20 Challenges for Innovation Studies

Ben R. Martin

SPRU – Science and
Technology Policy Research

B.Martin@sussex.ac.uk

Opening Presentation to the Conference on
'Open Innovation: New Insights and Evidence',
Imperial College, London, 25-26 June 2012

Introduction

Structure

- Identifying the challenges
- Hilbert's mathematical problems
- What have we achieved in previous 50 years?
  ➔ 20 major advances
- Identification of 20 challenges
- Concluding remarks

MATHEMATICAL PROBLEMS.*

LECTURE DELIVERED BEFORE THE INTERNATIONAL CONGRESS OF MATHEMATICIANS AT PARIS IN 1900.

BY PROFESSOR DAVID HILBERT.

WHO of us would not be glad to lift the veil behind which the future lies hidden; to cast a glance at the next advances of our science and at the secrets of its development during future centuries? What particular goals will there be toward which the leading mathematical spirits of coming generations will strive? What new methods and new facts in the wide and rich field of mathematical thought will the new centuries disclose?

History teaches the continuity of the development of science. We know that every age has its own problems, which the following age either solves or casts aside as profitless and replaces by new ones. If we would obtain an idea of the probable development of mathematical knowledge in the immediate future, we must let the unsettled questions pass before our minds and look over the problems which

Identifying the challenges

- Can one identify a set of challenges for IS?
- Challenges need to be “difficult in order to entice us, yet not completely inaccessible” (Hilbert)
- Harder than in maths as IS more subject to unpredictable external influences
- Should offer clear target and some way of assessing progress
- Many of the challenges not ‘new’ – but tried to bring together in systematic comprehensive way
- First need to construct a robust viewing platform
- Given continuity & path-dependence, past may offers clues to future directions

Scope of field of Innovation Studies

"Economic, policy, management and organisational studies of science, technology and innovation (STI) with a view to providing useful inputs to decision-makers concerned with policies for and the management of STI."

(Treated as separate from STS)

Primary focus = policy/mngt issues rather than theory

Research multi/inter-disciplinary – 'Mode 2'

Grown from a handful to thousands of researchers

20 advances in innovation studies

From individual entrepreneur to corporate innovator

From *laissez faire* to government intervention

From 2 factors of production to 3

From single division to multi-divisional efforts

From technology adoption to innovation diffusion

From science push to demand pull?

From single factor to multi-factor explanations of innovation

From static to dynamic model of innovation

From linear model to interactive 'chain-link' model

From one innovation process to several sector-specific types

From neo-classical to evolutionary economics

From neo-classical to new growth theory

From optimising firm to resource-based view of the firm

From individual actors to systems of innovation

From market failure to system failure

From one to 'two faces' of R&D

From Mode 1 to Mode 2

From single-technology to multi-technology firms

From closed to open innovation

From national to multi-level systems of innovation

Impact on T&I management

From individual entrepreneur to corporate innovator

From *laissez faire* to government intervention

From 2 factors of production to 3

From single division to multi-divisional efforts

From technology adoption to innovation diffusion

From science push to demand pull?

From single factor to multi-factor explanations of innovation

From static to dynamic model of innovation

From linear model to interactive 'chain-link' model

From one innovation process to several sector-specific types

From neo-classical to evolutionary economics

From neo-classical to new growth theory

From optimising firm to resource-based view of the firm

From individual actors to systems of innovation

From market failure to system failure

From one to 'two faces' of R&D

From Mode 1 to Mode 2

From single-technology to multi-technology firms

From closed to open innovation

From national to multi-level systems of innovation

Impact on STI policy

From individual entrepreneur to corporate innovator

From *laissez faire* to government intervention

From 2 factors of production to 3

From single division to multi-divisional efforts

From technology adoption to innovation diffusion

From science push to demand pull?

From single factor to multi-factor explanations of innovation

From static to dynamic model of innovation

From linear model to interactive 'chain-link' model

From one innovation process to several sector-specific types

From neo-classical to evolutionary economics

From neo-classical to new growth theory

From optimising firm to resource-based view of the firm

From individual actors to systems of innovation

From market failure to system failure

From one to 'two faces' of R&D

From Mode 1 to Mode 2

From single-technology to multi-technology firms

From closed to open innovation

From national to multi-level systems of innovation

The challenges

- Hard to be as precise in formulation of challenges confronting innovation studies as in mathematics
- First 11 are couched in similar terms to major shifts in past – i.e. ‘from X to Y’
- Four involve negotiating between certain intrinsic tensions and finding optimum balance
- Five represent more general challenges for field of innovation studies and its practitioners
- Identified 20 challenges in total

1. From visible innovation to 'dark innovation'

- 'Innovation' conceptualised, defined & measured in terms of dominant forms of innovation from several decades ago
- Developed indicators to 'measure' this – e.g. R&D funding, no's of researchers, patents
- These 'missing' much innovative activity – (i) incremental, (ii) not in form of manufactured product innovations, (iii) involves little formal R&D, (iv) not patented – e.g.
  - incremental process innovations in factories of China etc.
  - financial innovations, organisational innovations, social innovations
- cf. cosmology – observations reveal only fraction of universe – rest = dark matter or dark energy
- Challenge = to conceptualise, define and devise methods for measuring, analysing and understanding 'dark innovation'

2. From innovation in mfg to innovation in services

- In the early decades of Innovation Studies (IS), manufacturing was still ‘king’
- Now dwarfed by services in most advanced countries
- Yet empirical studies in IS still focus predominantly on manufacturing

Manufacturing VS services

Search on *Google Scholar* among *RP* papers – “innovation” AND

	1980-89	1990-99	2000-09
manufacturing	22	239	652
service sector	3	22	93
health service/hospital	2	31	150
financial services	1	15	45
leisure/sport	1	24	52

2. From innovation in mfg to innovation in services

- In the early decades of IS, manufacturing was still ‘king’
- Now dwarfed by services in most advanced countries
- Yet empirical studies in IS still focus predominantly on manufacturing
- Challenge for IS scholars is to distribute their empirical efforts more evenly across all economic activities

3. From ‘boy’s toys’ to ‘women’s liberation’

- Many in IS made names in 1980s/90s when focus on high-tech manufacturing
- Empirical focus of their work?

Sector focus of *RP* papers

Search on *Google Scholar* – “innovation” AND

computer/PC	717
car/automobile	284
television/TV/radio	209
camera/video	134
video/electronic/interactive game	120
hard disk/disk drive	42
cell/mobile phone	37
VS	
refrigerator/freezer/fridge	11
washing machine/tumble drier	6
vacuum cleaner	2
washing powder/detergent	2
domestic/toilet/kitchen/bathroom cleaner	0

3. From ‘boy’s toys’ to ‘women’s liberation’

- Many in IS made names in 1980s/90s when focus on high-tech manufacturing.
- Tendency to focus on ‘boy’s toys’ cf. other innovations that have improved human lives
- Skewed our search for methodological tools, indicators, analytical frameworks, models?
- Those developed less applicable to other forms of innovation
- Challenge = to give more equal treatment to mundane innovations that have done/could do more for humanity e.g. in liberating women from household drudgery or the poor from poverty

4. From national and regional to global systems of innovation

- Concept of ‘national system of innovation’ one of most important in last 25 years
- But not all innovative activity ‘national’
- Key players in innovation are MNCs – increasingly operate on global scale
- Forging links between national systems of innovation – starting to see emergence of *global* systems of innovation
- Challenge to IS researchers = to analyse these global systems & interactions with national systems
- Likely to have major policy implications e.g. for policies for tackling global problems

5. From innov'n for productivity to innov'n for sustainability

- During '80s/'90s, pol & econ agenda dominated by concerns with econ competition, productivity, etc.
- Innovation seen as key ➔ policies to stimulate
- Little concern with sustainability etc. so concepts, indicators, models etc. all oriented to innovation for productivity
- Reflected in choice of empirical topics by IS scholars

Productivity VS Sustainability

Search on *Google Scholar* among *RP* papers

	1980-89	1990-99	2000-09
productivity	16	170	656
sustainability	3	51	328

5. From innov'n for productivity to innov'n for sustainability

- During '80s/'90s, pol & econ agenda dominated by concerns with econ competition, productivity, etc.
- Innovation seen as key ➔ policies to stimulate
- Little concern with sustainability etc. so concepts, indicators, models etc. all oriented to innovation for productivity
- Reflected in choice of empirical topics by IS scholars
- Late 1990s, increasing concern ➔ a few IS scholars became interested in innovation for sustainability
- Drew extensively upon inputs from STS ➔ work on socio-technical transitions, niches etc.
- Starting to have an impact but still much to be done before we complete transition to 'green innovation'

6. From innovation for econ growth to innovation for sustainable dvlpt

- Despite removing 100s of millions in China etc. from poverty, billions yet to benefit from econ development
- Poses challenges for IS community – see Lundvall (2012)
  - e.g. ideas on linking IS research to development economics
- Even after efforts of GLOBELICS, still far to go
- Challenge for IS scholars = to develop the conceptual, methodological and analytical tools to facilitate shift to innovation for sustainable development through appropriate policies

7. From risky innovation to socially responsible innovation

- STI central in improving econ & social conditions
  - e.g. life expectancy
- But also brought risks and unintended consequences
  - e.g. damage to environment, adverse effects on quality of life
- Technology led to increase in overall risk (Beck)?
- Previous IS work to address risk e.g. tech'y assessment
- Substantial inputs from STS
  - e.g. on constructive technology assessment; public understanding of science; ethical, legal & social implications of research; the precautionary principle
- Given rise to a call for 'responsible innovation'
- Although some begun to respond to this challenge, still much to do in coming decades

8. From innov'n for wealth creation to innovation for well-being

- For centuries, 'progress' seen in terms of 'more is better'
- Political agenda driven mainly by economic growth – tyranny of GDP
- Assumed more wealth and 'stuff' ➔ improved well-being – probably true for most of history
- Again, reflected in IS studies

Wealth VS Happiness

Search on *Google Scholar* among *Research Policy* papers

	1980-89	1990-99	2000-09
wealth/profit	9	145	599
happiness/ well(-)being	0	30	101

8. From innov'n for wealth creation to innovation for well-being

- For centuries, 'progress' seen in terms of 'more is better'
- Pol agenda driven mainly by econ growth – tyranny of GDP
- Assumed more wealth and 'stuff' ➔ improved well-being – probably true for most of history
- But (i) research on well-being suggests assumption only true up to a certain income – the Easterlin paradox;
  (ii) world can't support population of ~9 billion, all with US living standards
- ∴ Pol & econ agenda and notion of progress must change
- Shift from innov'n for wealth to innov'n for well-being
- Need policies to stimulate this – implies development of appropriate methods, indicators, conceptual frameworks
- Work begun by a few, but need to build on this if shift to innovation for well-being to be achieved

9. From ‘winner take all’ to ‘fairness for all’?

- “Polarisation and growing inequality inherent in the globalising learning economy” (Lundvall, 2012)
- Growing incidence of ‘winner take all’ phenomenon
  - i.e. one organisation benefits from an innovation to a far greater extent than competitors with only marginally inferior products
  - e.g. IT (Microsoft, Intel, Oracle, Apple, Google, Facebook)
- IS not to blame for this, but are we complicit?
- Can’t simply claim “not out fault” – moral responsibility
- Have a duty to explore whether we can say something about how firms might generate innovations that, instead of creating a few billionaires, result in ‘fairness for all’
- Lundvall (2012) – IS needs to adopt more critical perspective? Forge closer links with STS?
- Carlota Perez (2012) – ‘Innovation systems and policy: not only for the rich?’

10. From government as fixer of failures to the entrepren'l state

- Under neo-liberalism, gov't seen as playing restricted role
  - Task = to ensure the macro-economic climate OK for free-market capitalism, then 'get out of the way'
- Contrast between public and private sector
  - Former lumbering, bureaucratic, inefficient, while latter nimble, efficient and 'entrepreneurial'
- Underplays entrepreneurial role of state with regard to crucial innovations
  - e.g. pharmaceuticals, microchips, Internet, World-Wide Web, cell phones, GPS
- Unrealistic to assume that *all* policies will be successful
  - cf. research, entrepreneurial initiatives
- If govt's don't take risks in policies, may not have failures, but won't have any great successes either
- Need to change our conception of gov't from passive fixer of failures to 'the entrepreneurial state' (Mazzucato, 2011)

11. From faith-based policy to evidence-based policy?

(Steinmueller, 2012)

- Underpinning philosophy of IS pioneers based on assumption that STI fundamental to econ & social progress, but need effective policies
- Further assumed STI could ➔ better policies, and resulting evidence-based policies would ➔ benefits for humanity
- But often found policy-makers already wedded to particular (faith-based) policy – only willing to take on board evidence supporting it (i.e. policy-based evidence) not evidence pointing to a different policy (i.e. evidence-based policy)
- Little evidence our efforts have ➔ better policies, and virtually none that those policies have ➔ the world becoming a better place
- Providing such evidence & encouraging shift to evidence-based policy another crucial challenge to IS researchers

12. Balancing the intrinsic tensions … between IP and open source

- While a given policy may work in one sector, elsewhere may be ineffective or opposite policy may better
- In many cases, a balance between the two required
- e.g. balance between intellectual property and patenting VS open source
- In pharmaceuticals, patenting necessary to provide incentives, while for software ‘open source’ more effective
- In many sectors, some balance required between protecting IP and open source approach
- Task for IS researchers = to specify more clearly what balance between the two is required in different sectors/ circumstances

13. Balance between exploration and exploitation

- One area where more known about balancing two competing alternatives is with regard to exploitation of existing knowledge VS exploration of new knowledge
  - e.g. studies analysing the ‘ambidexterity hypothesis’
- But important research remains to be done here
  - What are pros and cons of exploration and exploitation?
  - Under what conditions is each the more appropriate?
  - What is optimum balance for individual sectors or firms?
  - What are the factors affecting that balance?
- Linked closely with next challenge

14. Between closed and open innovation

- One HCP from last 10 years is Chesbrough's *Open Innovation*
- Stimulated debate as to *how* open an organisation can be
- Danger that industry seen as justification for slashing internal R&D – if many adopt this approach, will adequate R&D be conducted 'elsewhere'?
- From Cohen and Levinthal's work on 'absorptive capacity', we know firms need to conduct a certain level of R&D if to exploit knowledge developed externally
- Challenge for IS researchers = to explore what is the appropriate balance between open and closed innovation for specific sectors and firms, and factors that affect that balance

15. Balance between competition and cooperation

- Related topic is issue of when an organisation should compete and when it should cooperate
- Most organisations need to pursue a strategy based on some combination of the two
- But exact balance depends on range of factors
  - e.g. sector and competitors, maturity of technology, whether radical or incremental innovations sought, etc.
- Further research needed to obtain more detailed understanding of what is the most appropriate balance in different cases

16. Pricking academic bubbles

- Economic history characterised by periods of unbridled optimism giving rise to a ‘bubble’ (Perez)
  - e.g. Dutch tulips, canal building ‘mania’, railway mania, US stock market bubble in 1920s
- Not learned from these, viz Dotcom bubble of late 1990s, and feeding frenzy around financial derivatives in 21st C
- Even scientists not immune from such herd instincts
  - e.g. ‘string theorists’, ‘chaos’/‘complexity’ researchers
- Do we in the IS community sometimes fall prey to such manias or bubbles?
  - e.g. Japanese production processes in 1980s? Hype over biotechnology? Exaggerated benefits of clusters, or innovative potential of SMEs?
- Challenge to younger IS scholars = to maintain ability to assess if a popular line of research becoming a fad
- Need a few ‘contrarians’ willing to suggest the new emperor has no clothes!

17. Avoiding disciplinary sclerosis

- Initially IS populated by ‘immigrants’ from other disciplines – intrinsically interdisciplinary
- Driven by policy issues
- Mainly qualitative (e.g. case-studies)
- Now have dedicated centres, train own PhD’s, own journals & conf’s, own methodologies (mostly quantitative)
- Beginning to exhibit some disciplinary characteristics
  - At a Kuhnian transformation? (Steinmueller, 2012)
- BUT increasing homogeneity, more paradigm-driven & less policy-driven, less adventurous
- Economics – from heterogeneous mix to neoclassical dominance as ‘grey squirrels’ chased out the red ones
- What sort of field do we want to be? A disciplinary ‘pedigree’ or an interdisciplinary ‘mongrel’?

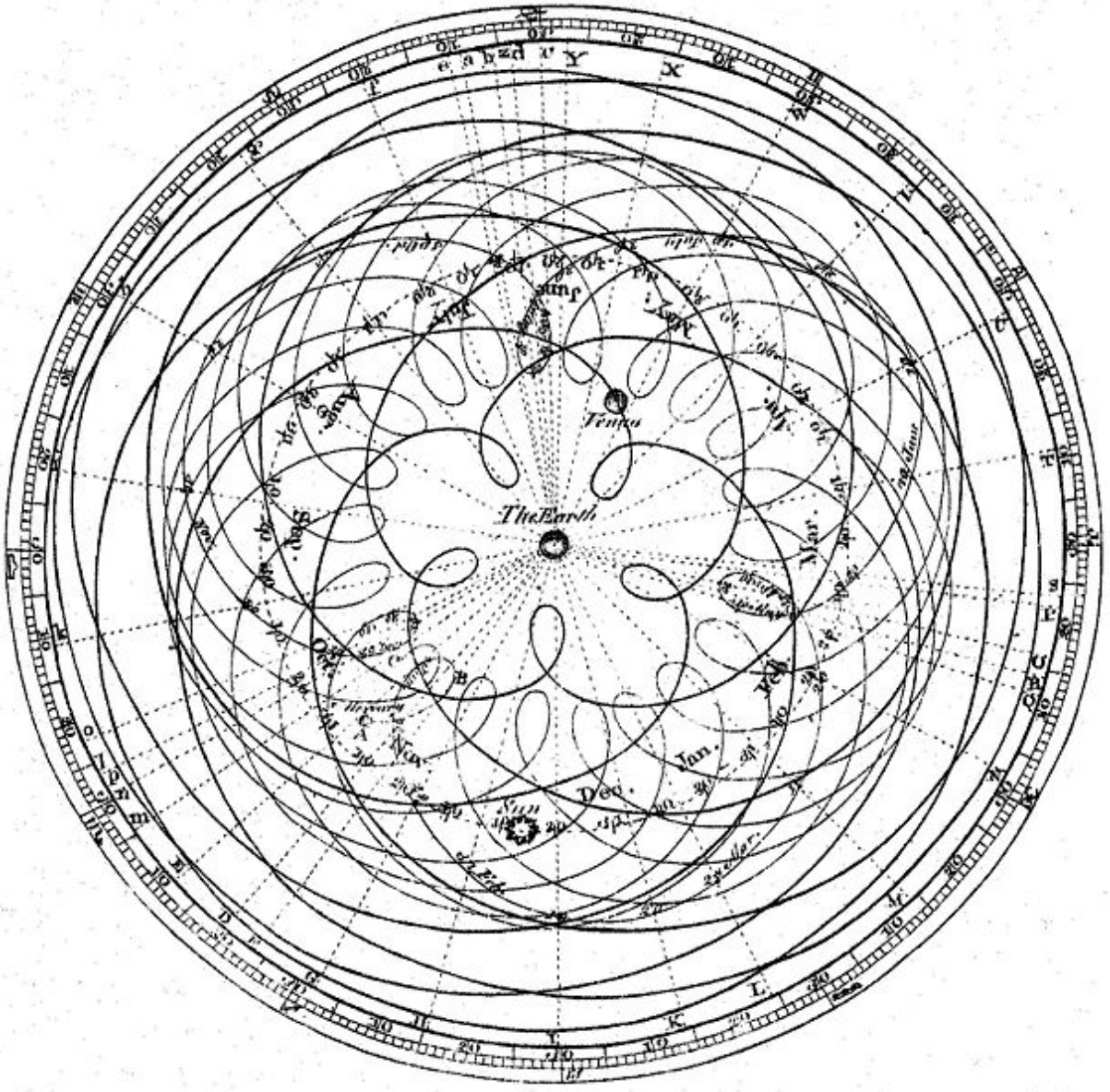
18. Identifying the causes of the current economic crisis

- Current econ crisis most serious since 1930s – causes?
- Innovations played a part
  - e.g. mortgage-backed securities, collateralised debt obligations, credit default swaps
  - Introduced to reduce risk
  - But spiralled out of control into trillion dollar 'casino banking'
- Problem not that IS contributed to these innovations, but that we failed to provide any analysis (with a few exceptions e.g. FINNOV)
- Even sociologists (e.g. Mackenzie) had more to say – 'The curious incident of the dog that failed to bark'
- Challenge = to provide an understanding of role played by financial innovations in creating the economic crisis, and lessons one can draw to minimise risk of happening again

19. Helping to generate a new paradigm for economics

- Lundvall – “the economics profession … has a major responsibility for the current crisis … there is a strong need for a paradigm shift” (cf. Freeman)
- See also Giovanni Dosi and Carlota Perez (both 2012)
- Cf. Ptolemaic astronomy (Dosi) – to explain why planets don’t move in circles as meant to, added epicycles

Ptolemy's Epicycles



19. Helping to generate a new paradigm for economics

- Lundvall – “the economics profession … has a major responsibility for the current crisis … there is a strong need for a paradigm shift”
- Cf. Ptolemaic astronomy – to explain why planets don’t move in circles as meant to, added epicycles
- Neo-classical economics seeks to protect core beliefs
  - e.g. equilibrium, rational agents, perfect information, efficient markets, representative firms etc.
- But had to invoke growing panoply of ad hoc ‘fixes’
  - e.g. bounded rationality, imperfect information, information asymmetry, satisficing, cognitive bias (e.g. ‘anchoring’)
- Kuhn – accumulation of ‘anomalies’ often a prelude to end of normal science and transition to new paradigm
- Opportunity for IS to introduce evolutionary element

20. Maintaining our research integrity and sense of morality

- Professional communities operated on basis of ‘self-policing’ – assumed external regulations unnecessary
- But succession of scandals (doctors, accountants, MPs, journalists, bankers) suggest self-policing ineffective
- ‘Republic of Science’ one last bastion where misconduct is rare, low-level and self-correcting?
- IS – fortunate in our ‘founding fathers’ (e.g. Freeman, Nelson) – shaped culture & norms – openness, intellectual generosity (NSI example), integrity
- But now warning signs – secrecy, ‘borrowing’ of data
- Plagiarism – rare (?) but increasing
- Growing problem of ‘salami publishing’ – difficult to police, & can shade into self-plagiarism
- Where is the boundary between acceptable and unacceptable research behaviour? How to maintain?

20 challenges for innovation studies

From visible to ‘dark’ innov’n
From manufacturing to services
From ‘boy’s toys’ to ‘women’s lib
From national to global SIs
From productivity to sustainability
From economic growth to sustainable development
From risky to socially responsible innovation
From wealth creation to well-being
From ‘winner take all’ to ‘fairness for all’?
From gov’t as fixer of failures to the entrepreneurial state
From faith to evidence-based policy
Balancing IP Vs open source
Balancing exploration Vs exploitation
Balancing closed Vs open innovation
Balancing competition Vs cooperation
Pricking academic bubbles
Avoiding disciplinary sclerosis
Identifying causes of current economic crisis
A new paradigm for economics
Maintaining our research integrity & sense of morality

Concluding comments

- Now that Innovation Studies half a century old, appropriate time to reflect on achievements
- Also occasion to look forward and discuss future challenges and what sort of field we want to be
- List of 20 challenges not intended to be prescriptive
- Purpose = to join with others in launching a debate
- May shape our future for decades to come

References

G. Dosi (2012), ‘Innovation studies: challenging economics?’

B.-Å. Lundvall (2012), ‘Reflections on innovation studies’.

B.R. Martin (2012), ‘Innovation Studies: challenging the boundaries’.

C. Perez (2012), ‘Innovation systems and policy: not only for the rich?’

W.E. Steinmueller (2012), ‘The past and future of STI training in the European tradition’.

(All presented at the Lundvall Symposium on the Future of Innovation Studies, held at Aalborg University on 16-17 February 2012.)

20 challenges for innovation studies

From visible to ‘dark’ innov’n
From manufacturing to services
From ‘boy’s toys’ to ‘women’s lib
From national to global SIs
From productivity to sustainability
From economic growth to sustainable development
From risky to socially responsible innovation
From wealth creation to well-being
From ‘winner take all’ to ‘fairness for all’?
From gov’t as fixer of failures to the entrepreneurial state
From faith to evidence-based policy
Balancing IP Vs open source
Balancing exploration Vs exploitation
Balancing closed Vs open innovation
Balancing competition Vs cooperation
Pricking academic bubbles
Identifying causes of current economic crisis
Avoiding disciplinary sclerosis
A new paradigm for economics
Maintaining our research integrity & sense of morality