

Forks in the Road:

Contrasting Transition Pathways to a Hydrogen Economy

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Low Carbon Research Institute (LCRI)

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EPSRC

Engineering and Physical Sciences
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HDelivery

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SUPERGEN XIV Consortium

- **Aim:** “deliver new technologies capable of clean and cost-effective conversion of low-carbon electricity and various carbon sources, including biomass and waste, into hydrogen”
- **Aim:** “achieve significant critical mass and provide a proactive consortium, well-linked to a range of industrial actors, to address these major long-term problems”



WP4.2 – International Comparison

- **Aim 1:** to understand innovation as the result of social process involving actors, networks, institutions and resources,
- **Aim 2:** offer policy advice on delivering sustainable hydrogen to the consortium, government and other stakeholders.



Methodology

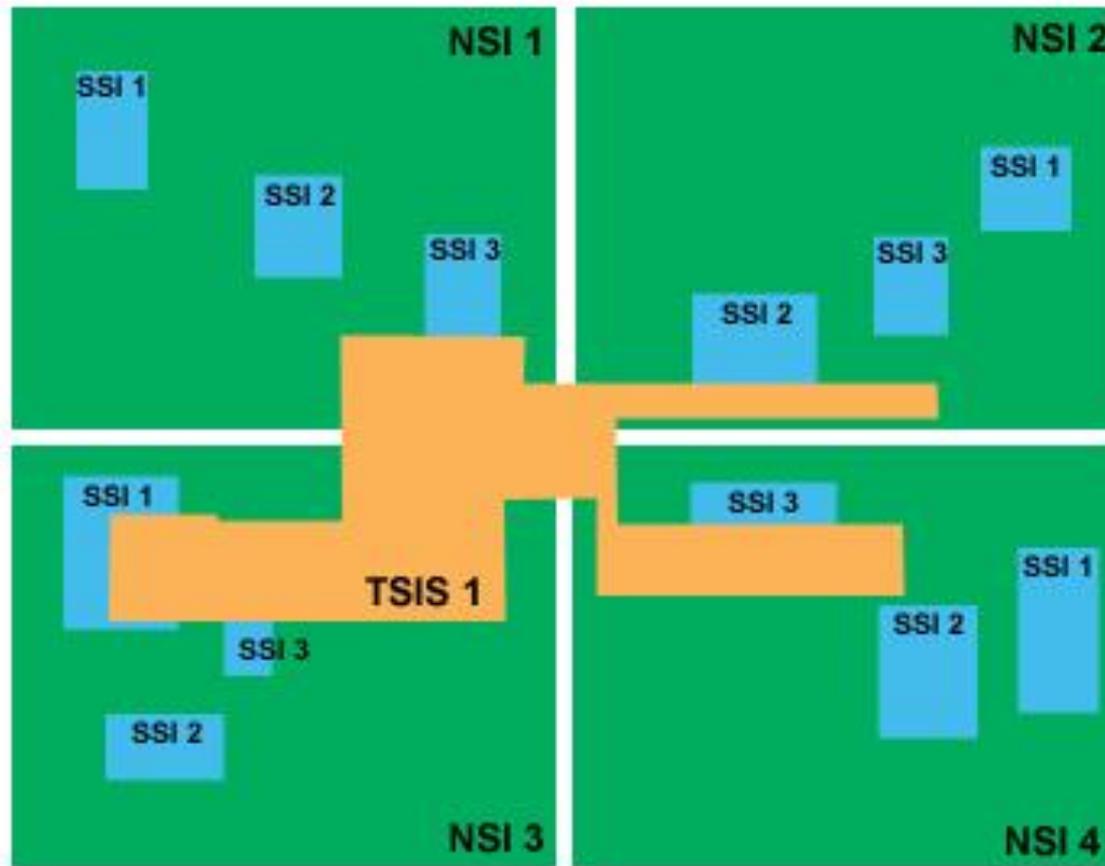
- **Literature review:**
 - i) innovation studies,
 - ii) social constructivism (how technology & learning link),
 - iii) hydrogen-specific research.
- **Empirical case studies:** UK & Germany,
- **Quantitative & qualitative data:** inc. expert interviews coded in NVivo software,
- **Analysis & conceptual development:** advancing existing perspectives on innovation & energy transitions.



Innovation Systems

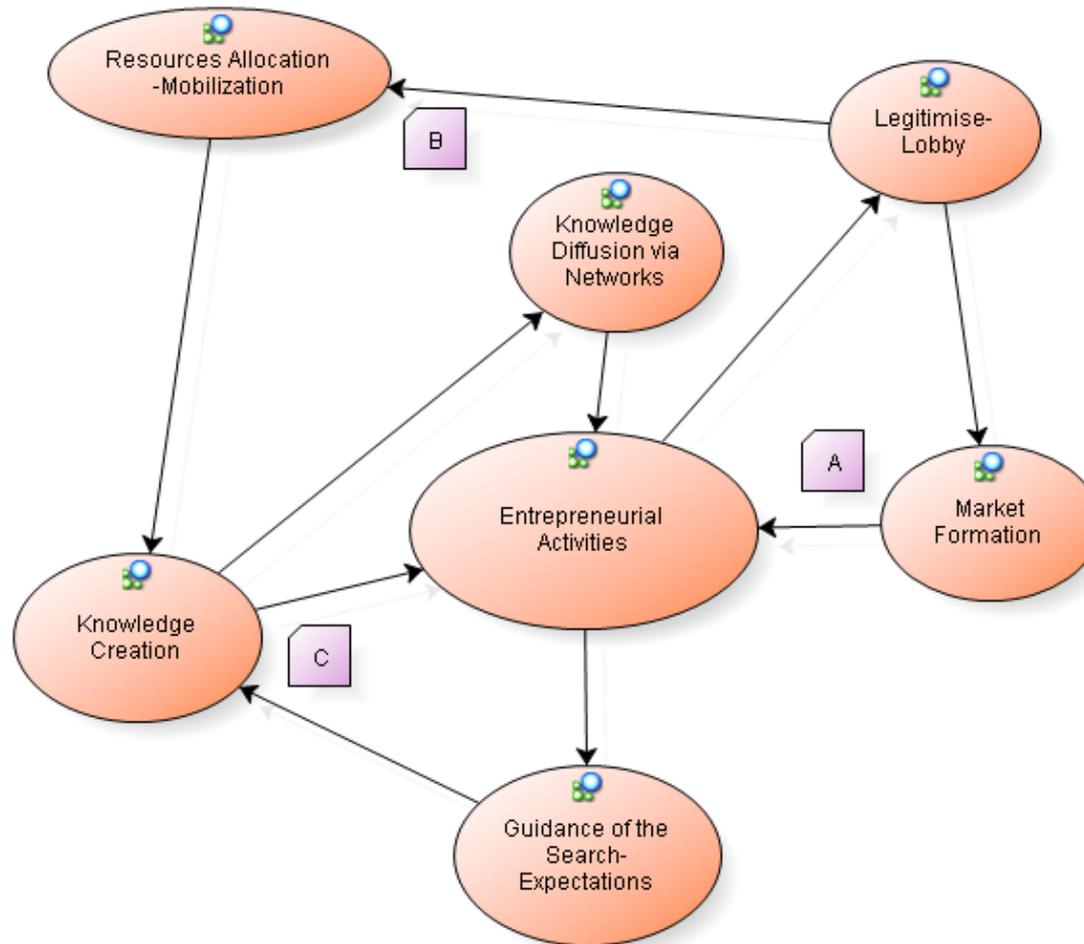
- **Aim:** understand innovation as the result of co-evolutionary, enacted, relational and interactional social process involving actors, networks, institutions and resources
- **Focus:** National Systems of Innovation (NSIs), Regional Innovation Systems (RISs), Sectoral Systems of Innovation (SSIs)
- **Recent model:** Technology Specific Innovation System (TSIS or TIS) - understand the global development of specific technologies and the relationship between NSIs and SSIs

Innovation Systems



Four-country technology-specific innovation system (TSIS)
(Hekkert et al, 2007)

Functions of Innovation Systems



‘Motors of change’ in a TSIS – A, B & C feedback loops (+/-)
(Hekkert et al, 2007)



Case Study: UK



source: UKHA (2008)



Case Study: UK

Positives:

- a strong science base with strengths in H₂ production & storage R&D,
- a number of regionally-based hydrogen demonstration projects,
- private-sector actors with interests in hydrogen technology,
- an interviewee from a multinational says, “In the UK, we have moved beyond the demonstration stage. We’re ready for the market.”



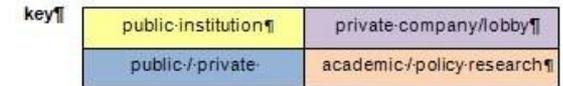
Case Study: UK

Negatives:

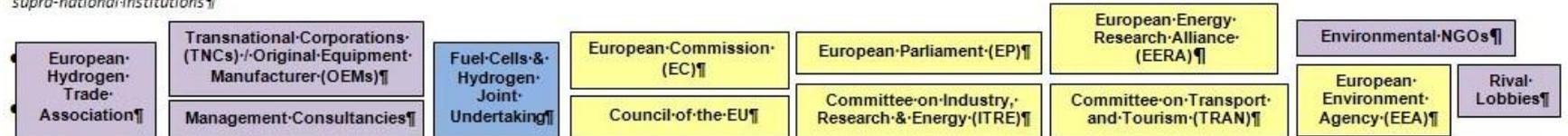
- lack of a top-down, politically-sanctioned medium- to long-term vision,
- the short-term trading emphasis of Britain's capital markets,
- persistent under-resourcing and under-valuation of education and training,
- less effective institutional links between universities doing hydrogen RD&D and regional development agencies (RDAs), local planning authorities (LPAs) and private enterprise,
- the lack of home-grown R&D in the automotive sector may be a significant factor in terms of lack of government political priority and strategic support leading to poor funding allocation,
- national policy makers have largely focussed on electric vehicle prospects.

English Regional Hydrogen 'Cluster' 1: London

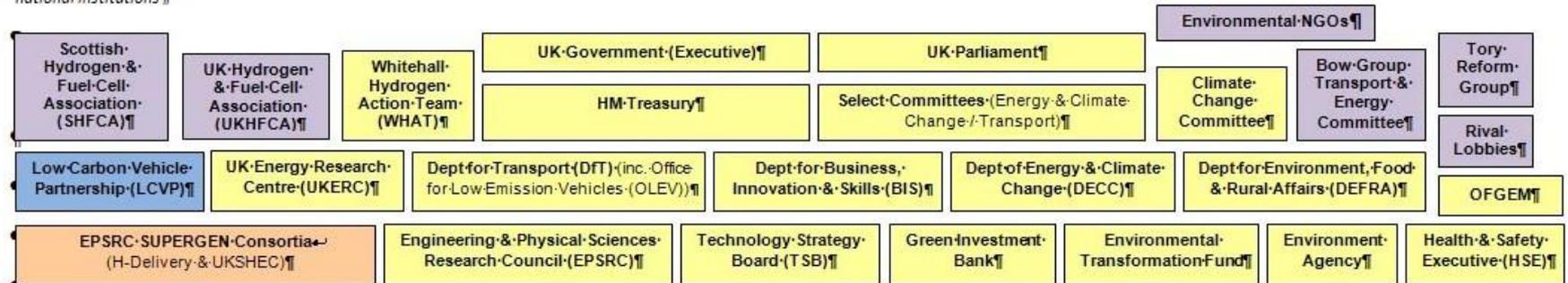
Institutional Map



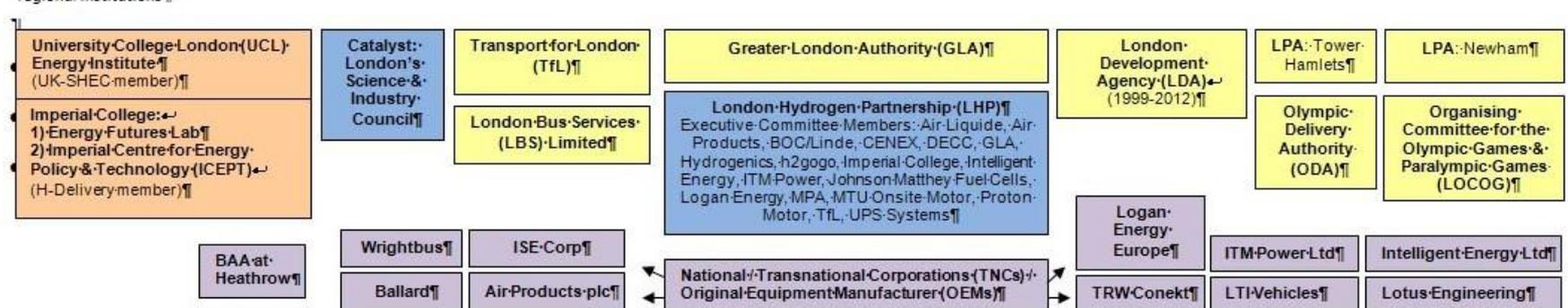
supra-national institutions



national institutions

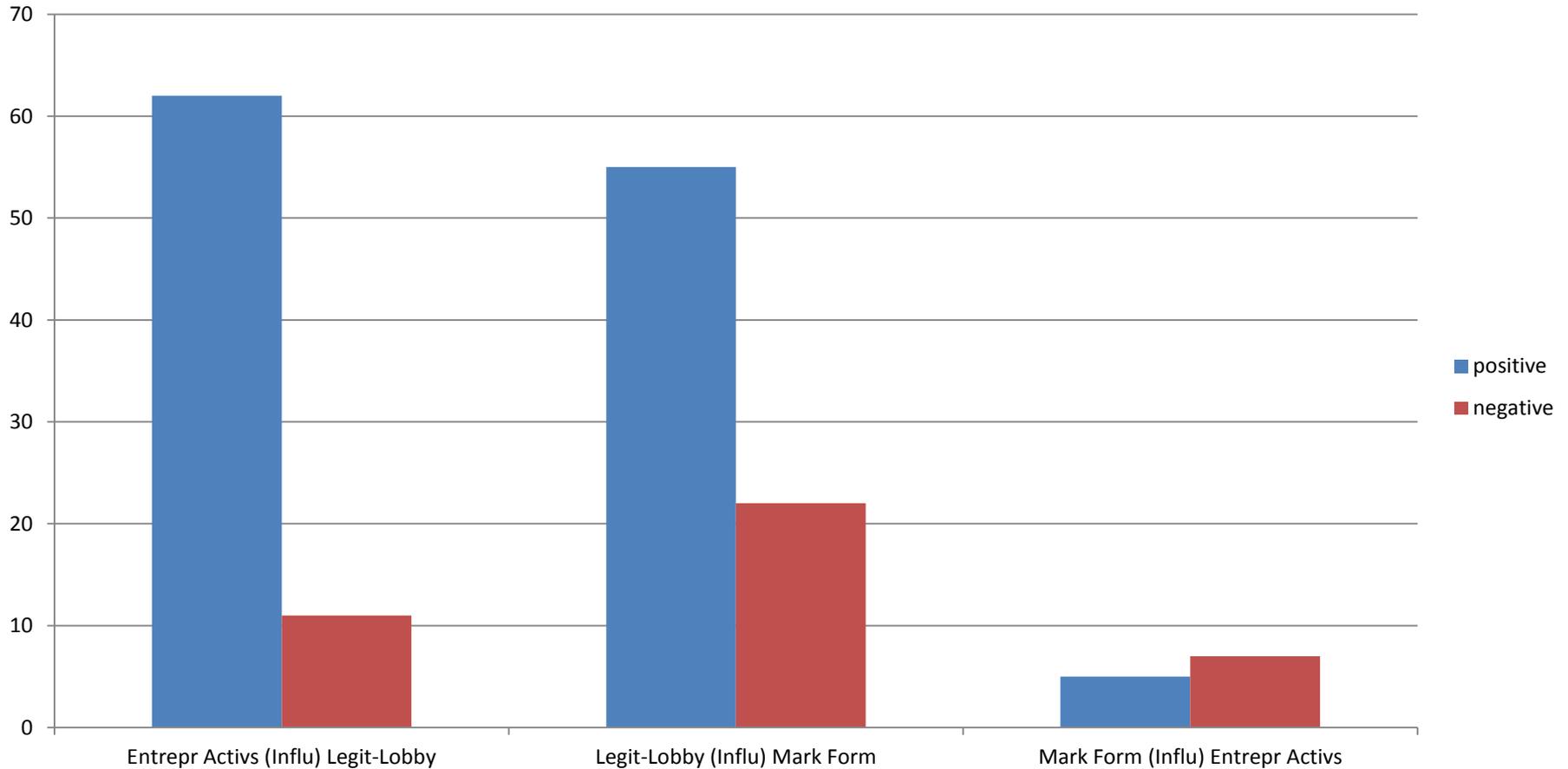


regional institutions





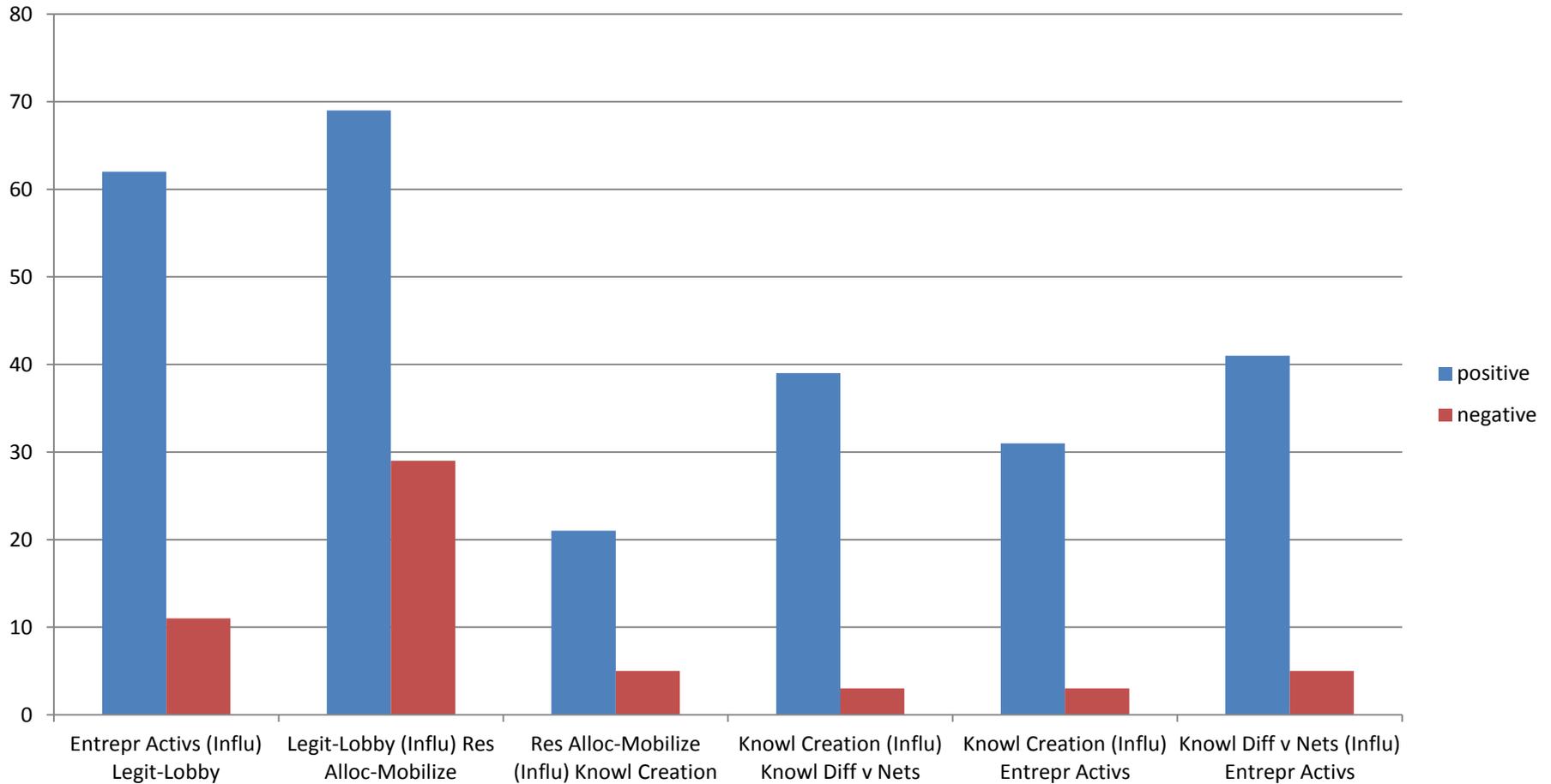
Case Study: UK



Feedback Loop A - coding reference counts

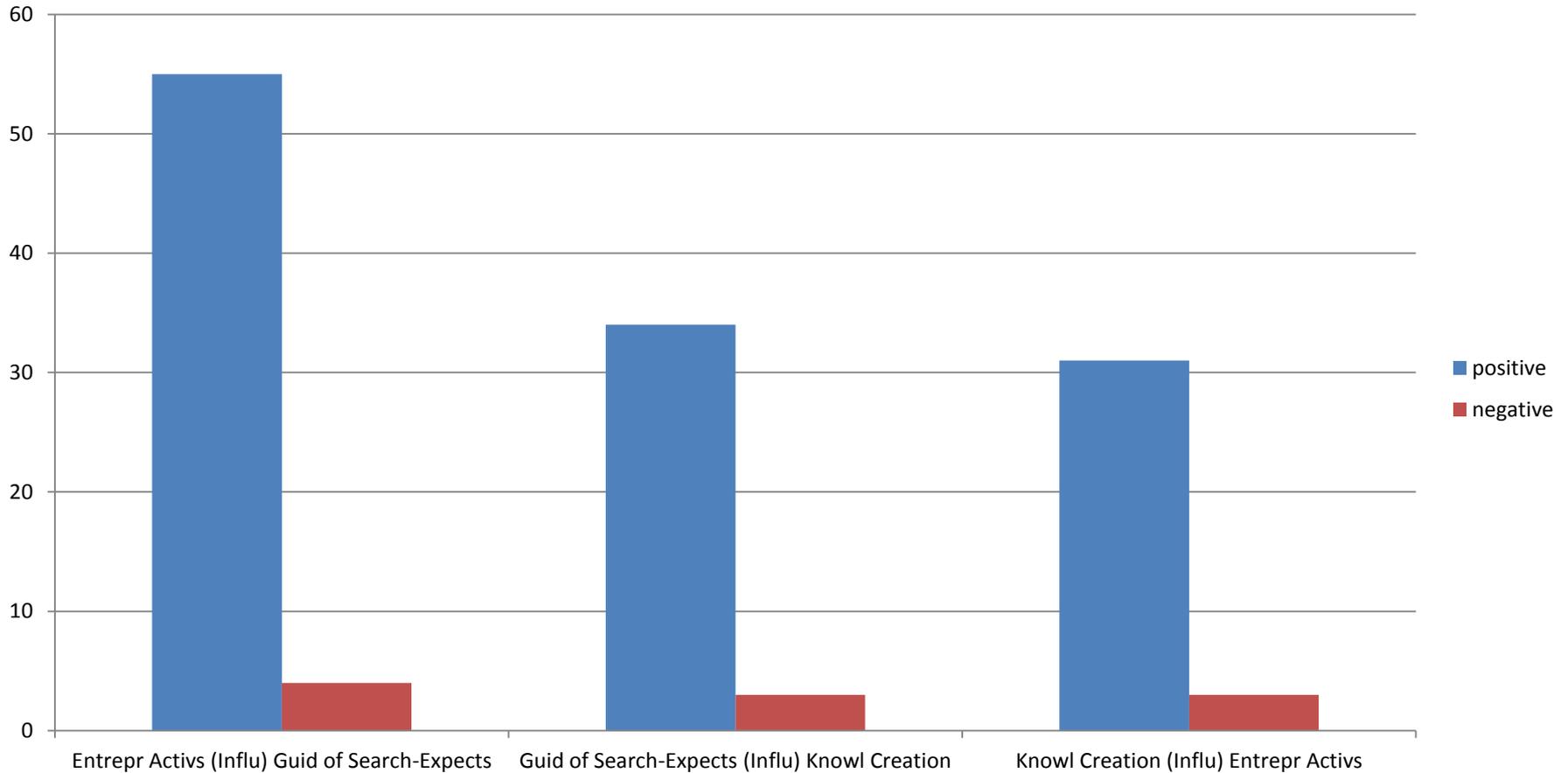


Case Study: UK



Feedback Loop B - coding reference counts

Case Study: UK



Feedback Loop C - coding reference counts



Case Study: Germany

- Memorandum of Understanding (MOU) signed between the German government and major automobile manufacturers, gas companies and energy utilities (2009),
- H₂ Mobility programme - coordinated cross-sectoral approach to rolling out mass-produced hydrogen fuel cell vehicles by 2015 (or earlier),
- Konjunkturpaket II programme - investment in public hydrogen refuelling network - part of an economic stimulus package,
- H₂ Mobility & Konjunkturpaket II help to meet Europe's low carbon targets for 2050 whilst simultaneously boosting German domestic economy.



Case Study: Germany



German public H₂ fuelling stations (2009) = 5

German planned hydrogen fuelling stations:

2013 = 159

2015 = 500

2017 = 1,000



UK public H₂ fuelling stations (2011) = 1



Case Study: Germany

Initial Analysis of Interviews:

- the importance of a collectively agreed public-private vision for hydrogen's future development,
- the ability of the sixteen fully devolved Länder to boost funding for national and supranational hydrogen projects especially in certain cities like Hamburg and Berlin,
- the historically close institutional links between certain academic researchers and industry,
- “It’s really about innovation and innovation isn’t just about novelty,” said one participant. “It’s about bringing novelty to the market. [This is when] you need a stronger input by industry.”



Initial Conclusions

- data & anecdotal evidence suggests UK & Germany are on very different 'innovation paths' re. moves towards sustainable hydrogen in their national economies,
- this is due largely to different:
 - a) political visions/commitments,
 - b) national economic & political structures,
 - c) industry-university research links,
 - d) skills bases, and
 - e) investor return horizons.



Initial Conclusions

- possibly enhance analysis by putting more emphasis on the learning that takes place and the power relations between actors, for example,
- analysis planned for around 50 actors in total (plus quantitative data indicators) to be concluded during 2012.