



**CIECTI**

Centro Interdisciplinario  
de Estudios en Ciencia,  
Tecnología e Innovación

CIECTI / SEMINARIO INTERNACIONAL



**RECURSOS NATURALES Y DESARROLLO:  
DESAFÍOS PARA LA CTI EN EL SIGLO XXI**

**CENTRO CULTURAL DE LA CIENCIA (C3)**

**Godoy Cruz 2270**

**CABA**

# KNOWLEDGE PRODUCTION, AUTOMATIZATION AND INDUSTRY 4.0

## *Anticipation and Foresight for Transformative Innovation Policy*

Petra Schaper-Rinkel,  
AIT – Austrian Institute of Technology  
Center for innovation systems & policy

International Seminar. Natural resources and development. Challenges for  
STI in the XXI Century; Buenos Aires, Argentina. November 8<sup>th</sup> , 2017



# THE WORLD IN 2030 – 2050?



## Robotics

Will robots replace human work or will robots assist human needs?



## Research

Research divided 4.0 - New elites and traditional losers? OR Transdisciplinary co-production in research and innovation



## Big Data

Controlled by Big Data OR Transparent Algorithms support individual and collective Decision Making



## Blockchain

Dezentralized Ledger Technologies ensure trust OR New waves of cybercrime are all over

# WHAT I WILL DISCUSS



Anticipating Futures in Europe – Megatrends 2050
Megatrend Accelerating technology
Scenarios for Europe in 2050
Trends in STI
Policy Concepts to Re-Conzeptionalize Innovation
Transformative Innovation policy
Conclusions

# ANTICIPATING FUTURES IN EUROPE

- Expert Group - Key Long-term Transformations in Research, Innovation and Higher Education (2014/2015)
- *The Knowledge Future: Intelligent policy choices for Europe 2050. A report to the European Commission.* Borch, K; Daimer, S; De Roure, D; Deketelaere, K ; Dimitropoulos, A; Felt, U ; Geuna, A ; Glenn, J ; Gulda, K; Kolar, J; Gallart, Jordi Molas ; Narula, R ; Ringland, G ; Schaper-Rinkel, P ; Smith, J ; Tschaut, A; van der Wende, M.; Luxembourg : Publications Office of the European Union, December 2015.



# MEGATRENDS 2050

## Accelerating technology

- Each invention, coming faster and faster, changes not only society and economy, but also the way we work in education, science and business.

## Demographic change

- the move to cities,
- the ageing population
- the shifts in family size and social norms
- → all will change expectations and options for policies regarding education, research and innovation.

## Globalisation

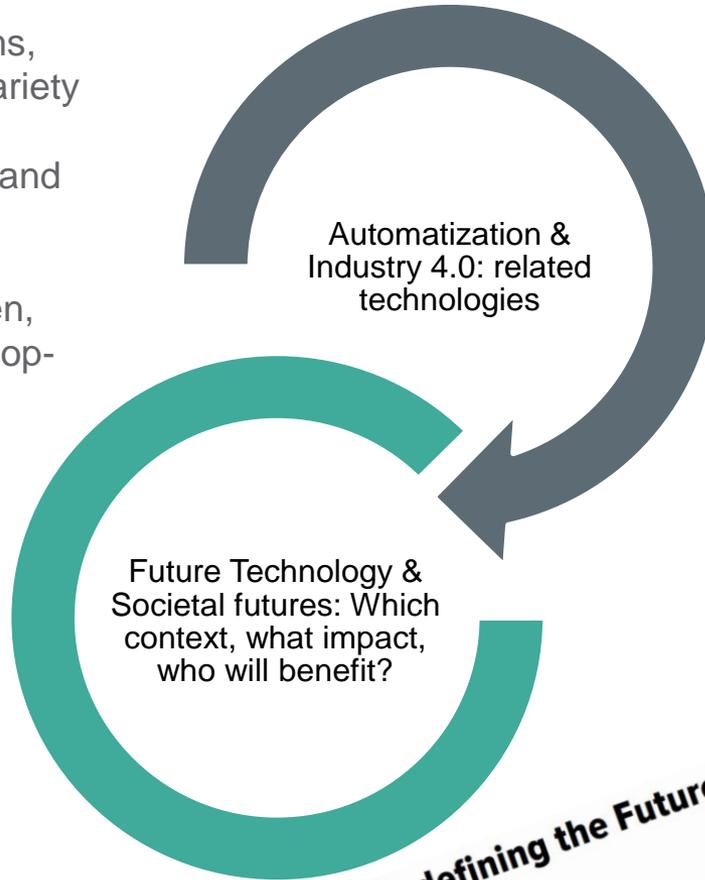
- world gets more inter-connected,
- and economic competition expands,
- interdependence will rise, power will shift; new opportunities and risks: for whom?



# MEGATREND ACCELERATING TECHNOLOGY: AUTOMATIZATION, AND INDUSTRY 4.0

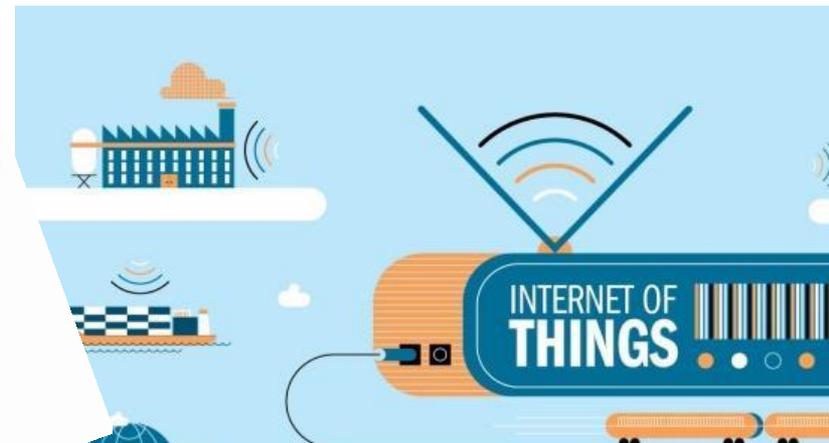
Automatization, and industry 4.0

- umbrella terms, covering in variety of new technologies and their impact
- In Europa: industry-driven, hierarchical, top-down



- Cyber-physical Systems
- Internet of things / Internet of Moving things
- Blockchain
- Semantic Web
- Augmented reality
- Quantum computing
- 4-D printing
- 3-D biological printing
- Nanorobotic manufacturing

**How Blockchain Is Redefining the Future of Commerce**

# EUROPE 2050 – SCENARIO 1

## EUROPEAN SUCCESS

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**Open Innovation** is the dominant mode: multinationals, SMEs, universities and many new actors – foundations, NGOs, individuals - work together in fast-changing global networks to solve global problems.

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Automation and data-intensive science have changed the nature of doing research. From open science to radical open access: **new actors** are rushing into research; co-creation of knowledge

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EU institutions generally are strengthened; regions and cities have climbed in importance – Europe’s growing **laboratories of democracy** – the coordinating role of EU institutions has risen.

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Effect of coordination: **Multinational tax avoidance is under control**, strengthening public treasuries everywhere

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core values: **equality, openness, social inclusion and environmental responsibility**



# EUROPE 2050 – SCENARIO 2

## EUROPE MISSES OUT

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Megatrends beyond Europe's control: Automation and globalisation have triggered **mass unemployment, social exclusion, inequality** is higher than ever

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New creative jobs evolving from new technologies – such as service bots, machine learning, ubiquitous sensing – but they are **only for the skilled few**

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Politically: **Europe has fragmented** into a coalition of rich and poor regions with minimal coordination.

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Multinational companies, SMEs and individuals use global markets & digital technologies to **avoid tax**. Public treasuries are impoverished; universities and labs depend heavily on private funding → new ideas and talent are **controlled by the wealthy and powerful**.

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Big companies, on which public labs and universities rely for major funding, get early access to discoveries & use their influence to **steer the remaining public funds towards their projects**

# RECENT TRENDS IN STI IN EUROPE

- Framework Program Horizon 2020
  - Extreme low success rates in funding (Future Emerging Technologies: below 2%)
- Grand Challenge Orientation (Lund Declaration 2009)
  - Thematic structure instead of real focus on the Grand Challenges of our time

Lund Declaration: Europe must Focus on the Grand Challenges of our Time, in: Swedish EU Presidency, Swedish EU Presidency, 2009.

# POLICY CONCEPTS TO RE- CONZEPTIONALIZE INNOVATION

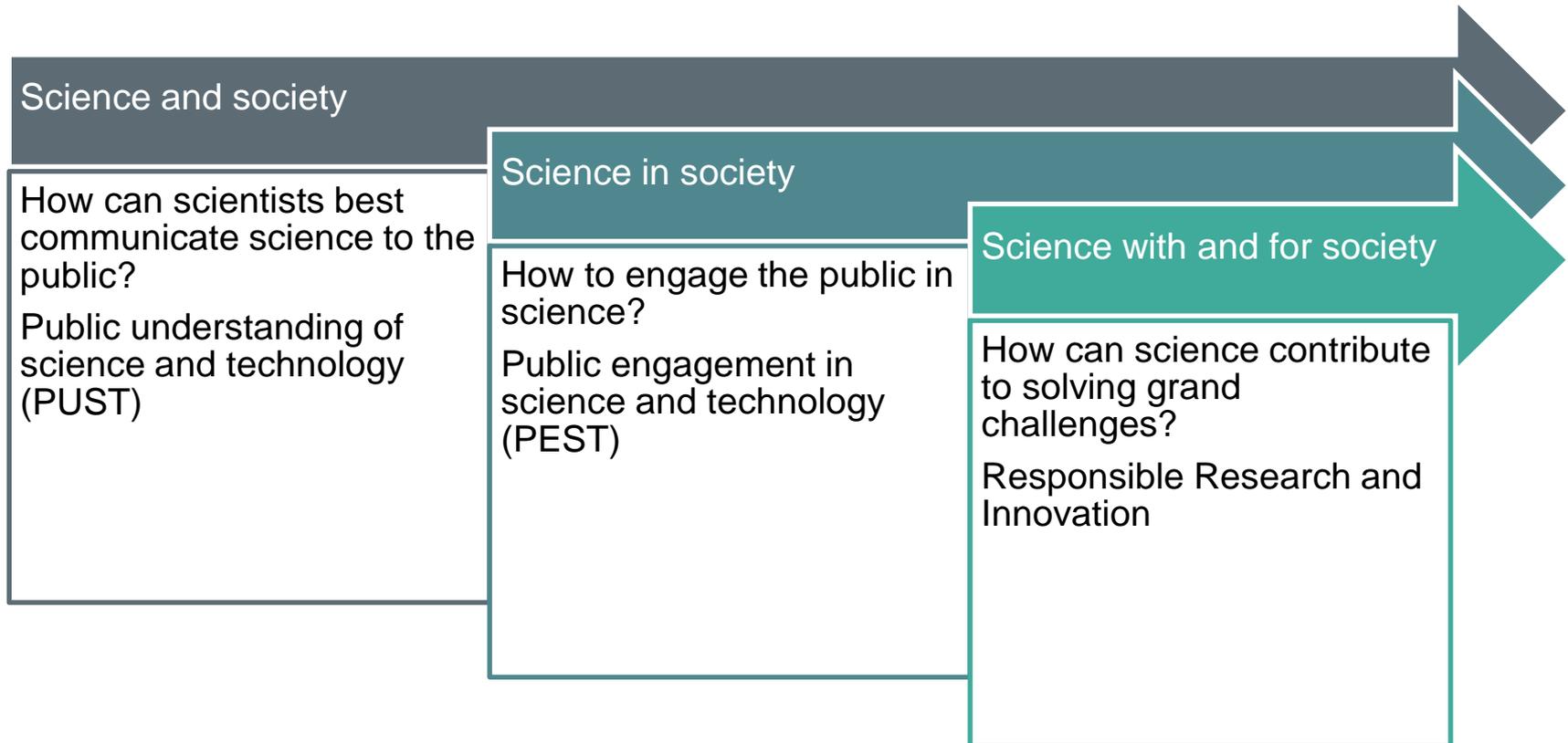
Science with and for  
Society / RRI -  
Responsible  
Research and  
Innovation

SDGs Sustainable  
Development Goals

Social Innovation

Transformative  
Innovation policy

# SCIENCE WITH AND FOR SOCIETY – THE CONCEPT



# RESPONSIBLE RESEARCH AND INNOVATION (RRI)

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**“Responsible Research and Innovation is a transparent, **interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).**”**

(von Schomberg, René. "A Vision of Responsible Research and Innovation."  
In *Responsible Innovation*, edited by Richard Owen, John Bessant and  
Maggy Heintz. 51-74: John Wiley & Sons, Ltd, 2013.)

# TRANSFORMATIVE INNOVATION POLICY

- Framing 1: Innovation for Growth
  - commercialization of scientific discovery; boosting R&D
- Framing 2 – National Systems of Innovation
- Framing 3: Transformative Change
  - How could innovation directly address environmental challenges and social challenges?
  - central focus: how to achieve fundamental systemic change in the interests of social, economic and environmental sustainability
  - System innovation involves multiple actors, also innovative civil society actors, playing a crucial role in co-construction new systems
  - “it is essential to reflect on social and environmental needs and the search process has to be guided by improvements in anticipation of collateral effects and consequences” (Schot/Steinmueller 2016)

Schot, J. and Steinmueller, E. (2016) Framing Innovation Policy for Transformative Change: Innovation Policy 3.0. SPRU Science Policy Research Unit, University of Sussex: Brighton, UK.

# SOCIAL INNOVATION – OPEN DEFINITIONS FROM THE SI COMMUNITY



.. “social innovation is a new combination of social practices in certain areas of action or social contexts **with the goal of better satisfying or answering social needs** and problems than is possible on the basis of existing practices“

- Better for whom?
- In which time horizon and which social and political context?



“Social innovations are innovations that are **social in both their ends and their means.**” (BEPA 2010)

# SUSTAINABLE DEVELOPMENT GOALS (SDGS)

- The Sustainable Development Goals (SDGs), officially known as resolution adopted by the UN General Assembly on 25 September 2015 with the title “Transforming our world: the 2030 Agenda for Sustainable Development” is a set of 17 "Global Goals" with 169 targets between them.
- Explicitly, the document only mentions scientific and technological innovations.
- Explicit: innovation as scientific and technological innovations
- Addressing global innovation challenges
- The concept of social innovation is not explicitly mentioned
  
- Implicit: The challenges how to shape emerging technologies / how to innovate technologically and socially in search of sustainable alternatives for the planet



# SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



Explicitly Innovation oriented: Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

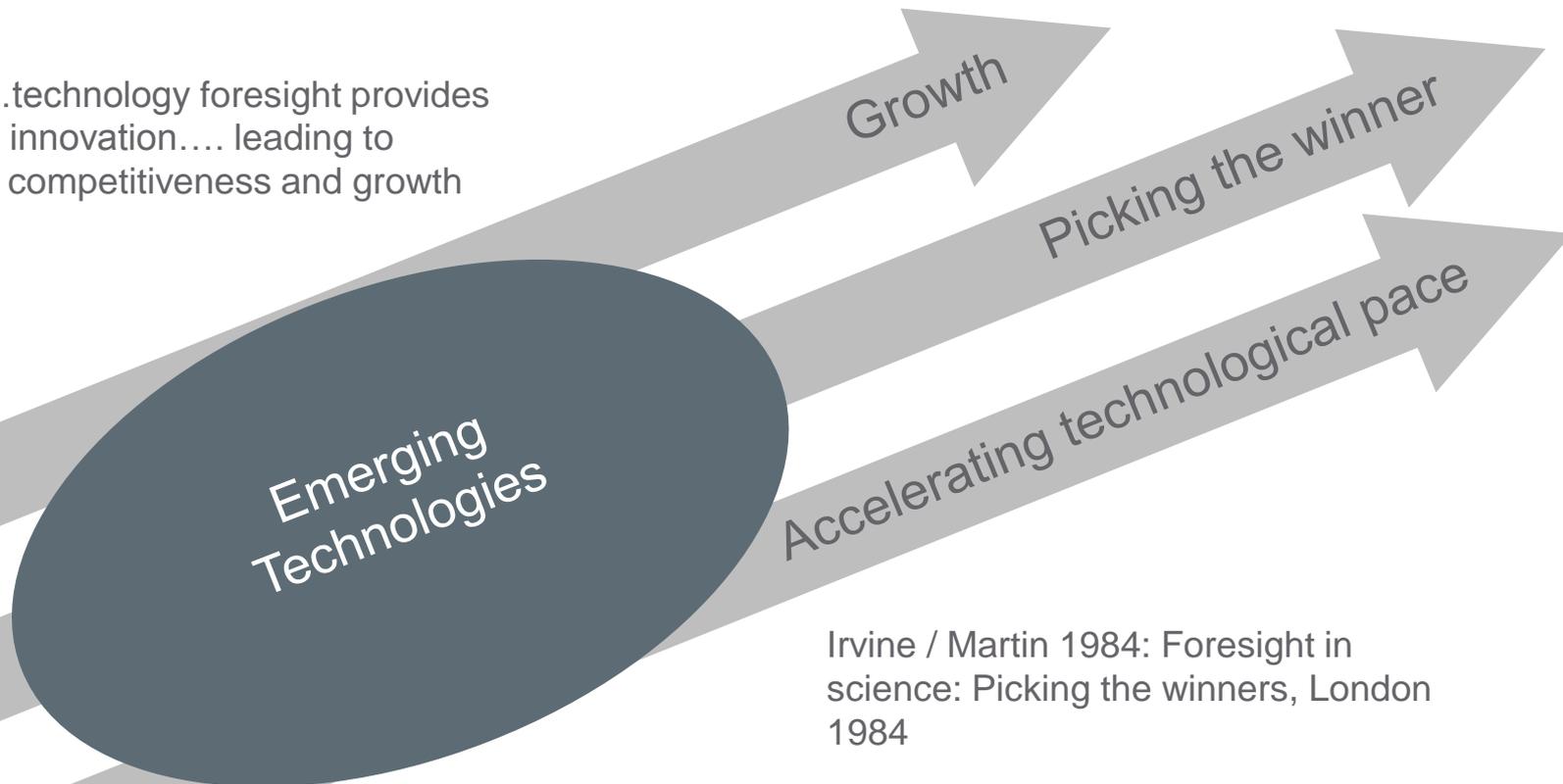
All Goals: Need for research to shape emerging technologies towards societal innovation - open question of new institutions to establish the societal innovation globally

# ANTICIPATION AND FORESIGHT IN TRANSFORMATIVE INNOVATION POLICY



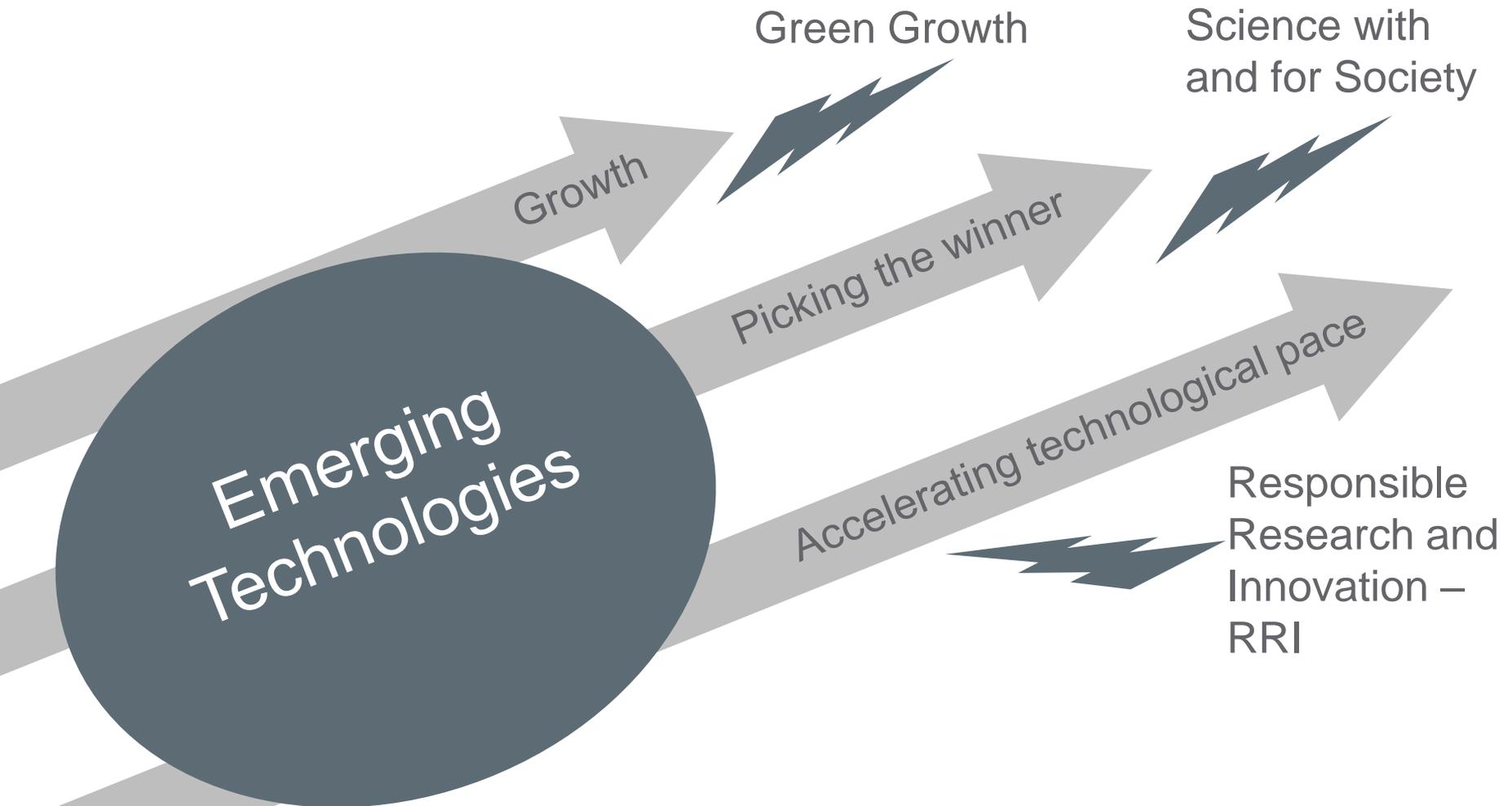
# THE FUTURE OF INNOVATION SYSTEMS; TECHNOLOGY FORESIGHT

UNIDO: ...technology foresight provides support to innovation.... leading to enhanced competitiveness and growth

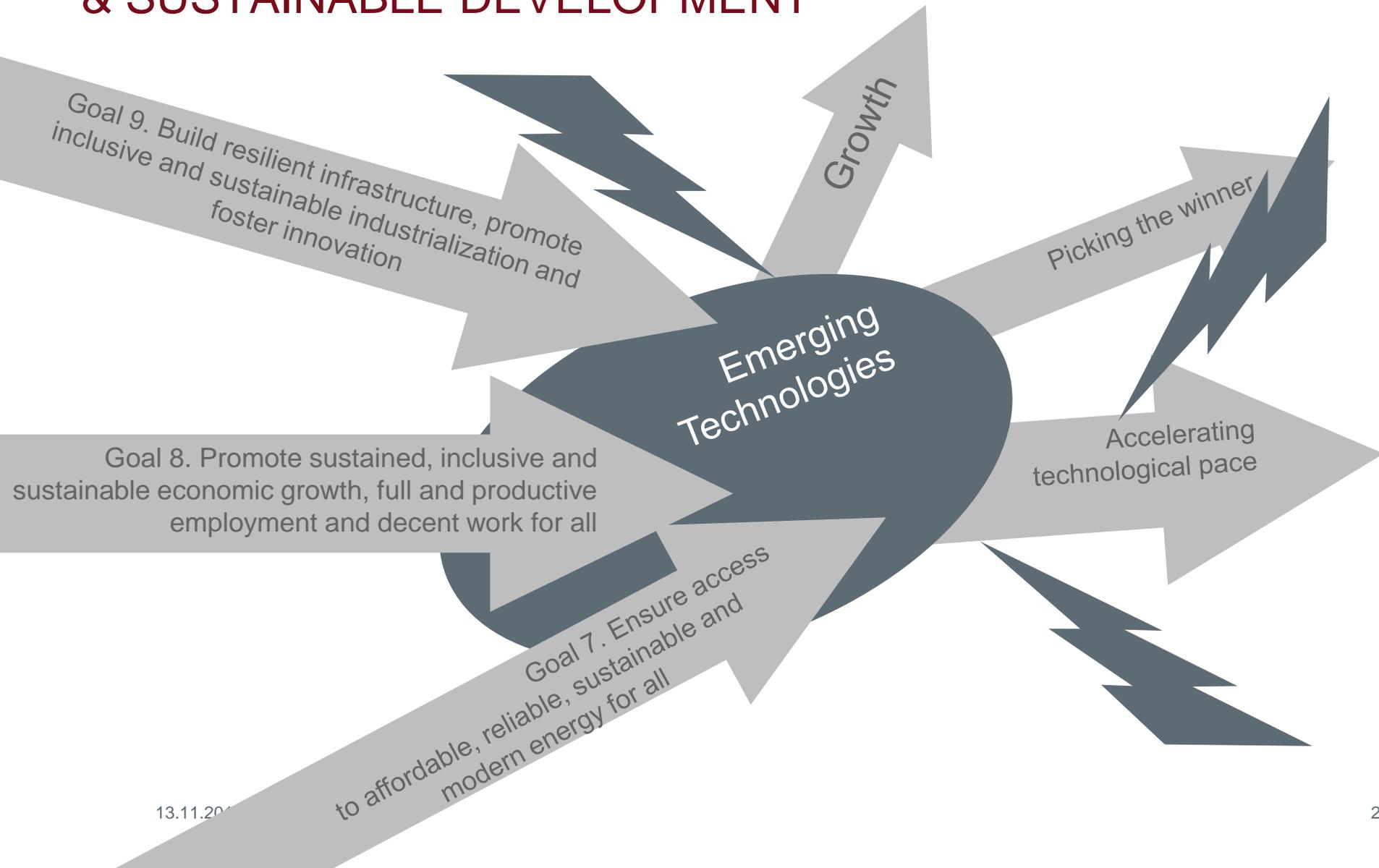


Irvine / Martin 1984: Foresight in science: Picking the winners, London 1984

# FORESIGHT TODAY – TENSIONS - GROWTH, ACCELERATING TECHNOLOGICAL CHANGE AND PICKING THE WINNER



# FORESIGHT FOR SOCIETAL FUTURES X.0 ? TENSIONS BETWEEN TECHNOLOGY RACE & SUSTAINABLE DEVELOPMENT



## DISCUSSION

- Knowledge production, Automatization and Industry 4.0
  - Need to change the innovation dynamics in generic technologies such as blockchain:; Internet of (moving) things (from 'fail fast' logic to frameworks for responsible development)
  - co-creation of overall frameworks to develop complex technologies
- Anticipation and Foresight for Transformative Innovation Policy
  - Transdisciplinary integration of actors
  - New governance mechanism for co-creation of innovation
  - Objectives beyond growth and competitiveness
- What's missing so far in thinking experiments in foresight?
  - Disruptive events?
  - Degrowth in Europe?
  - Ownership of basic digital infrastructures of the future?

Weltausstellung vom 1.8. - 31.10. 2000 in Hannover

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# THANK YOU!

Petra Schaper Rinkel, November 2017

