# Gender and context in academia

## From the "Ivory Tower" to the Next Generation Entrepreneurial University

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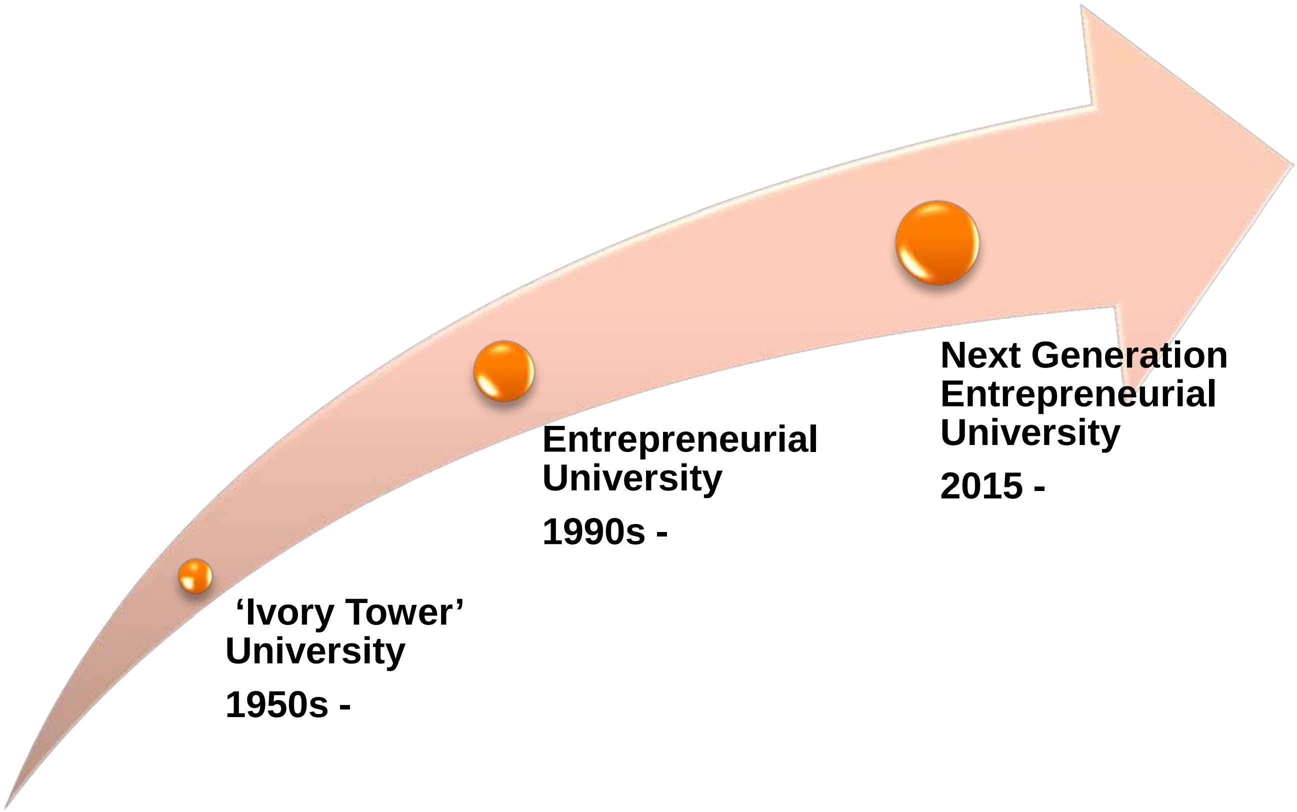
## The myopia of the gender debate in academia

- The gender debate in academia takes place all too often from a static, atemporal perspective that does not take sufficient account of the dynamic transformations of the university institution and its connections with the socio-economic environment.

- Poor contextualization of the gender debate may reduce the relevance of conclusions and slow down the progress in narrowing gender gaps.

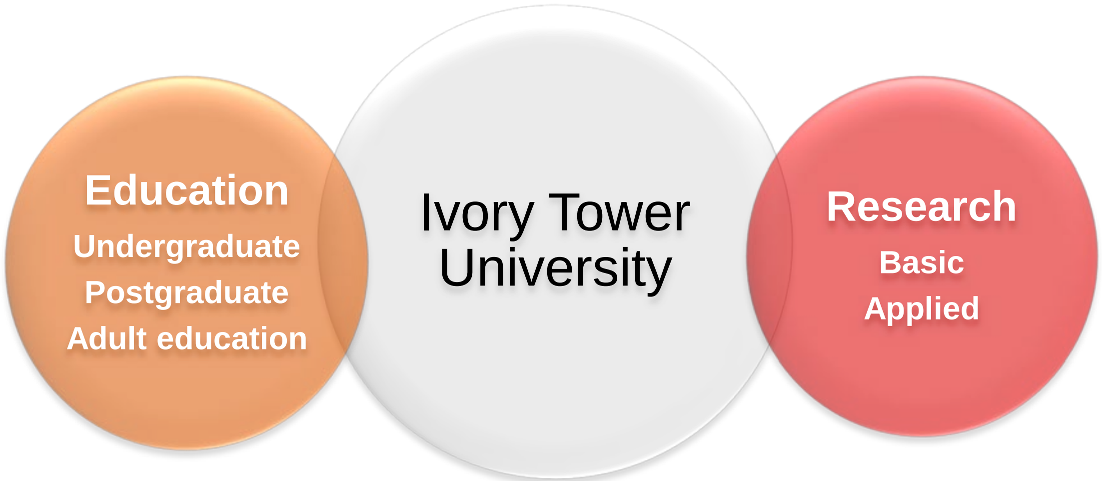
# Contextualizing the gender debate in academia

- Each stage in the university evolution brings new, specific gender concerns
- Old concerns often carried over to the next stage, co-existing with the new ones

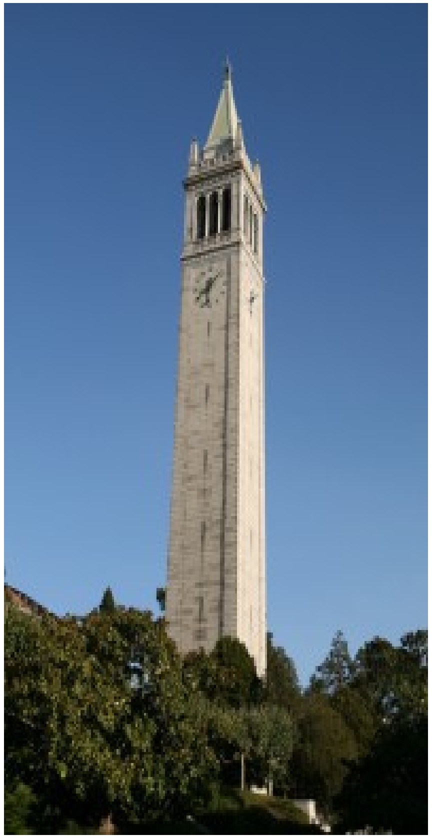


## 1. The ‘Ivory Tower’ University

- Education and research as the two main university missions
- University’s primary function to provide skilled graduates for the economy
- Extensive focus on basic research, applied research the remit of industry
- Science and research largely in isolation from industry needs
- Specific to Industrial Society



# Gender in the 'Ivory Tower' University



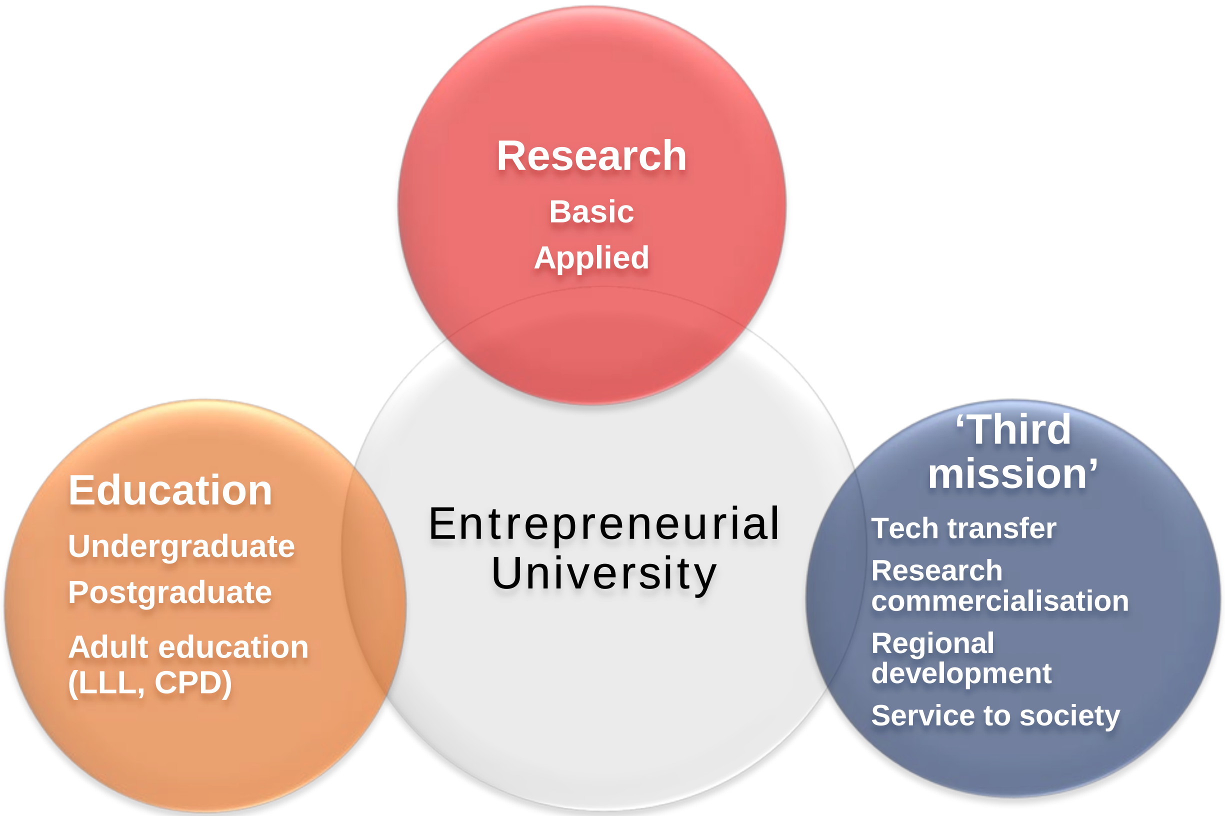
- *The "leaky pipeline"* - static social structure of science and economy, strong institutional boundaries

*Women who had reached top positions in their areas were thought to have "extraordinary motivation, thick skins, exceptional ability, and some unusual pattern of socialization in order to reach their occupational destinations" (Rossi, 1965, p. 1201)*

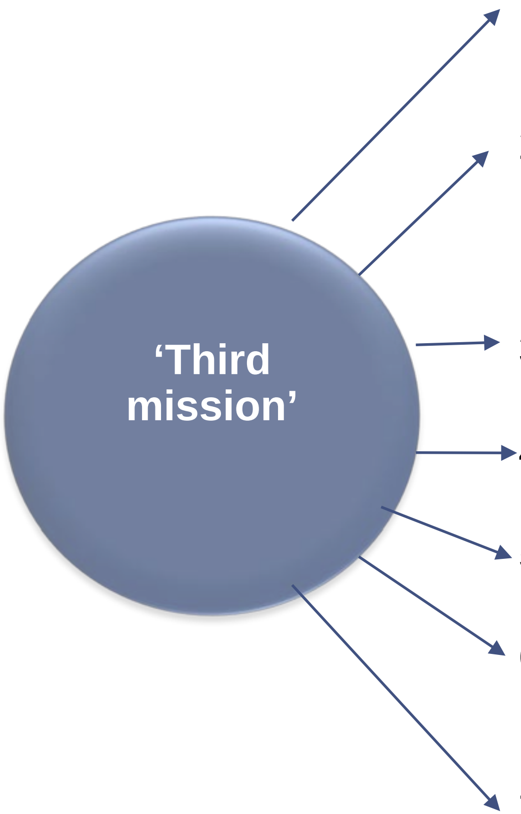
- *Relatively inflexible academic format:* "male model" of scientific career, "tenure clock" vs. "biological clock", difficult work-life balance
- *Gendered separation of labour in sciences* - status differentiation.
- *The "stag effect"*
- *Lower availability/lack of mentoring* for women
- *Men-domination of peer-review and evaluation procedures*
- *Gender-bias in research funding.*

## 2. The Entrepreneurial University

- "Third mission" added to education and research
- Paradigm shift in the university's socio-economic role
- Specific to the Knowledge Society



# Entrepreneurial University activities




1. Joint research projects with industry (contract research, consortia).
2. Tech transfer infrastructure: tech transfer offices, S&T parks, business incubators, business accelerators, industrial parks, technology parks, etc.
3. Research commercialisation (patents and licenses)
4. Spin-off formation by academic faculty and students
5. Strategic partnerships with business firms
6. Venture capital for research commercialization and spin-off formation
7. Involvement in local and regional development projects through PPPs

# Gender in the Entrepreneurial University

- Gender gaps in education and research continued, some improved → substantial gender gaps in 'third mission' activities
- "Gender stratification" in entrepreneurial activities arising from explicit early exclusion of women → fewer opportunities in the marketplace, weaker socialization and commercialization skills
- Difficult challenge for senior/mid-career women, easier for junior faculty.
- Lower gap among most accomplished and best-networked scientists, and in universities with formal TTOs;
- Higher gap in the highest-ranking academic departments where men are more involved than women in academic entrepreneurship

# Gender in patenting

- Large gender gap:
  - 5% women patent holders in Sweden (Nyberg, 2009)
  - 2% in Israel (incl. firms), up to 6% excl. firms (Yanisky-Ravid, 2010)
  - Female academics in life sciences in the US patent at about 40% of the rate of their male colleagues (Ding, Murray and Stuart, 2006)
  - Women patents at EPO (2005): 3.2% Austria, 4.7% Germany, 8.2% US, 10.2% France, 12.3% Spain (Frietsch et al. 2009)
    - 7% of the gap explained by the lower share of women without any S&E degree
    - 78% of the gap explained by lower female patenting among S&E degree holders - women's underrepresentation in engineering and in jobs involving product development and design (Hunt et al. 2009)

- Exception in biotechnology: organizational structure differences
  - Small, more flexible, network-based spin-off firms vs. larger, more hierarchical organizational settings in industry or academia (Whittington & Smith-Doerr, 2008).

## Gender in academic spin-off formation

Large gender gap:

Only 12% female spinoffs founders, 20 leading UK universities (Rosa and Dawson, 2006).

- Relatively few senior women researchers in leading S&E departments from which they could have better access to entrepreneurial activities
- Greater exposure of male academics to the business community
- External drivers of research commercialization often target senior academics, which proportionally are mostly male
- Less commercially-relevant research by female professors
- Greater personal and professional responsibilities for women academics, time constraints in work-life balance
- Poor/lack of prior work and managerial experience in entrepreneurial ventures
- Attitudes of technology licensing officers on university campuses.

# Gender in academic spin-off formation (cont.)

- Women scientists' lower propensity to become entrepreneurs, due to *individual factors*:
  - Attitudes to risk-taking and competition, motivation, self-confidence and other characteristics due to gender socialisation (Sonnert and Holton, 2006).
  - Attitude to "selling of science" (supply factors), vs. women's role in networks, preferences of venture capitalists and "gender discounting" (demand factors) (Stephan and El-Ganainy , 2007).
  - *"Bitch avoidance"* - fear of being perceived as highly assertive and confrontational, often necessary for defending ideas, fundraising, etc. (Anonymous, 2008).

- While both male and female science entrepreneurs display similar motivations to entrepreneurship, collectively as scientists, they differed appreciably from non-academic entrepreneurs (Rosa and Dawson, 2006).

# Gender in venture capital funding

Large gender gap:

- In 1999, less than 5% of US companies receiving VC had a woman in their executive team; in 2011-2013, more than 15% (Diana Project, Brush et al. 2014)
- In 2006, only 4% of VC-backed companies had female CEOs; companies led by women received just 3% of the total VC (Abrams, 2008).

- Investor bias against female entrepreneurs, who are less esteemed than male entrepreneurs (e.g. Ahl, 2002), or are seen as complementary, not good enough (Ahl, 2004; Aaltio, 2008),

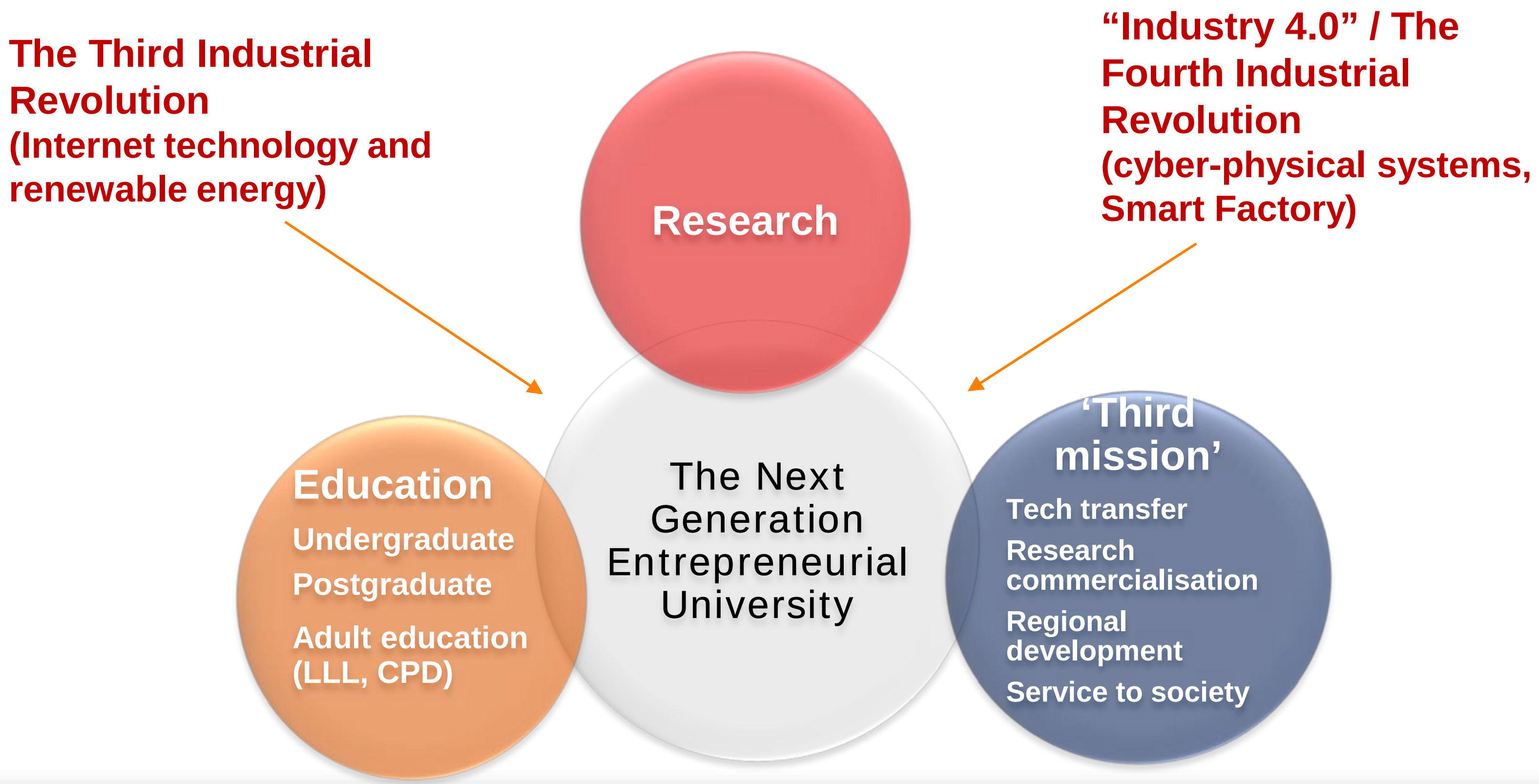
- Entrepreneurship associated with masculinity, women depicted as ‘in need’, weaker → women entrepreneurship as a stigmatized identity (Lewis, 2006).

- VC community has become more homogenous → fewer female VCs, male VCs expect entrepreneurs to look like them--young and male.

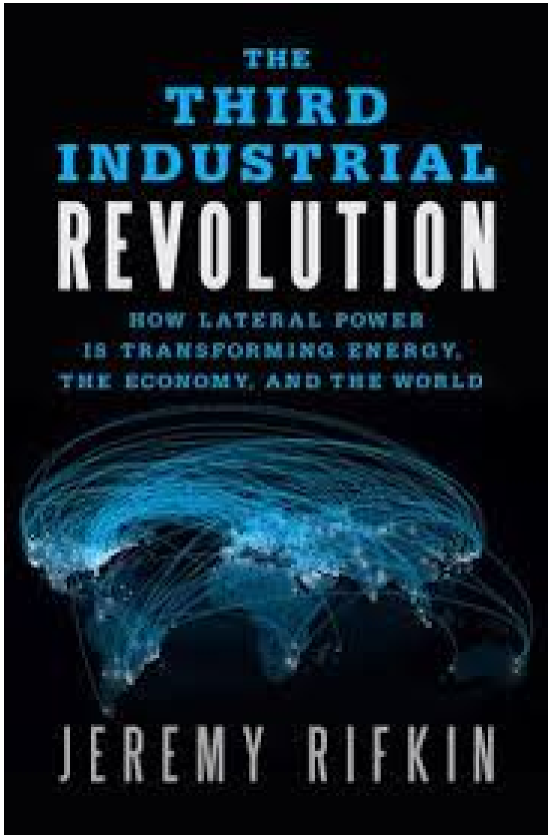
- Few pitches from women entrepreneurs (10-20%)

# 3. The Next Generation Entrepreneurial University

- Paradigm shift in industry determined by key new technologies
- Deep changes in all the three missions of the Entrepreneurial University
- Stronger industry-driven agenda to meet knowledge needs, narrow graduate unemployment gaps



# The Third Industrial Revolution (Rifkin, 2011)




## The five pillars of the Third Industrial Revolution

(1) Shift to renewable energy;

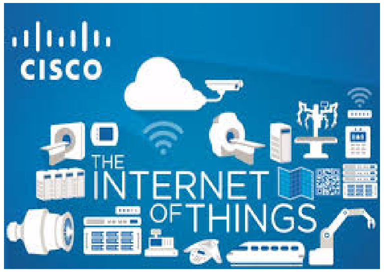
(2) Creation of renewable energy by turning buildings into green micro–power plants;

(3) Use of hydrogen and other storage technologies in every building to store intermittent energies;

(4) Use of Internet technology to transform the power grid into an energy internet;

(5)Transition of the transport fleet to electric plug-in and fuel cell vehicles that can buy and sell green electricity on a smart, interactive power grid.

# Enablers of the Third Industrial Revolution




## Cisco's Internet of Things (IoT)

- Accelerated market adoption of IoT because of:
  - Growth in analytics and cloud computing
  - More interconnected machines and personal smart devices
  - More apps connecting supply chains, partners, customers


## GE's "Industrial Internet"

- Convergence of the global industrial system with advanced computing, analytics, low-cost sensing and higher internet connectivity
- New hybrid business models, product-service hybrids
- Digital services based on Big Data analytics


## IBM's "Smarter Planet"  / "Smarter Cities" technologies

- 2010, Rio de Janeiro, Brazil: emergency response solution using IBM technology for the 2016 Olympics and 2014 World Cup.
- 2013, New Taipei City Police: police productivity and public safety.
- 2013, Tucson, Arizona: water conservation solution focused on smart metering and water leak detection.
- 2013, Digital Delta transforms Dutch water management system using Big Data.

# Implementing the Third Industrial Revolution

- **TIR Master Plans:** Rome (2009), San Antonio, U.S. (2009), Utrecht (2010), Monaco (2011), Nord-Pas-de-Calais (2013)

- **UK's "White Paper for Energy Market Reform"** (2010)

- **China:** $82 bn for TIR distributed "energy Internet" that will serve as a technology platform and infrastructure for the "intercontinental backbone network" (2013)

- **Kazakhstan's** plans for building TIR infrastructure for "Energy Expo 2017"

- **UNIDO** recognizes TIR as a "provocative strategy for transforming the global energy system" (2011)

- **European Union**

- June 2009: law to implement the 20-20-20 targets (20% cut of greenhouse gas emissions, 20% increase in the renewables share in the energy mix, 20% cut in energy use, all by 2020).
- Feb 2010: the Environment Committee of the EP calls for a "Third Industrial Revolution"
- May 2012: EC conference "*Mission Growth: Europe at the Lead of The New Industrial Revolution*"

# "Industry 4.0" and the Fourth Industrial Revolution

- Industry 4.0 project originated from German government's 2011 High-Tech Strategy for computerization of manufacturing industry by 2020 (€400m investment)

- Smart Factories with cyber-physical systems that monitor physical processes → communicate over the Internet of Things → offer services via Internet of Service

- Integration of industrial production + business processes + customer networks

- Strong customization of products under highly flexible (mass) production, smart products (self-optimization, self-configuration, self-diagnosis), intelligent support of workers, just-in time maintenance, near-zero downtime.

# Industry 4.0 – What is changing for companies?

## 1. Output: Personalized, local production and mass customization

**-** More flexibility of production process, products tailored to customer, lower costs

## 2. Process: Networked manufacturing and cluster dynamics

- Concentration of suppliers in small areas
- *“Industrial democracy*“: lower entry barriers for smaller or more specialized firms.
- Shifting distribution of power between MNEs and SMEs or very focused players
- More complex production and supply networks → "*mobile manufacturing units“*

## 3. Business models: Fragmentation of the value chain

- Changing roles of designers, physical product suppliers and customer interfaces
- Fragmentation of the value chain, lower barriers to entry for small entrants

# Industry 4.0 – What is changing for companies? (cont.)

## 4. Competition: Converging frontiers

- Blurring of traditional industry boundaries between industrial and non-industrial applications.
- Focus on industrial working methods, reproducibility of products and services.
- Mas-production of services
- High-quality digital services and comprehensive digital infrastructure
- Closer dovetailing between IT/telecom firms and traditional manufacturing firms.

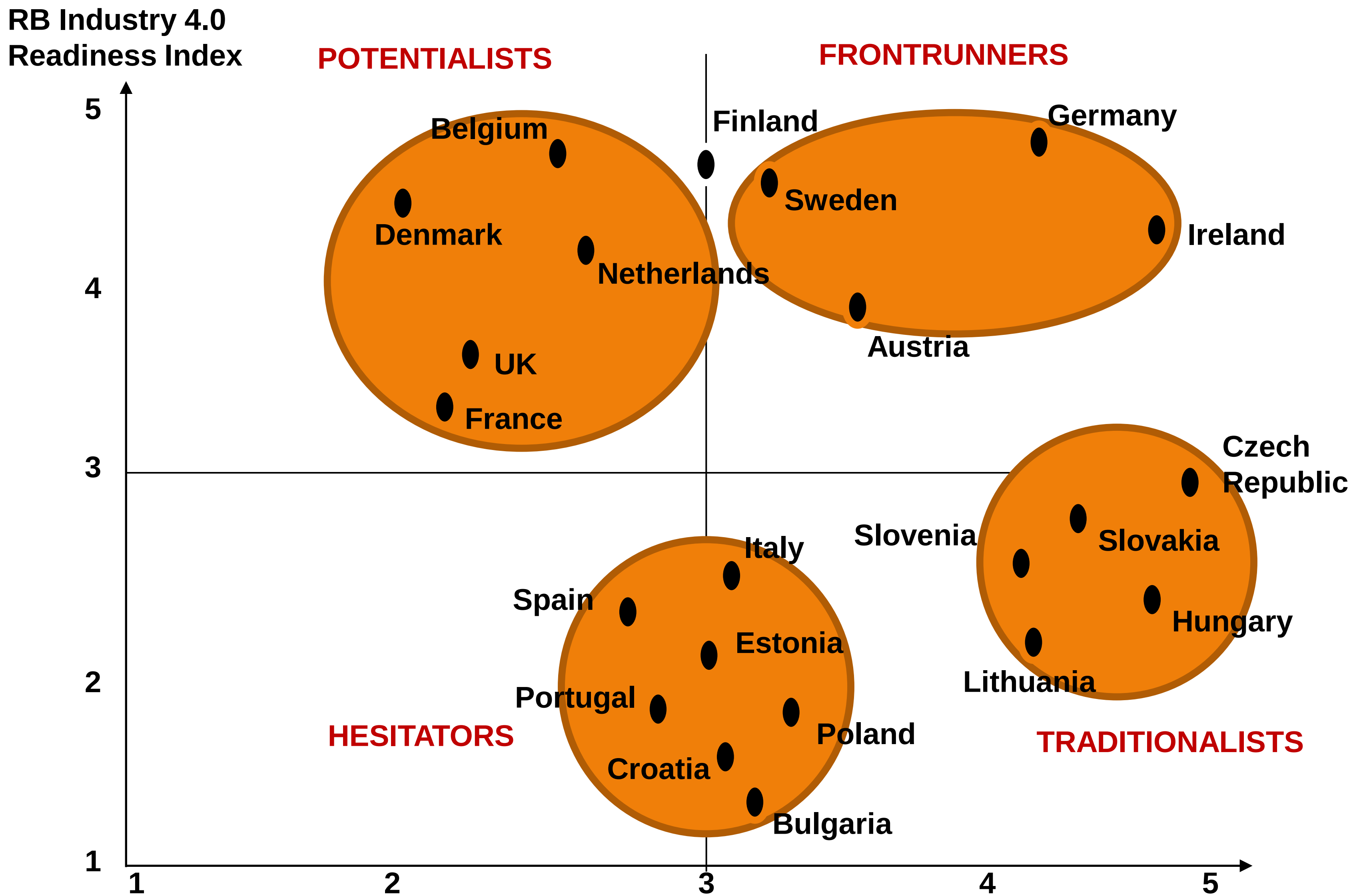
## 5. Skills: Interdisciplinary thinking is key

- Dominant technologies: IT, electronics and robotics, but also biotech, nanotech.
- Need for enhanced social and technical skills.
- Shift toward design thinking instead of production thinking.
- Corporate cultures with CPD and LLL, collaborative and cross-cultural skills
- Broader 3D printer usage

## 6. Globalization: Lighter footprint

- Selected hotspots, rather than comprehensive global presence
- Local small scale production, more decentralized and flexible organizations

*(Source: Roland Berger, 2014)*




*(Source: Roland Berger, 2014)*

# Implementing Industry 4.0 – The Roadmap

| STEP | ACTION | PLAYER |
|---|---|---|
| 1. Set conditions for the 4.0 ecosystem | Promote Industry 4.0 as a European idea | European and state policy-makers |
| 2. Boost Industry 4.0 offerings | Accelerate innovation | **Public and private partners, collaborative networks, innovative clusters** |
| | Develop future champions | Equipment and infrastructure industry players and associations |
| | Establish a dynamic digital environment | Infrastructure providers and financing |
| 3. Promote fast adoption as competitive lever | Progressive transition to 4.0 | Industrial users (pharma, automotive, aerospace, manufacturing, etc.) |

**The Next Generation Entrepreneurial University**

*(Source: Roland Berger, 2014)*

# Implications for education

- **Provide the next generation workforce for Industry 4.0**
  - More students in STEM and MINT subjects (mathematics, informatics, natural sciences and technology).
  - New curricula and training programmes for students based on a dialogue with manufacturing industry to reflect requirements of the digital economy
  - Training of IT/engineering students driven by business and their customers → convergence of IT and production engineering training.
  - New relevant learning content, new didactic and methodological approaches
  - Basic training programs followed by work placements, advanced courses.
  - New qualifications in some business areas, dual degrees → stronger cooperation business schools and engineering schools
  - Social skills and interdisciplinary skills, e.g. business or project management

# Implications for research

**Stronger emphasis on interdisciplinary research and cooperation**

**New research areas:**

- On interactions between virtual and real machines, factory control systems and production management systems.
- On work organization, process design, management and cooperation, impact on the evolution of work and training.
- On combining traditional manufacturing processes with new "smart" structures with decision-taking, coordination, control and support functions.
- On modelling of technological systems, modelling of interactions between the real and digital worlds → integrated view of strategy, business processes and systems

# Implications on “third mission”/entrepreneurship

- Encourage formation of start-ups in Industry 4.0 technologies, to establish new ideas, companies and business models
- Better financing for start-ups
- More involvement in clusters where start-ups and established firms can network and together build up Europe-wide value chains.
- Better social perception of company founders, successful entrepreneurs as role models.
- Encourage risk-taking, change the fear of failure

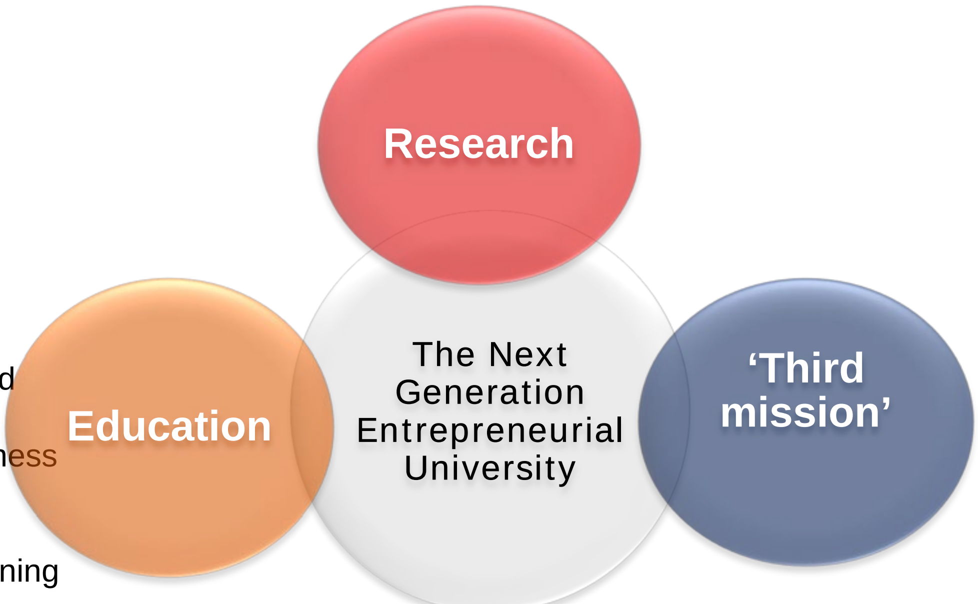
# Gender in the Next Generation Entrepreneurial University

- More interdisciplinary research on gender differences in e.g. medicine, drug effects, new product development, work psychology, etc.

- **Faculty level:** More senior women academics

- **Student level**: More girls in STEM and management, new technologies and business

- **Curriculum level**: New teaching and learning methods that are more student-oriented and more aware of gender differences in learning




More girl students in entrepreneurial education

More women academics in spin-off creation, better access to mentoring and coaching, VC financing, business advice, etc.

## The policy dimension - Responsible Research and Innovation (RRI)

The gender objectives of the Next Generation Entrepreneurial University are relevant to the six key objectives of RRI:

- Engagement
- *Gender Equality*
- *Science Education*
- Open access
- Ethics
- Governance

**Major policy challenge: to make new industrial revolutions reduce gender gaps in academia, rather than perpetuate them in a new context.**

Forthcoming book:

**Pooran Wynarczyk and Marina Ranga (eds.) (2015), G*lobal insights into the commercialization of new technology through a gendered lens,* Palgrave Macmillan.**

*Foreword by Sue Rosser*

Ch 1. Introduction: *Pooran Wynarczyk and Marina Ranga*

Ch 2. Gender Dimensions in Knowledge and Technology Transfer: The German Case - *Kathinka Best, Marie Heidingsfelder and Martina Schraudner*

Ch 3. Women's Role in Biotechnology research: The Case of Mexico - *Humberto Merritt and Pilar Pérez-Hernández*

Ch 4. Patenting Activity in Spain: A Gender Perspective - Elba Mauleón and María Bordons

Ch 5. Gender, Commercialization & Thought Leadership: Examining Women's Participation in Information Technology Patenting and Conference Paper Authorship - *Catherine Ashcraft and Joanne McGrath Cohoon*

Ch 6. Gender Patterns of Businesses with Growth Potential in Croatia - *Slavica Singer, Nataša Šarlija and Sanja Pfeifer*

# THANK YOU!

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