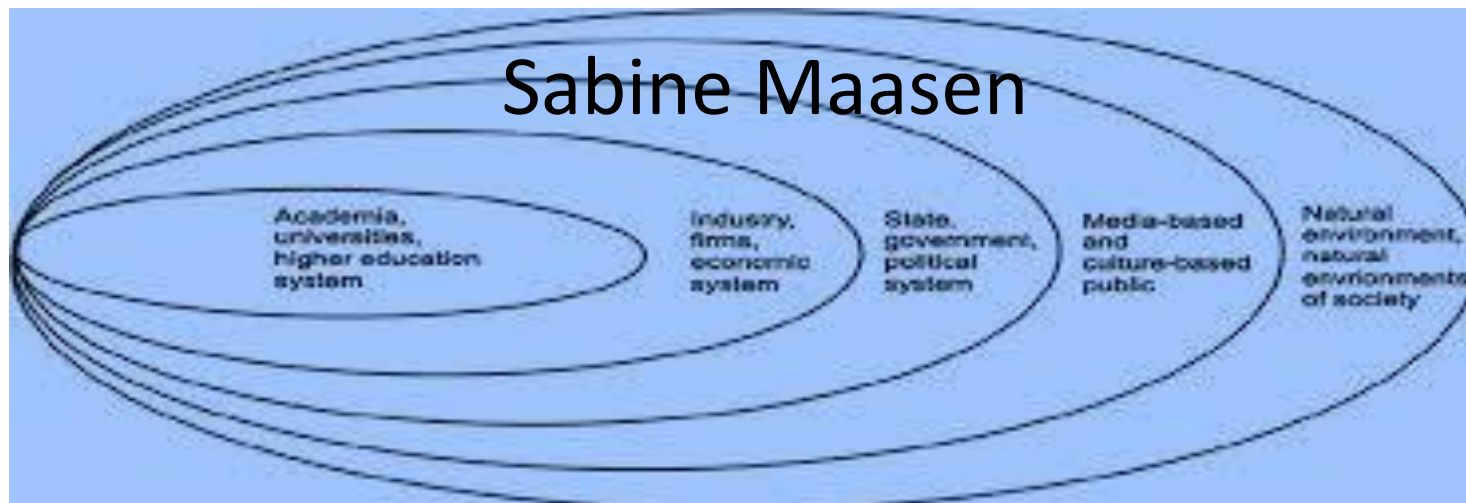
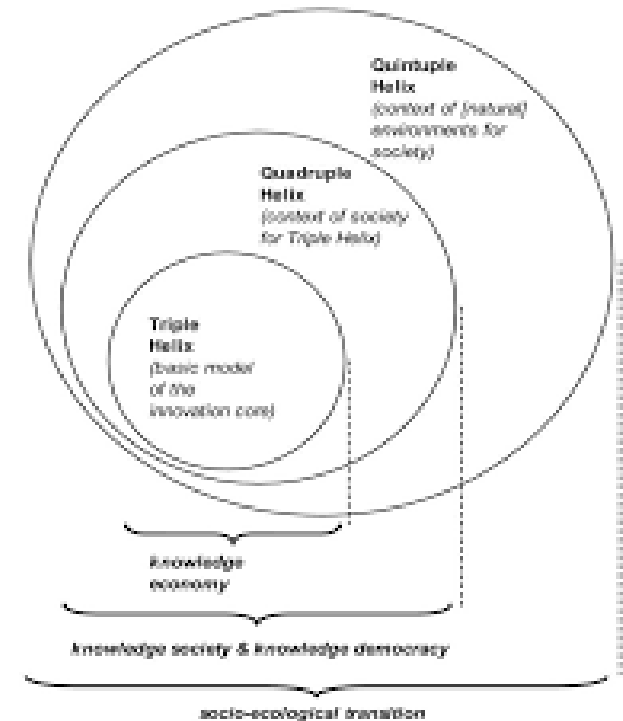


Universities co-creating sustainable solutions together with government, industry, civil society considering the natural environment –
Toward a “quintuple helix”- model of innovation ?



- The traditional mode:
 - universities produce knowledge: new & robust
 - industry: economic engine of society
 - government: prosperity and justice
- Boundaries are becoming blurry
- The emerging mode:
 - government takes the role of a funder
 - universities often partner with industry (enterprising research)
 - Industries cooperate with universities (increasing competitiveness)
 - ...
- different institutional spheres (helices) intertwine

- metaphor of a helix
 - the ways in which different societal entities interact and co-evolve dynamically so as to intensify innovation dynamics.
 - To date, research has outlined three main helix metaphors, the Triple Helix, Quadruple Helix and Quintuple Helix.



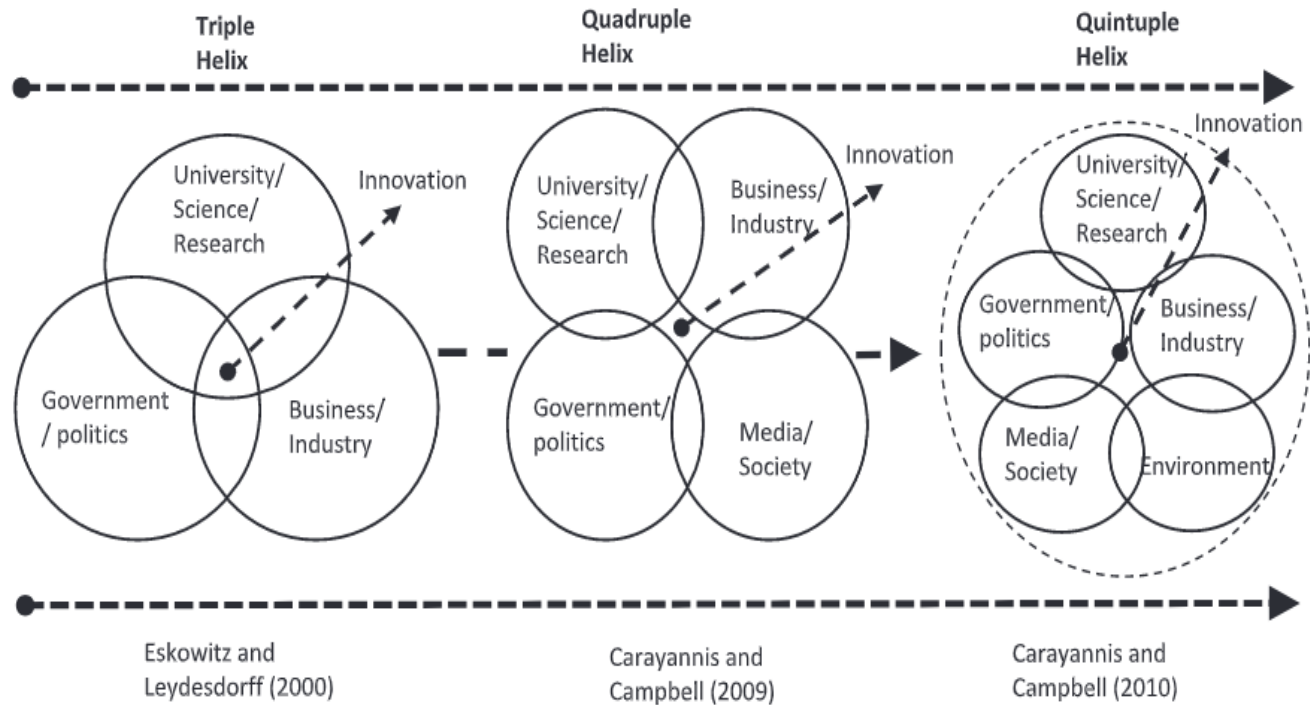


Fig. 4. The Helix Structure influence on innovation (Adapted from Barth and Schlegelmilch (2013)).

- **Triple Helix:** university-industry-government relations
→ *knowledge economy*
 - **Quadruple Helix:** 'media-based public' and 'civil society'
→ *knowledge democracy*
 - **The Quintuple Helix:** natural environments
→ *socioecological transition of society*
- society and the ecological environment have become active & accountable participants in the innovation process

education system: universities, higher education systems, schools

- human capital of a state: students, teachers, researchers, academic entrepreneurs, etc.

economic system: industry, firms, services, banks, etc.

- economic capital: entrepreneurship, machines, products, technology, money, etc.

natural environment:

- natural capital: regenerative resources & technologies, etc.

civil society:

- social capital: tradition, values, etc.
- capital of information: television, internet, social networks, etc.

political system:

- political and legal capital: ideas, laws, action-pl, etc.

Step 1: economic system ↔ economic capital ↔ education system

Step 2: education system ↔ human capital ↔ environmental system

Step 3: environmental system ↔ natural capital ↔ civil society

Step 4: civil society ↔ social capital ↔ political system

Step 5: political system ↔ 'political and legal capital' ↔ education system, economic system, natural environment, civil society

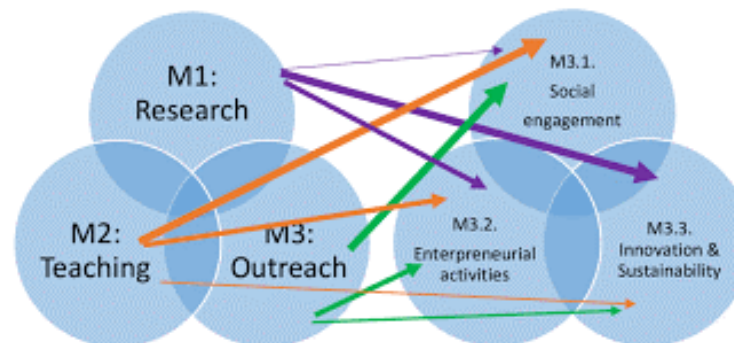
- Implications for universities
 - shift from their traditional missions of teaching and research to **Third Mission**
 - ideas of **co-creation and co-producing innovation** alter their structure and configuration: inclusion of multiple stakeholders more explicitly
 - New identity: **entrepreneurial universities**
 - Key function: **knowledge transfer**
 - hard entrepreneurial activities: patenting, spin-offs
 - softer activities: entrepreneurship education

Third Mission initiatives require the efforts of

- **internal stakeholders**, including scholars, students, alumni, administration and university staff, and
- **the collective involvement of non-academic partners**, such as industry, government, local communities, intermediary organizations and citizens.
- Furthermore, to deliver a socio-economic value, stakeholders should put together their **tangible and intangible assets, competences**, and specificities.

- Assessing university performances in terms of the creation of **Intellectual Capital (IC)**
 - **research**: technology transfer and innovation including the management of intellectual property, spin-off creation, R&D network development;
 - **teaching**: lifelong learning and continuing education, based on education for entrepreneurial competences
 - **social engagement**: embedded in regional and international communities

- Global economic crisis, increasing pressure on natural resources and the environment:
- official statements
 - increasingly recognize the role of the university in SD
 - demand active policies from them
- A **university culture of sustainability** embedded in Third Mission activities



- Quadruple /Quintuple Helix models of innovation have gained **policy relevance**
- Civil society and the environment: **decision-making correctives** of innovation

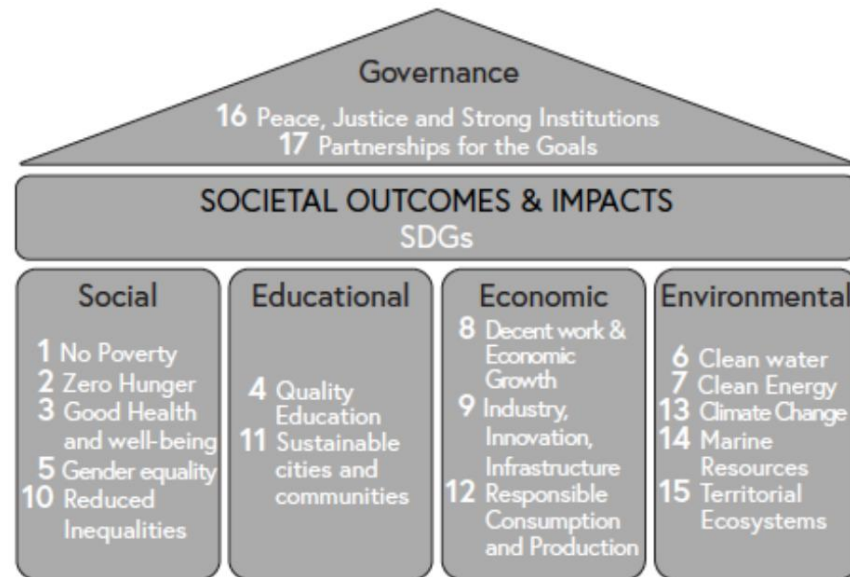
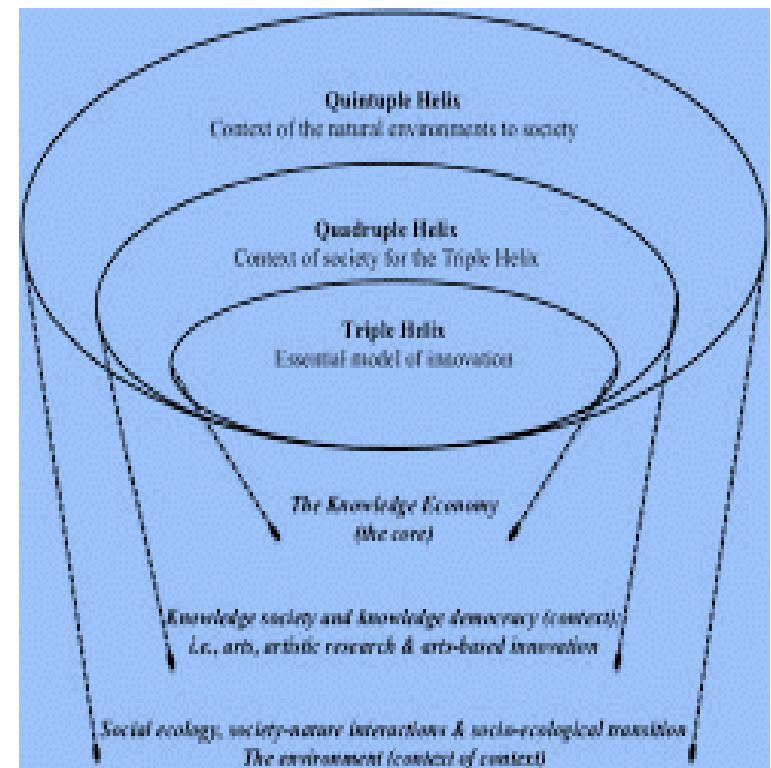


Figure 3 UN 17 Sustainable Development Goals and dominant Helix properties (own depiction based on ideas of UN 2016, Millard 2018)

- A new role for Third Mission in co-creating societal transformations for sustainability. This implies
 - building **multi-stakeholder alliances** and partnerships, including researchers from various disciplines, government officials, practitioners and civilians.
 - They collaborate on **grand challenges**, yet specifically addressing problems in their **regions**,
 - They are **solution-oriented** and engage in **long-term projects**,
 - often taking place in **innovation clusters, science cities and/or living labs**,
 - including **socio-technical prototyping** as well as
 - **multi-stakeholder conversations on value-implications.**

- **Entrepreneurial University meets Engaged University**
- In this double-role, modern Technical Universities
 - interact with government, industry and civil society,
 - considering the natural environment,
 - so as to produce sustainable solutions vis-à-vis
 - today's grand challenges, albeit at varying scales,
 - notably focusing on regional ones.



Quintuple helix model of innovation –

- (more than) a mindset,
- advancing practices and policies
- of negotiation and cooperation
- within and beyond (Technical) Universities.

–Thank you!