

Creating innovation futures

an exploration of the role of foresight in guiding research and innovation policy

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- Trends and observations in research & innovation
- New (and renewed) demands on foresight
 - Grand challenges
 - Identification
 - Articulation – ad hoc or systematic
 - Key technologies
 - Innovation ecosystem

Trends & observations

- In the age of austerity a new paradox is a general political recognition that research and innovation offer the long term path out of economic decline but that their ability to deliver on this is constrained by the effects of cuts arising from that crisis
- Broad response has been to seek higher returns from the R&I system
 - Competitive drive to excellence
 - Strengthening focus on impact
 - Redistribution of the innovation system
- All are long term trends which have gathered momentum

Focus on impact – grand challenges

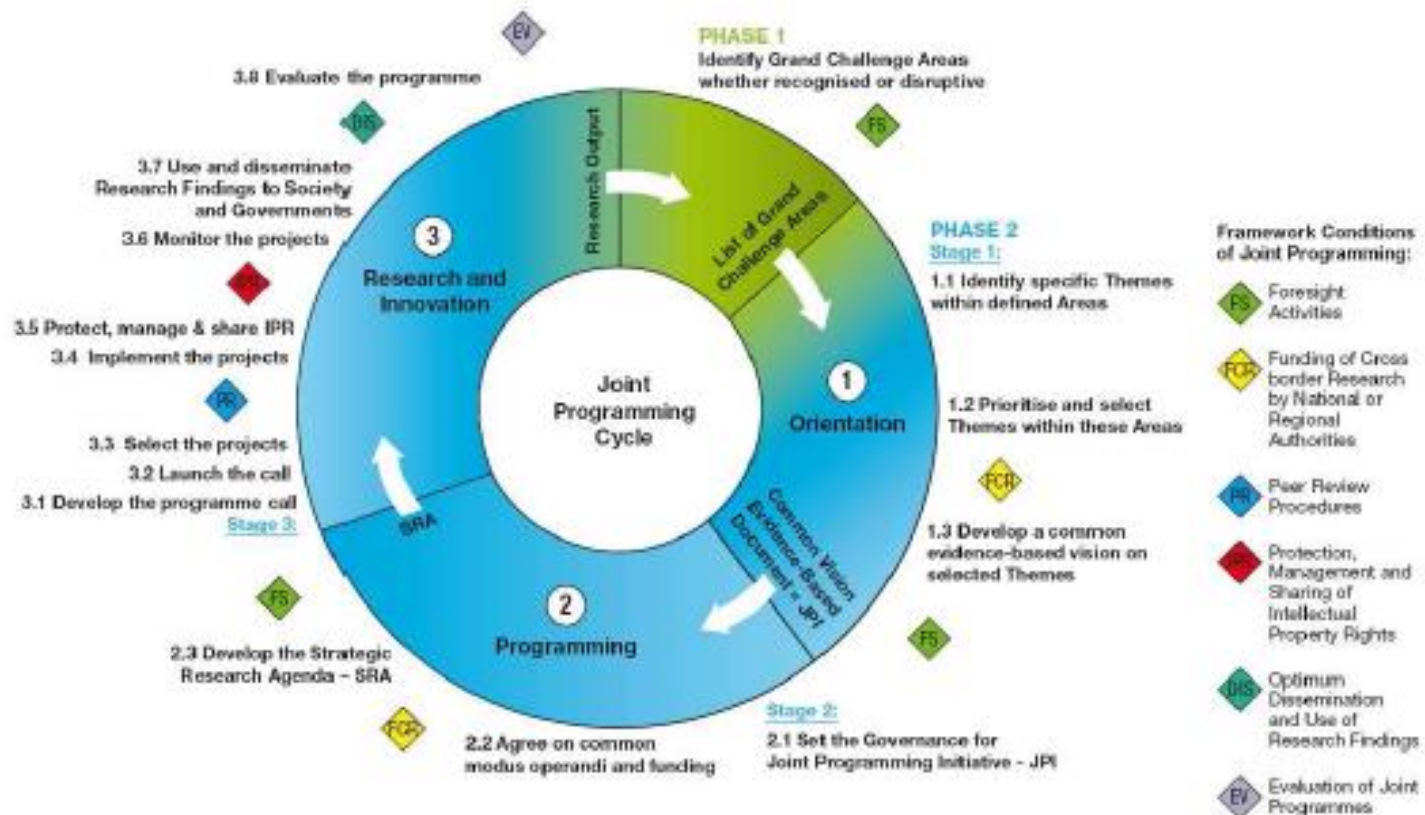
- Grand challenges are increasingly used as an organising principle for research programmes
 - Sustainability and climate change
 - Food, energy, water security
 - Ageing, migration, health....
- Dual rationale
 - Providing an envelope for coordination across wide range of disciplines and stakeholders
 - Communication device to politicians and their constituencies
- Also seen in USA but most prominent in EU
 - First in European Research Area and now major plank of Horizon 2020 programme as Societal challenges

Demands on foresight

- Process and content
- Process issue arises because most challenges demand societal transition
- To get beyond relabelled research programmes need a new kind of political process combining bottom-up and top-down
 - Government as entrepreneur
 - Shared ownership across range of stakeholders
- Targeted foresight to bring together socioeconomic demand and innovation potential around common vision
 - Both incubator and lobby

Content - Identifying challenges

Figure 1: Joint Programming Cycle: Steps proposed by the ESF



The influence of headlines and fashion should not be underestimated – pandemics, global warming, financial stability, rare metals and minerals....

Content – articulating challenges

- Even where there is clear consensus about the importance of the challenge this may not be matched by agreement on the ensuing research and innovation priorities
- Demand on foresight to identify priorities but several problems
 - Establishing meaningful level of granularity avoiding generic categories (eg ‘environment’)
 - Interdependence of priorities including those below line
 - Reluctance among researchers to identify negative priorities

Example of ad hoc approach: Agriclimature foresight experience in FP7 FarHorizon project

- Policy context: Communications on climate change, Previous Standing Committee on Agricultural Research foresight and Joint Programming Initiative in preparation (subsequently adopted)
- Key stakeholders:
 - Standing Committee on Agricultural Research (SCAR) and DG RTD Agriculture, Forestry, Fisheries, Aquaculture
- Aim of workshop:
 - To identify breakthrough technologies which could have a major impact upon the capacity of European agriculture to adapt to climate change in agriculture
 - To define in broad terms the research and innovation strategies needed to develop and make use of such technologies
- Attendees: 25 from 13 Member States and Commission including SCAR and CREST members, agriculture and foresight experts.

Workshop Structure

Pre-meeting research & report on policy context and previous work

Overview of baseline situation

Pests and Diseases

Water and Land

Socio-economic

Identification of Challenges

Plenary



Bio-based

Non-bio-based

Technological breakthroughs

Key steps

Post-meeting review of R&I ecology and consultation on key actions

Flavour of findings - challenges

Impacts	Challenges
Detecting and controlling spread of invasive species	Need for rapid detection and control of pests and diseases recognising
Water quantity and quality reduced – droughts, floods, increased pollutants & bacteria	Selection of plant varieties to conserve water and exhibit drought-resistance
Reduced availability of arable land driving greater intensification	New model of European agriculture which is sustainably competitive

Success scenario encompassed technological and social change up to 2050

- New varieties of plants with reduced need for fertilisers and new varieties of fertilisers from manure and other less energy intensive sources
 - “Nitrogen fixing in grasses was key breakthrough in the early 2020s. Opposition to GM approaches was dissipated when some key concerns of opponents were alleviated by creation of low risk plants (eg without the ability to spread pollen). “
- Mesh of disposable wireless network mimic sensors for early detection of fungal disease
- Knowledge management to use existing knowledge effectively
 - “Much of the plant molecular biology of last decades of 20th century had remained in research silos until an integrated approach to the adaptation challenge unleashed its interdisciplinary potential”
 - “Traditional knowledge and old practices proved an important take-off point. “

Example of systematic approach – European Forum for Forward-Looking Activities (EFFLA)

- **Status**
 - EFFLA one of the Commission’s 3 senior standing advisory groups on R&I policy
- **Mission**
 - Enhance collective intelligence and help devise better long-term European policies
- **Objectives**
 - Advise Commission on outcomes and signals from Forward Looking Activities and early identification of emerging grand societal challenges with S&T implications
 - Debate these studies and results with key stakeholders
 - Identify needs and means for further Forward Looking Activities
- **Core assumption**
 - Intermediaries are need to interpret futures findings for senior policymakers

Assessing a Societal Challenge: Climate change, Resource efficiency and Raw materials

- Underpinning study* reviewed policy intelligence from Forward Looking Activities in this domain
 - By European and international agencies
 - In horizon-scanning databases
 - In national foresight activities
- Found scenarios, visions and forward-looking strategies reflected profile and remit of commissioning organisation
- Analysis of trends and drivers indicated
 - Challenges on unprecedented scale, speed, interconnectedness, and impact
 - Complexity and cross impacts at different levels from other challenges
 - Need to factor in climate impacts from outside into Europe

Taking results to policy

- Resulting Policy Brief indicated some need for adjustment e.g.
 - Critical role of changing human behaviour in climate change mitigation needed stronger emphasis on social/behavioural research
 - Overlap with and underpinning of other societal challenges required integrated approach
 - High sensitivity to rapid changes in the geo-political, economic and social landscape requires agile programming
 - Framework is needed to contextualise research activity and to build working links across projects & with other users and stakeholders
- Very constructive response from Commission

Key technologies

- Longstanding branch of technology foresight activity
 - 1990s USA Critical Technologies, France 100 Key Technologies etc
 - Rationale in market dissipating technological effort over too wide a spectrum & hence need for prioritisation
 - Also lined to military/strategic concepts of criticality and vulnerability – eg rare earth minerals
 - Often in search of underpinning, pervasive technologies
 - Almost always compiled by expert opinion with various degrees of sophistication imposed
 - Echoes of long waves...

New wave of activity

- EU addressing Key Enabling Technologies
 - defined as micro- and nanoelectronics, photonics, nanotechnology, biotechnology, advanced materials and advanced manufacturing systems
- Also national lists
 - eg UK “8 Great Technologies” underpinned by Horizon Scanning Centre Technology & Innovation Futures report
- Conundrum
 - Despite being about competitiveness, almost always the lists are the same
 - Challenge of granularity is key to prioritisation

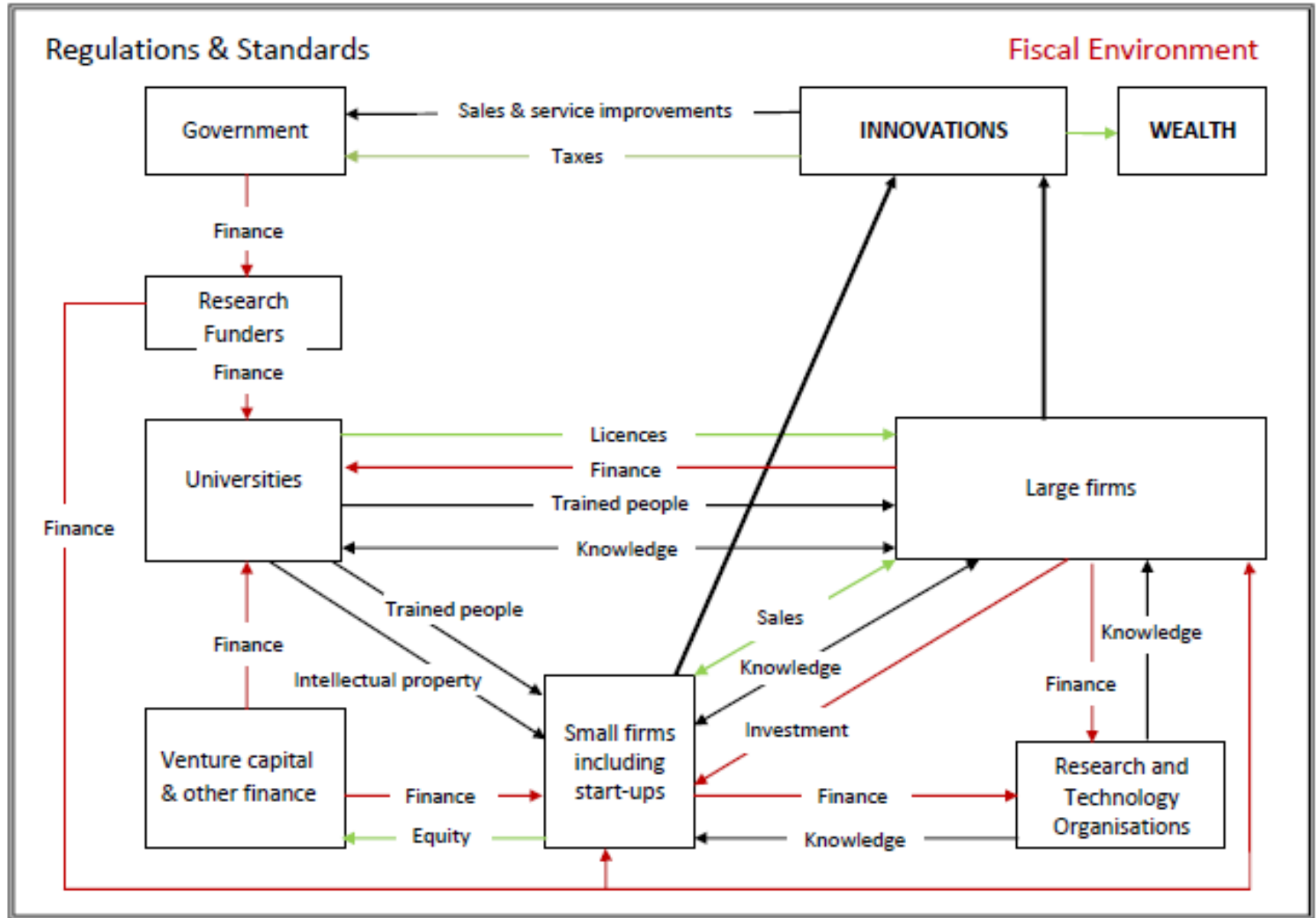
Smart specialisation

- Emergent idea of Smart Specialisation to tie regions down to strategy tailored to their strengths and opportunities
 - Integrated, place-based economic transformation agendas
- Pathways include
 - Transition from an existing sector to a new one
 - Modernisation of existing industry
 - Diversification
 - Radical foundation of a new domain
- Must be founded in process of entrepreneurial discovery which includes foresight with business engagement

Linking it together – four key flows in the innovation ecosystem

- People
 - Having the right skills and talents, retaining the best graduates from our education system, critical mass in labour markets for creative people
- Finance
 - Investment in research, support from banks for growth companies, seed capital, venture funding, enabling investment in infrastructure (physical and intangible)
- Services
 - Infrastructure and associated services for innovation including incubators, science parks, digital connectivity, business support, access to equipment for testing etc.
- Knowledge
 - Flow of ideas, IPR and opportunities emerging interactively from universities, hospitals, RTOs, business R&D, creative sector

The Innovation Ecosystem



Source: L.Georgiou cited in House of Commons Select Committee on Science & Technology Report Bridging the valley of death: improving the commercialisation of Research, March 2013

Redistributed innovation system places foresight in its flows

- Policy emphasis increasingly on functioning of the innovation ecosystem
- Recognition that innovation activity is increasing distributed
 - Open innovation is a method of transaction in this environment
- Places strategy formation in a collective environment
 - less emphasis on stand-alone foresight and more emphasis on interface with emerging R&I policy scenario
- Innovation policy also extending much more to demand-side
 - Procurement, regulation, clusters...
 - Progress in these domains also requiring common vision across disparate types of organisation

Conclusions

- Demands on research and innovation are in turn creating demands for better understanding of future
- The grand challenge approach can both open and close the futures we perceive and prepare for
- Ad hoc futures work can find niches in policy-making but more consistent influence can be achieved when the channels are institutionalised and trust is placed in a mediating body
- Competition and cooperation create a complex environment in which to place foresight activities but nonetheless there is an increasing dependence upon them to help moderate the flows of the innovation ecosystem

Links

- <https://farhorizon.portals.mbs.ac.uk/>
- http://ec.europa.eu/research/era/effla_en.htm
- http://ec.europa.eu/research/innovation-union/pdf/expert-groups/effla-reports/effla_pb4_-_climate_action,_resource_efficiency_and_raw_materials.pdf
- <http://www.bis.gov.uk/foresight/our-work/horizon-scanning-centre/technology-and-innovation-futures>
- http://ec.europa.eu/enterprise/sectors/ict/key_technologies/