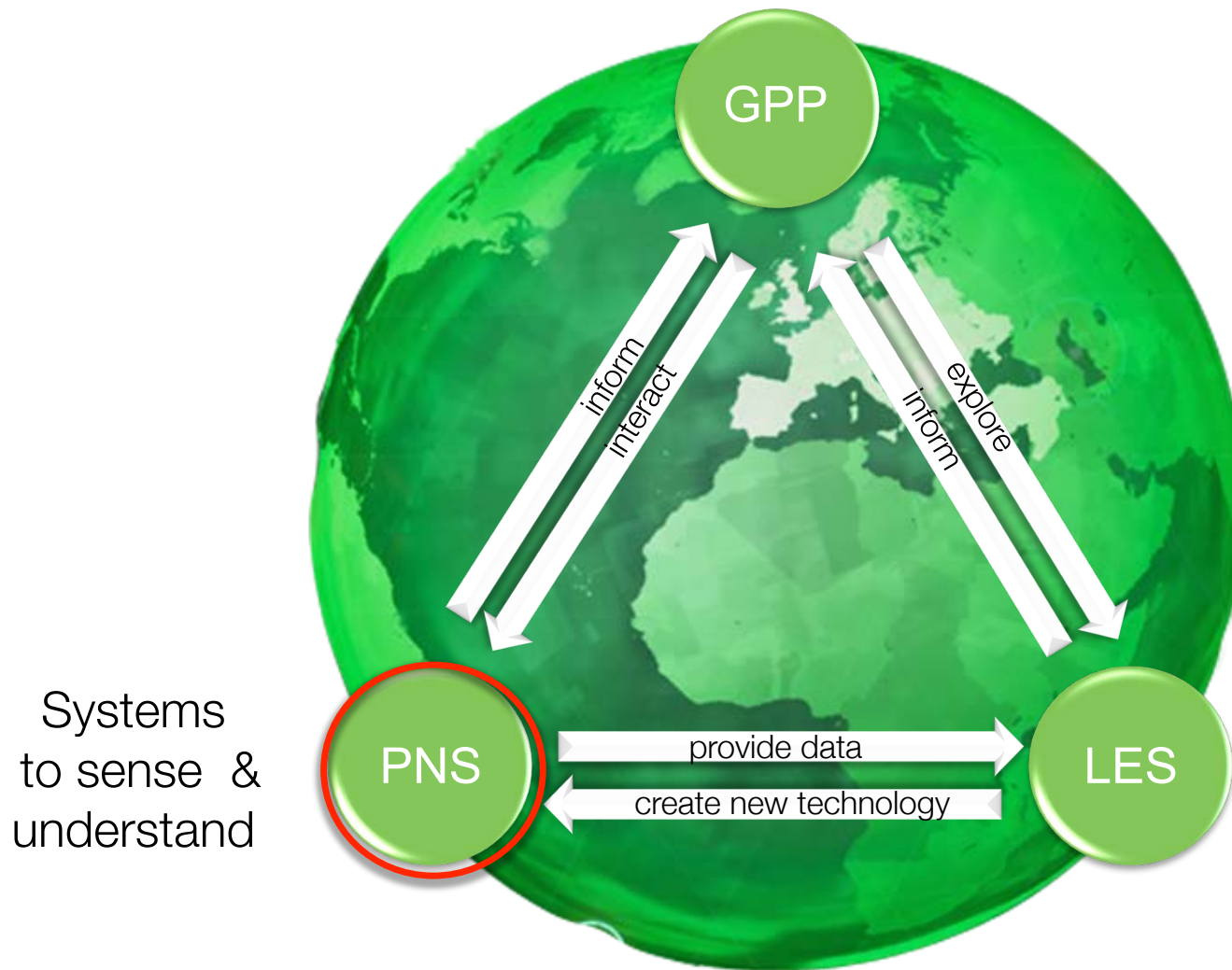
# How It Will Work



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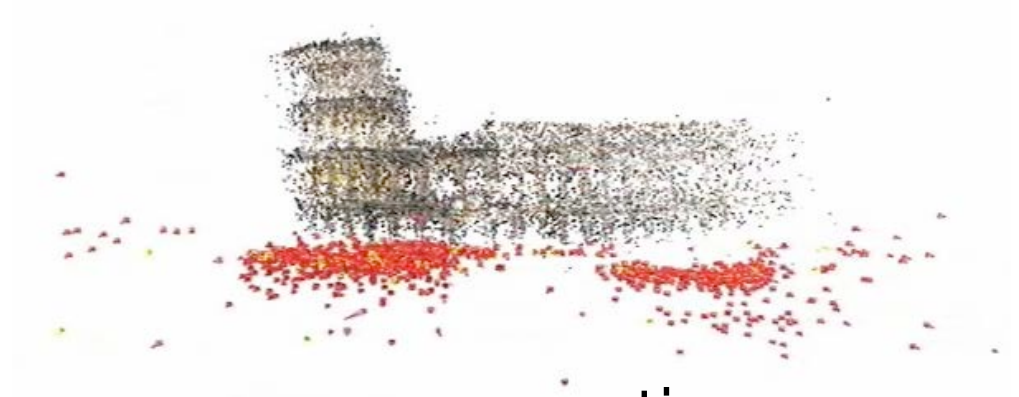
# Planetary Nervous System (PNS)



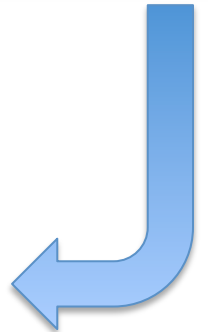
# Crowd Sourcing 3D Environments



contributed  
photos



aggregation



full 3-D model

Thanks  
to Marc  
Pollefeys  
et al.

# More Sustainability and Resilience through Collective, ICT-enabled (Self-)Awareness

1. **Goal:** Measure the world's state, '**social footprint**' and **social capital** (e.g. trust) in real time, **detect possible threats and opportunities**
2. **Privacy-respecting data mining**

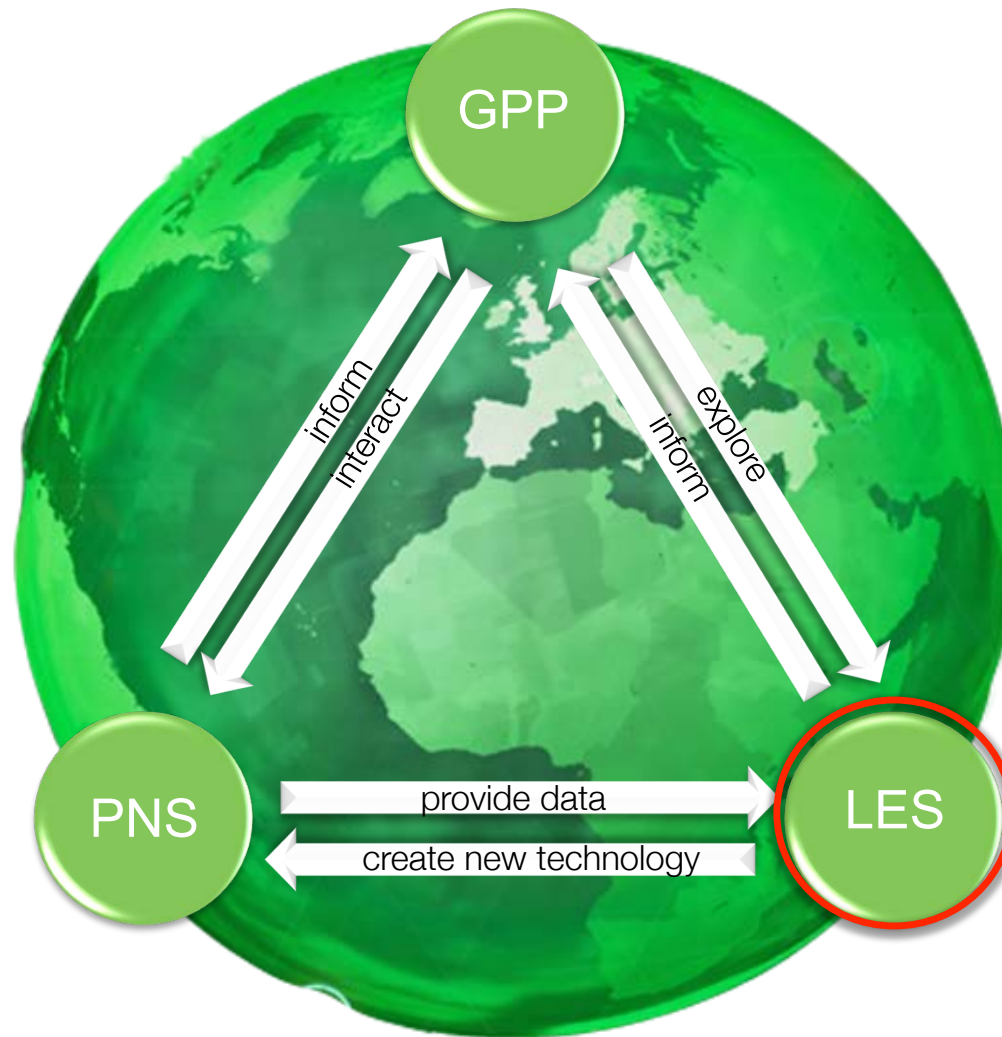


**'CERN-like' vision:** Create a measurement instrument for techno-socio-economic-environmental systems



Painting by Maurits Cornelis Escher

# Living Earth Simulator (LES)



Models  
to simulate &  
predict

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# Building FuturICT's Living Earth Simulator

- Integrate existing models
- Scale them up to global scale
- Increase degree of detail and accuracy



# Interactive Games as Experimental Platform



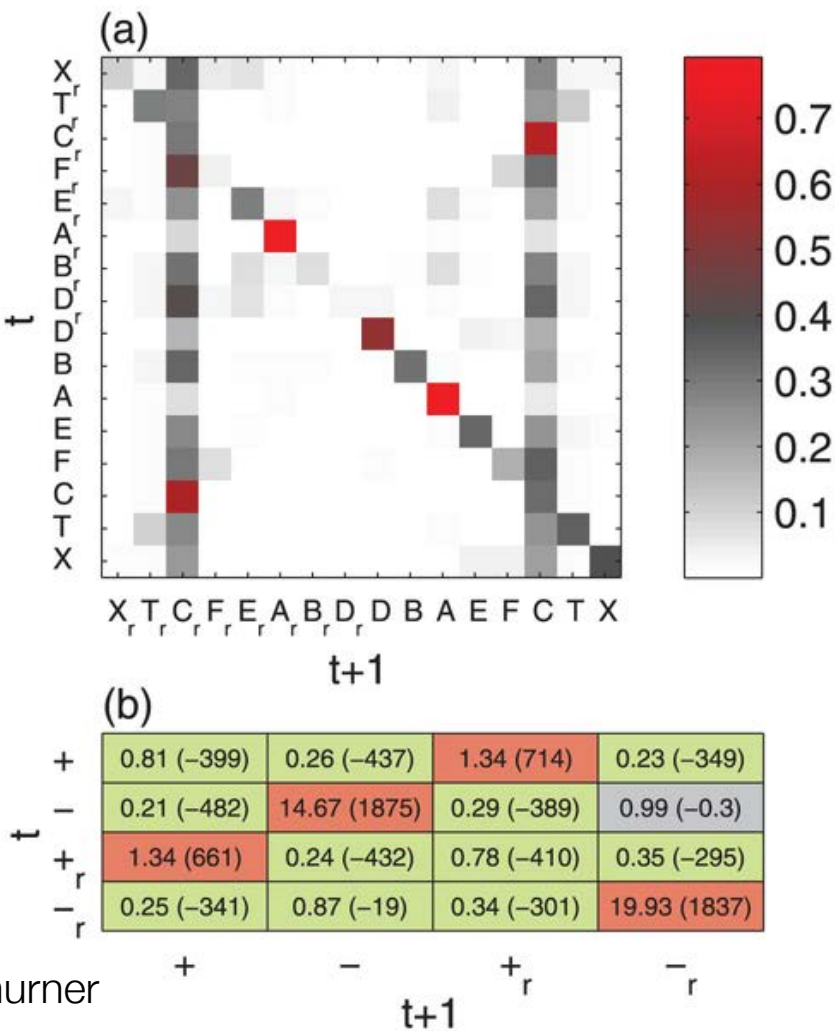
(a) Actions

Player 146 ... A A A A C C T E T E ...  
 Player 199 ... C A C A A F C C E A C ...  
 Player 701 ... C C C C T T T C C T C ...

Actions and received actions  
 Player 199 ... C A A C A A T F C T C C E E A C ...



Thanks to Stefan Thurner

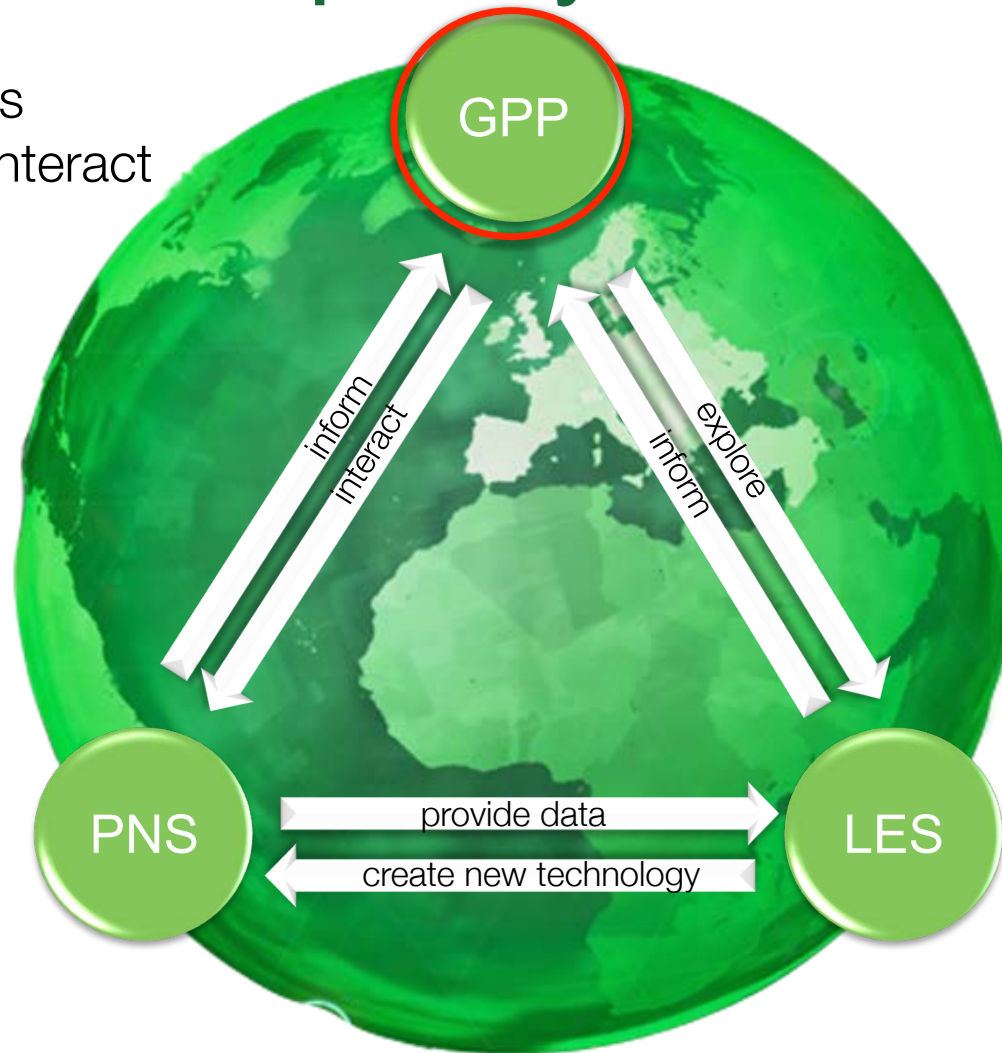


**‘Human-Genome-Project-like’ vision:** Develop interactive platforms for rapid experimenting, to better understand human behaviour

FuturiCT

# Global Participatory Platform (GPP)

Platforms  
to explore & interact

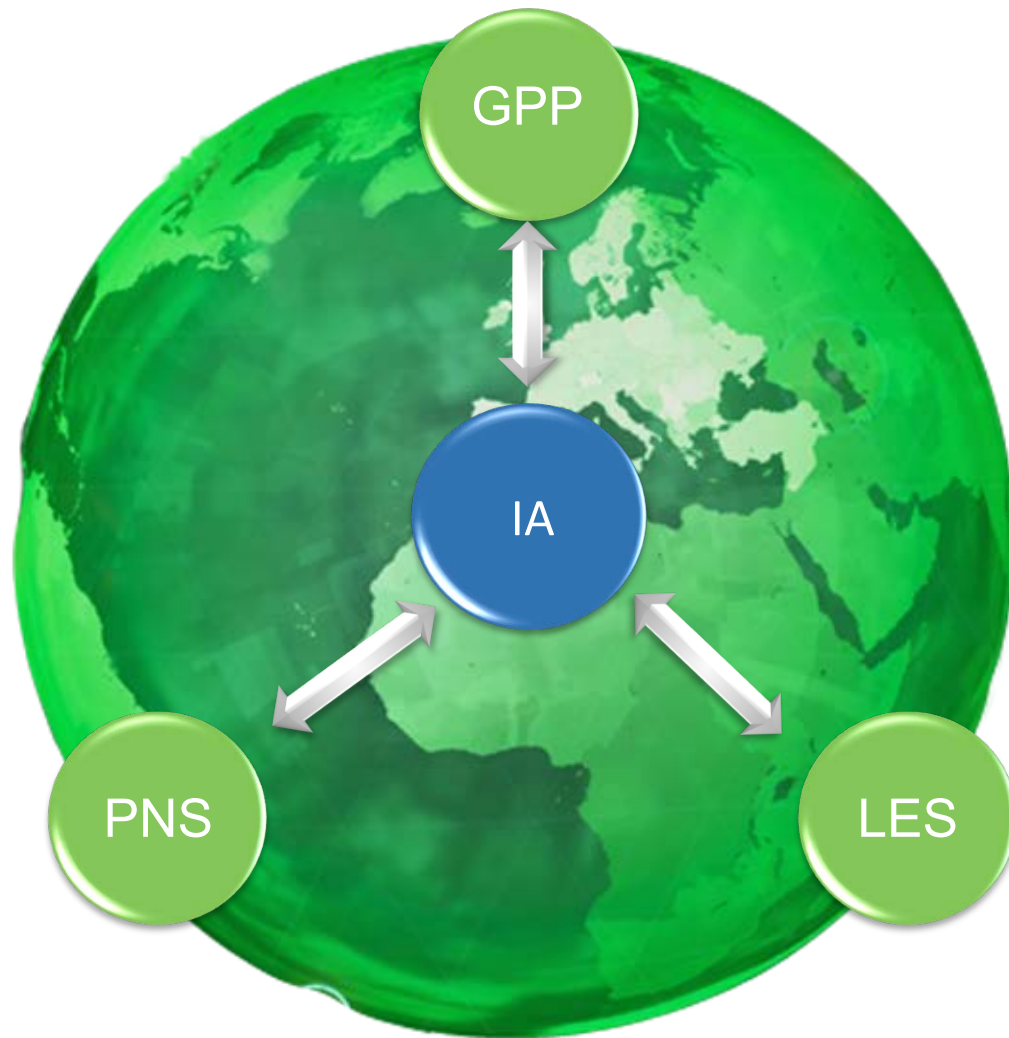


# An Open, Transparent Platform for Everyone

- **Goal:** A 'data, applications and model commons', an open platform for everyone
- **Potential:** New services and jobs, less barriers for social, economic and political participation
- **Problem:** A new public good, requiring mechanisms to avoid data pollution, manipulation, misuse, privacy intrusion, cybercrime
- **How to promote responsible use?**
- Need to develop a trustable, self-regulating **information ecosystem**

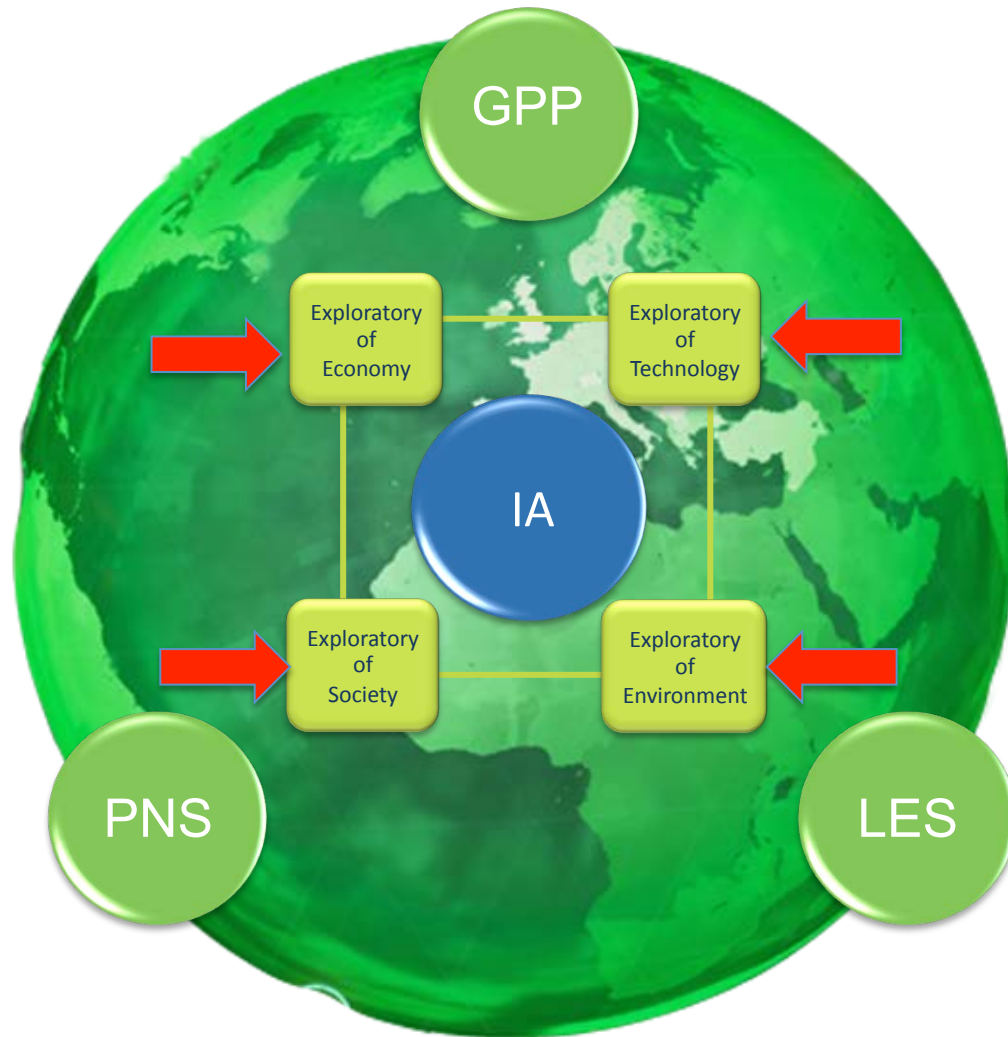


# The Innovation Accelerator (IA)

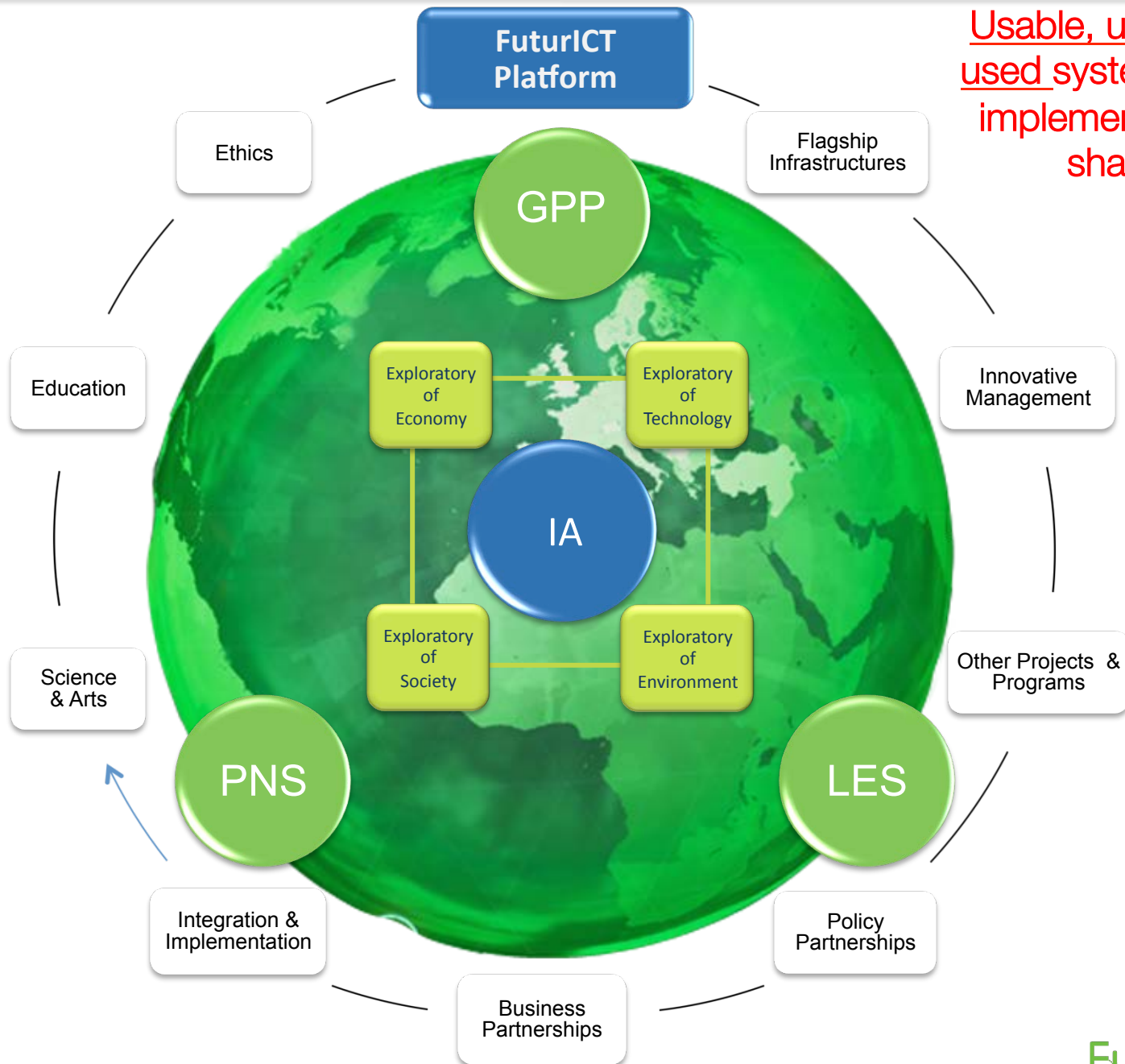


A platform for  
efficient large-  
scale  
cooperation,  
innovation and  
education

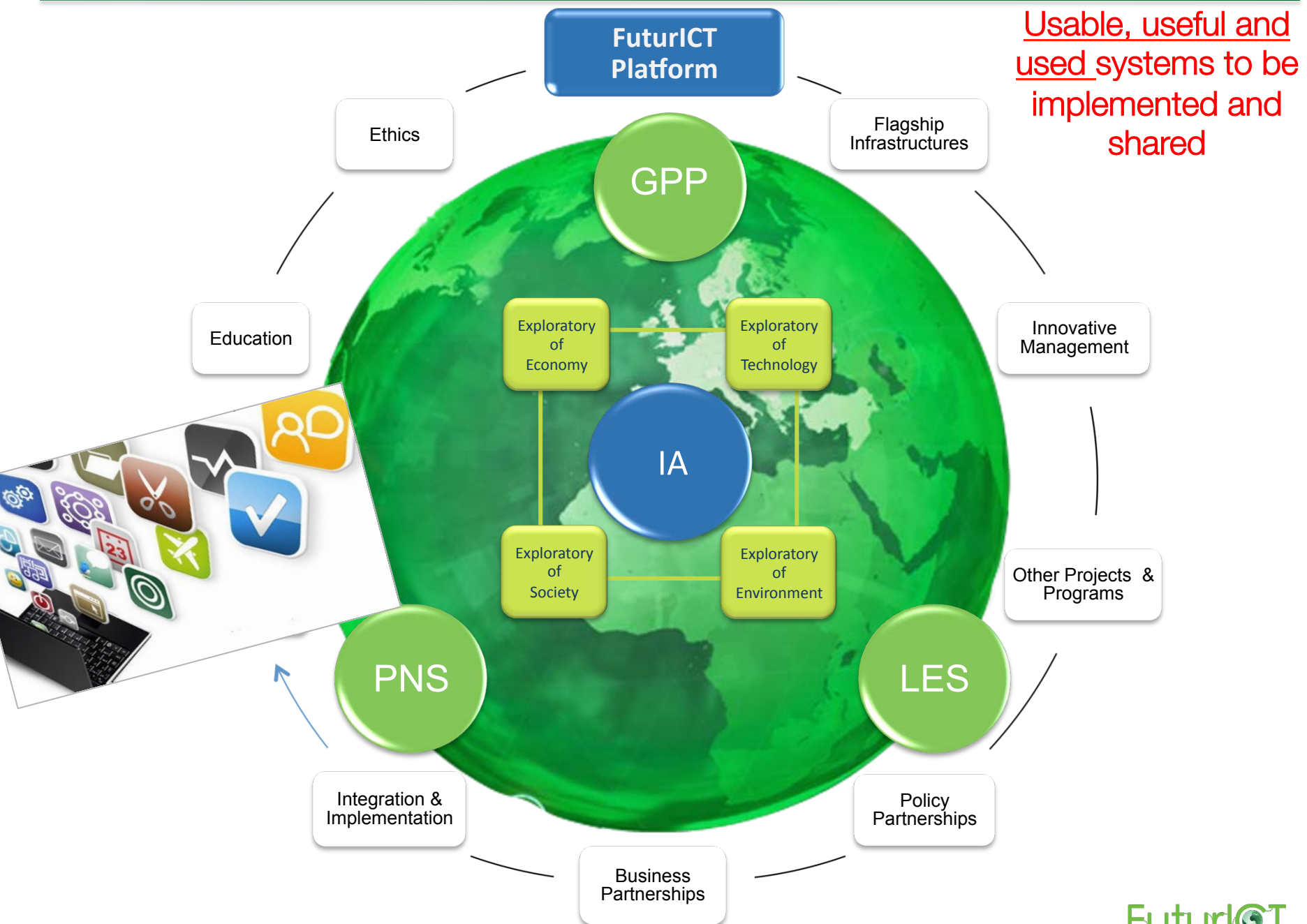
# Exploratories



- Financial Systems
- Health and Epidemics
- Crime and Conflict
- Risk and Resilience
- Sustainable Cities
- Smart Energy Systems
- Environment and Sustainability



Usable, useful and used systems to be implemented and shared



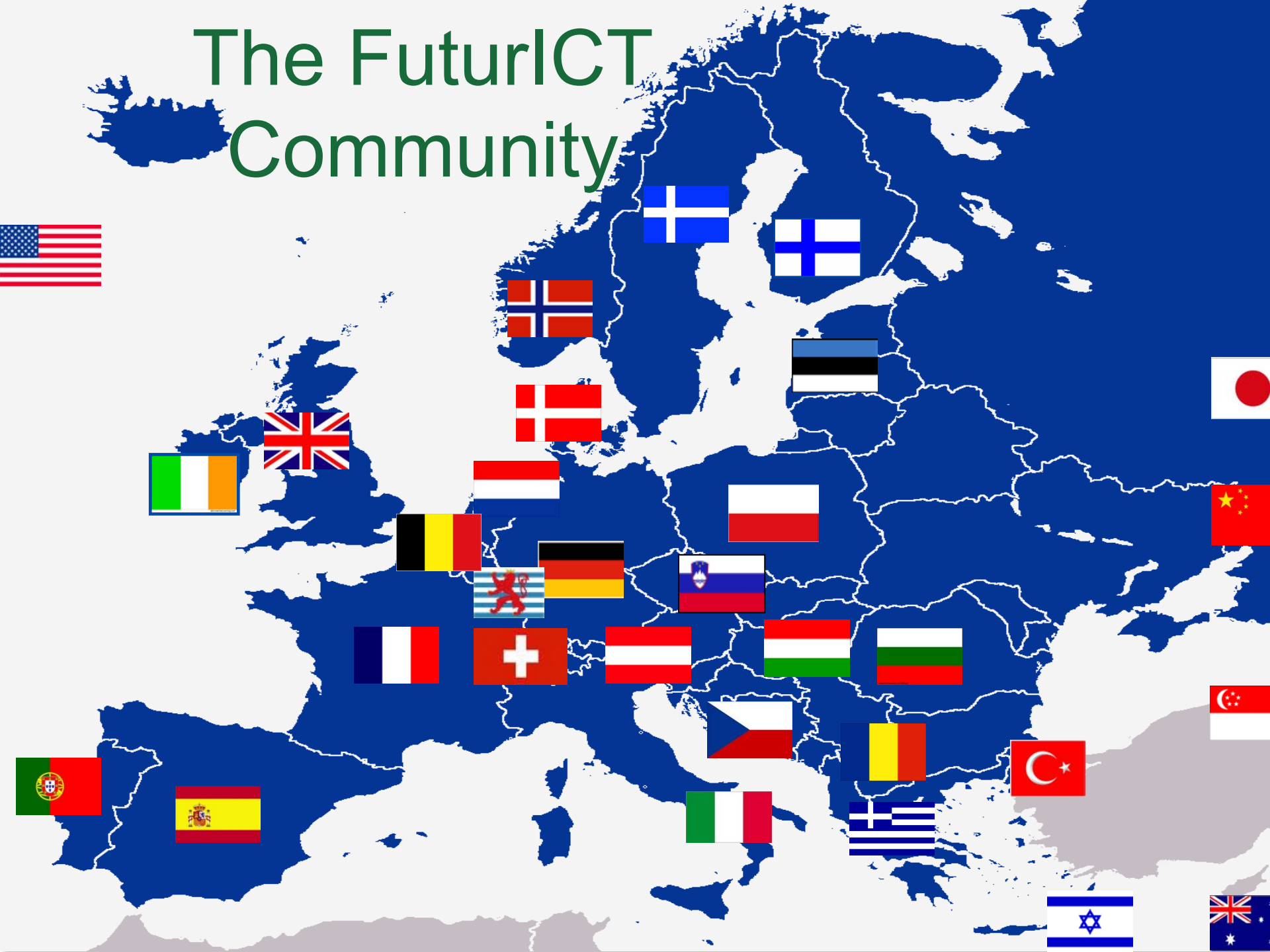
# FuturICT's Benefits Scale with Societal Costs

1. **Financial crisis:** Losses of 2-20 trillion \$
2. **Conflict:** Global military expenditures amount to 1.5 trillion \$ annually.
3. **Terrorism:** 9/11 attacks caused 90 billion \$ lost output of the US economy
4. **Crime and corruption:** 2-5% of GDP, about 2 trillion \$ annually.
5. **Cybercrime:** 750 billion EUR/a in Europe

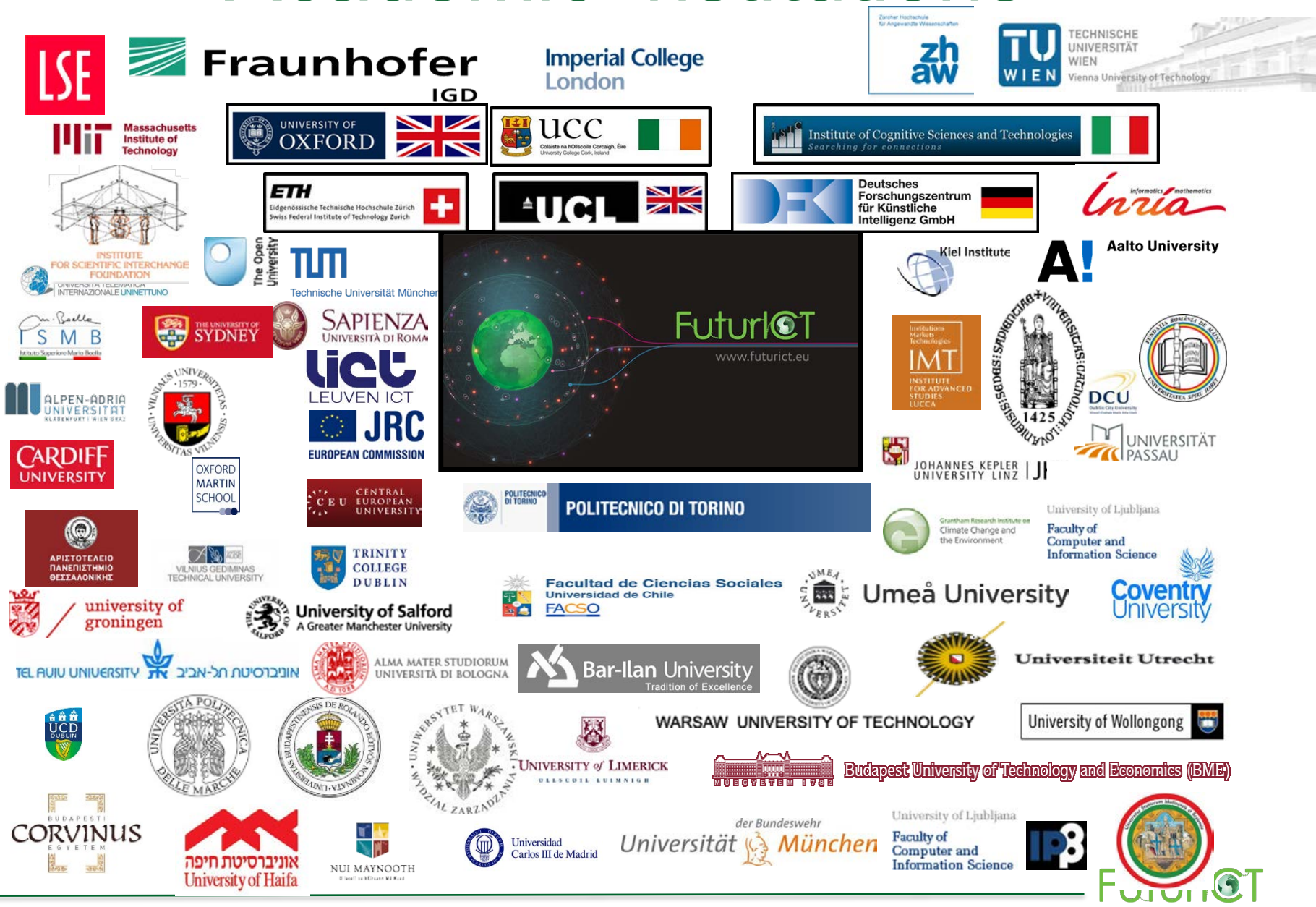


- Even a 1% improvement would create benefits many times higher than project investments
- **Business opportunities:** Facebook's value, for example, amounts to 60-80 billion \$

# The Future ICT Community



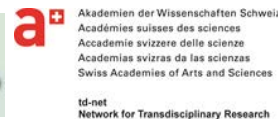
# Academic Institutions



# Research Organisations



# Businesses



td-net  
Network for Transdisciplinary Research



NATIONAL BANK OF UKRAINE





# Global Participatory Computing for Our Complex World



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