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Measuring the Returns on Research, Science and Technology

Luke Georghiou

PREST, Manchester Business School

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Outline

- Evaluation trends in a historical context
- Limitations of performance indicators and the project fallacy
- Two European efforts
- Additionality

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Research evaluation at the confluence

- Evaluate - to ascertain value, to judge the worth of ...
- Evaluation of R&D draws upon two streams:
  – Part of the general practice of science
    - career progression, editorial judgement, award of grants
  – Broader requirement for evaluation of publicly funded activities driven by
    - constraints on funding
    - requirement to demonstrate value-for-money
    - increasing competitiveness of science
- Tension between accountability and learning

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Co-evolution…

- Evaluation approaches tend to co-evolve cumulatively with policy development, eg
  – 1970s modification of peer review to extend criteria
  – 1980s interest began in collaborative R&D programmes
  – 1990s rise of:
    - performance indicators
    - emphasis on knowledge transfer indicators
    - Institutional evaluation using programmatic approach
  – 2000s interest in;
    - evaluation of system capabilities eg national or regional systems
    - aggregate or interactive effects of policies ("policy mix")
    - effect of "soft" policy tools such as foresight
    - strategic and persistent effects of public support ("behavioural additionality")

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One current trend - internationalised evaluation

- Constant cross-reference to international frame of reference
  - Key rationale now the international standing of a country's research
  - Dubious methodology of league tables nonetheless hold fascination
  - Confusing evaluation and benchmarking
  - From absolute (quality) to relative (standing)
- Visible in many national level or systemic evaluations
  - Exceptions Research Assessment Exercise where "international" is used as quality descriptor without any serious international validation

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Methods must be set in context before they are selected or results interpreted

- Systemic level evaluations typically depend on aggregate performance indicators BUT
- What to measure, when to measure, how to interpret all dependent upon the underlying model of innovation – implicit or explicit
- Data conditioned by positioning of the evaluation and evaluators
  - Need to understand setting & discourse in which results are located before choice of approach

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Limitations of performance indicators

- Main problem that they often measure what is measurable rather than what is needed
- Crudely constructed regime may distort performance (Goodhart's Law) or be subject to manipulation (Gibbons' Law)
- Current vogue for performance indicators both threat & opportunity
- Evaluations must be located in systemic context
  - Basic requirement for a performance indicator regime is clear understanding of context, goals and relationships between goals and effects
  - Logic model approach in evaluation a useful tool in this context

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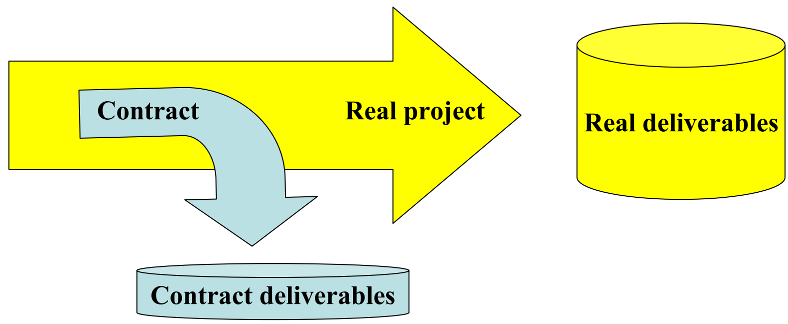
Evaluation and situating the object in its context

- When we come to evaluate support for industrial R&D (or other research) we encounter key problem
- Project fallacy
  - Confusion in timing and scope between the unit of research and the contractual entity
  - Research impacts are often cumulative over series of projects
  - Effects of research policies result from an interaction between the measure and the strategy of the research performer

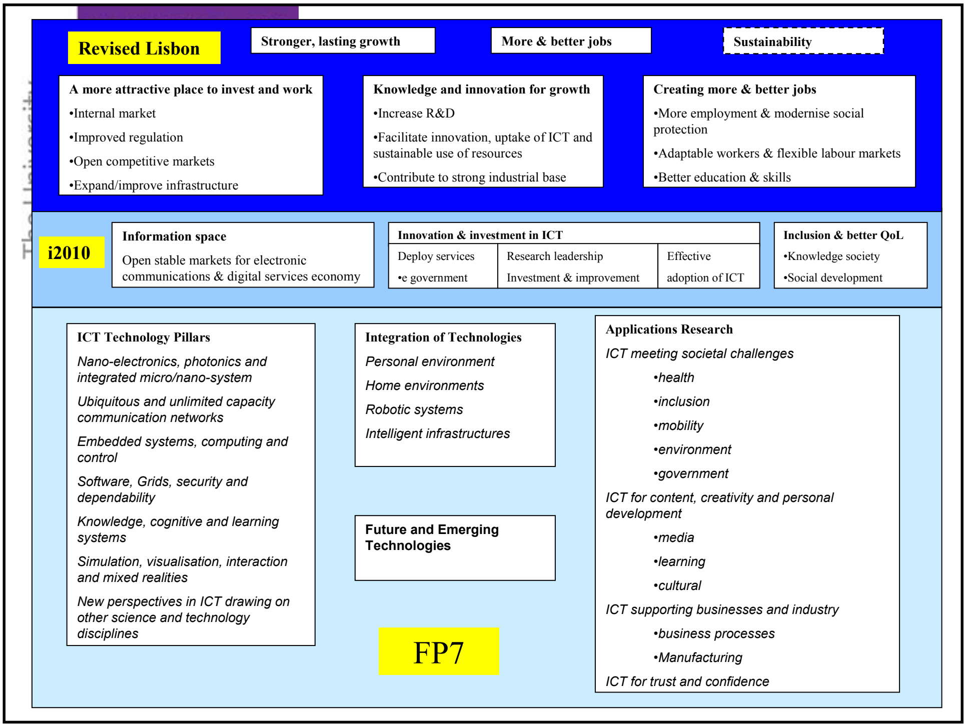
Project fallacy

- Key problem of “project fallacy” in which policymaker assumes that a contract is equivalent to a project
  - In practice contracted work is often only part of a longer and broader project



Two European examples of grappling with these issues

1. Using logic chart approach to examine overall intervention logic of European Programmes for Information Society Technologies, and hence to develop indicator framework
2. Economic evaluation of EUREKA initiative
   - Supporting firms in industrial R&D with clear market objectives


Revised Lisbon
Stronger, lasting growth
More & better jobs
Sustainability
A more attractive place to invest and work
•Internal market
•Improved regulation
•Open competitive markets
•Expand/improve infrastructure
Knowledge and innovation for growth
•Increase R&D
•Facilitate innovation, uptake of ICT and sustainable use of resources
•Contribute to strong industrial base
Creating more & better jobs
•More employment & modernise social protection
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Information space
Open stable markets for electronic communications & digital services economy
Innovation & investment in ICT
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ICT Technology Pillars
Nano-electronics, photonics and integrated micro/nano-system
Ubiquitous and unlimited capacity communication networks
Embedded systems, computing and control
Software, Grids, security and dependability
Knowledge, cognitive and learning systems
Simulation, visualisation, interaction and mixed realities
New perspectives in ICT drawing on other science and technology disciplines
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Personal environment
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Robotic systems
Intelligent infrastructures
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Applications Research
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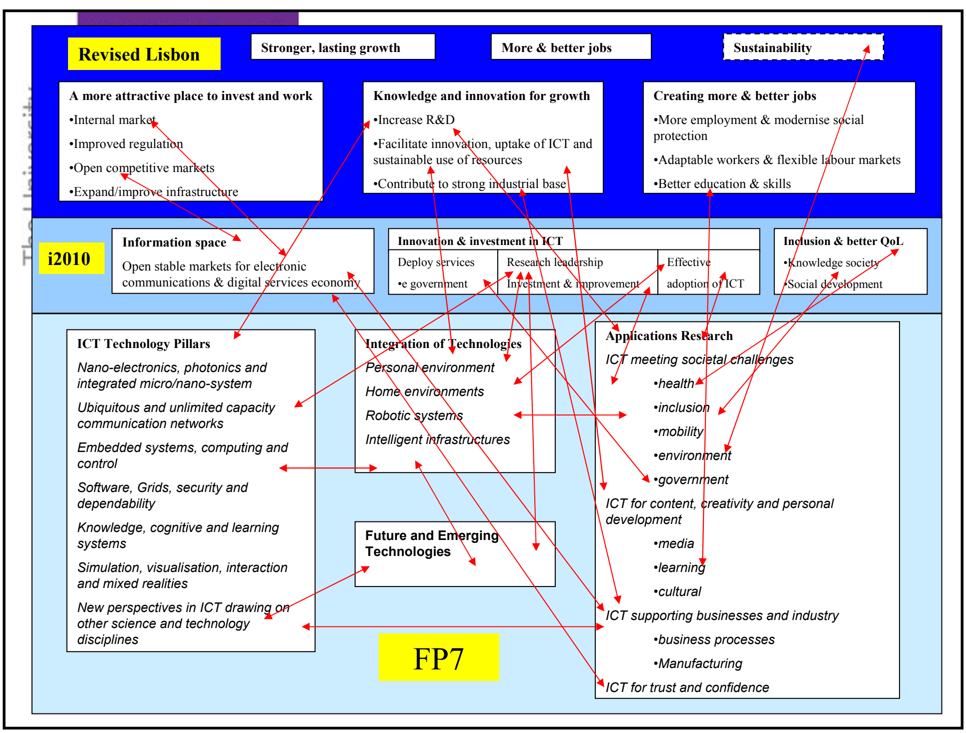
•Manufacturing
ICT for trust and confidence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FP7
Applications Research
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•inclusion
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Overall linkage mapping can become very dense

- Previous slide shows only a selection of the more obvious linkages
- While important not to lose the argument of connected rationale must also be able to examine elements of it in isolation to allow more detailed arguments to be developed

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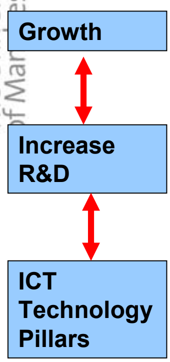
Different logics

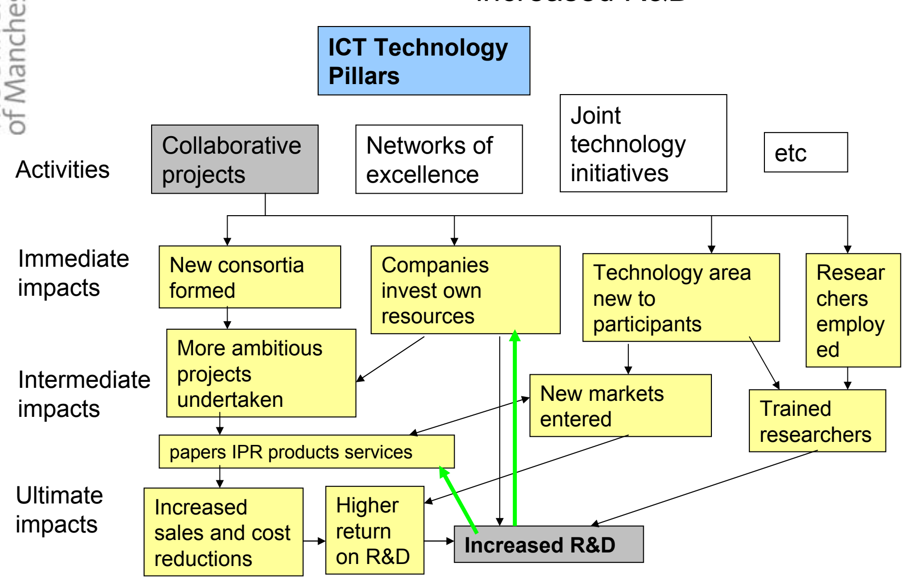
- Horizontal logic
  - Exploring interdependency between high level objectives or between intermediate level actions (ie the proposals for FP7) as per previous example
- Vertical logic
  - Exploring interdependency between an objective and the relevant parts of FP7
    - Can isolate as binary link, or
    - Consider combined effect of all aspects of the Programme on that objective, or
    - Consider multiple effects on objectives of a single Programme activity
- Systemic logic
  - Considering implications of change across the whole system

Vertical logic – binary chain example



- Pair of binary relationships
- Overall Lisbon strategy sees increased R&D as necessary condition for growth by making business more innovative, productive etc
- Activity here is sponsorship of pre-competitive R&D
- Stated rationale for spending on research rests on:
  - “European industry lags in investment cf major competitors”
  - “More intensive cooperation makes most of current capabilities”

Expected impacts and outcomes en route to increased R&D



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EUREKA Case

- Panel carrying out case studies of high impact projects
- Using methodology developed by PREST in evaluation of Japanese National R&D Programme for Medical and Welfare Equipment using Beta method as starting point

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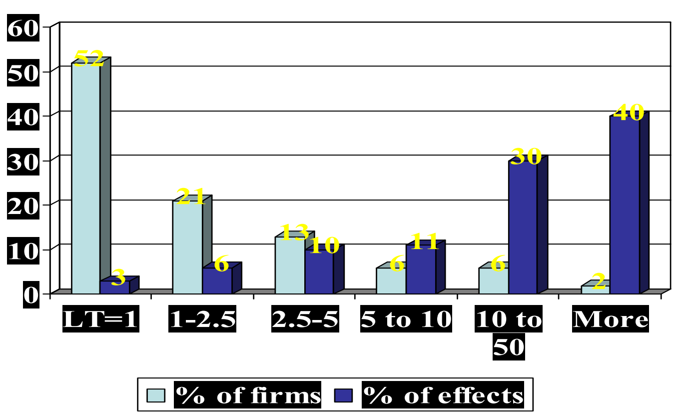
EUREKA Turnover effects - Skewed returns



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Underevaluation = Underinvestment

- Our failure to appreciate the full extent of both the private and the social returns to R&D is a key reason for the international decline in government investment in research
- Our framework attempts to address the full benefits on a sliding scale from quantitative to qualitative

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Benefits of grants

Sales of innovative product

Reduced process costs

Licence income

Use of technology in other parts of the business

New contacts/networks & prestige

Organisation and method learning

Competence & training

Spillovers to non-participants

User and social benefits

Additionality – what difference does the intervention make?

- Input additionality – are resources being spent on desired target?
- Output additionality – what proportion of outputs result from particular intervention?
- Behavioural additionality – what difference in behaviour results from the intervention
  - Concept formulated mid-1990s to help explain consistent evaluation findings
  - Rooted in question of how support interacts with strategies and capabilities of funded organisations
  - Looks closely at mode of delivery of support for research
  - Emphasis on persistent changes
  - OECD project exploring measurement issues in industrial grant schemes

Conclusions

- Recognition that in knowledge economy and society must understand and account for knowledge and human capital
- Methods rarely give precise or complete answers to policy questions so major element of expertise lies in their positioning, combination and interpretation
- Maturity
  - enough confidence in evaluation to use it to drive major resource allocation and system shaping decisions