Innovation system research and policy: Where it came from and Where it might go

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Structure of the lecture

1. Why study innovation?
2. A brief history of innovation system research:
3. Why we need a broad definition of the innovation system.
4. Policy implications of systemic and evolutionary perspective?
5. Globelics and the Challenges for Innovation System Research

Why study innovation? Critique and/or Engineering

- Critical understanding of capitalist development
  - Innovation and inequality
  - Innovation as creative destruction
- Critical perspective on economic theory
  - Neglect of learning
  - Lack of interdisciplinarity
- Promote the good society.
  - Innovation, growth and well being
  - Innovation, creativity and democracy.
- Produce knowledge base for practise in
  - Business management
  - Public policy

Acceleration of Innovation reearch

Share of scientific articles with innovation in title 1955-2004 (number out of 10.000 – estimated from Fagerberg (2005), Handbook on Innovation, p.2.

Year	Number
1955	1
1965	2
1975	6
1985	7
1995	10
2004	16

The message

- The drift away from critique and engineering - toward primitive engineering approach.
- Too strong focus on science as source of innovation and with neglect of experience based learning.
- A call for research linking innovation:
  - To interactive learning and the evolution of knowledge.
  - Economic development
  - Transnational systems of innovation
- Public policy in an evolutionary context takes the form of institutional design and 'creating and supporting winners' through a combination of supply and demand instruments.

The Original NSI-concept

- Friedrich List (1840) as the Grandfather of the NSI-conceptand Freeman (1982) as the Father.
- List, Freeman, Nelson and Aalborg versions were broad and linked innovation to the production system and to the organisation of firms.
- Parallel efforts toward systemic perspective in the development studies and in the South (Prebisch)
- The aim was to understand catching-up or international competitiveness
- Gave rise to criticism to standard economics and to standard economic policy.

A brief history of innovation research – the classical antecedents

- Adam Smith on the role of both experience-based and science based learning
- Friedrich List on the need for insfrastructural investment to build national innovation systems
- Karl Marx on the dialectical impact of technical progress for workers and society.
- Schumpeter as the Marx of the bourgeosie.

Schumpeter on innovation

- Schumpeter was mainly interested in the implications for economic theory and to explain historical phenomena such as long waves – less on management and policy..

- When explaining innovation he put most of the emphasis on the *supply side* – first the individual entrepreneur and later the R&D-lab of the big company.

- This view was challenged by Schmookler who demonstrated that the growth of *demand* was a prerequisite for innovation.

Chris Freeman (and Richard Nelson) father(s) of modern innovation theory

- CF Economist from London School of Economics – went to Keynes' lectures in Cambridge, read Marx and Schumpeter.
- Experience from empirical industrial economics before starting SPRU in the sixties.
- SPRU started with studying *prerequisites for successful innovation* (Sappho) but gradually Freeman, Perez, Soete, Dosi and others moved on toward *the critical perspective*
- Joined in OECD-group with Dick Nelson who, with a similar background, developed parallel efforts in the US (see Dosi et al 1988).

The eighties – a period of building innovation theory

- Technological paradigms (Dosi)
- International trade (Pavitt and Soete)
- Long waves (Perez and Freeman)
- Comparative sector and technology studies (SPRU and Nelson in the US) .
- Historical work (Rosenberg and David)
- Innovation systems in the South (Furtado)
- Innovation systems in small countries (Aalborg).
- The Dosi et al-book: Technical change and economic theory (1988)

Innovation as an interactive process and the innovation system perspective

- Among Freeman's favourite themes beginning of the 80's were:
  - The need to overcome the split between innovation as driven by supply factors versus innovation as driven by demand factors.
  - The importance of understanding interaction between agents in the innovation process
- 1982 Freeman introduced the concept national system of innovation in an unpublished paper for an OECD-group.

'European paradox' and the STI-bias

- A similar weakness of much of the policy oriented innovation research!!!
- Reflects the limited perspective with to much focus on Science based learning (STI) to the neglect of Experience based learning (DUI).
  - STI-learning can be measured and manipulated more easily than DUI-learning.
  - Policies involved are less controversial and easier to design.
  - Lamp-post syndrome!

STI-mode and DUI-mode of learning – getting the NSI-concept back on track

- STI=Science-Technology-Innovation mode is characterised by science-approach – formalisation, explicitation and *codification*
- DUI=Learning by Doing, Using and Interacting mode refers to *experience-based*, implicit, embedded and embodied knowledge.
- Jensen, Johnson, Lorenz and Lundvall, 'Forms of Knowledge and Modes of Innovation', Research Policy, 2007

Illustrating empirically how DUI and STI-learning promote innovation

- Year 2001, DISKO survey on technical and organisational change addressed to Danish firms in the private sector,.

- Survey and register data from 692 firms included in the following analysis.

- Jensen, Johnson, Lorenz and Lundvall in Research Policy 2007.

DUI-learning - seven indicators reflecting 'learning organisation' and 'user focus'

- The firm makes use of some of the following practises:
  - Interdisciplinary workgroups
  - Quality circles/groups
  - Systems for collecting employee proposals from employees
  - Autonomous groups
  - Integration of functions
- Demarcations between groups of employees have become less sharp 1998-2000.
- The firm has established closer relationships with customers 1998-2000.

STI-learning – three indicators reflecting R&D-effort and networking with science infrastructure

- The firm has positive expenditure on R&D.
- The firm has personnel with academic degree in natural science or engineering.
- The firm interacts with researchers attached to universities or other science institutes.

Odds ratio estimates (with control variables for sector, size & ownership)

	Odds ratio	Coefficient estimate
DUI/STI	5.064	1.6222**
STI	2.355	0.8564**
DUI	2.218	0.7967**

On the need to combine science-based with experience-based learning

- Firms combining *science-based (STI-mode)* with *experience-based (DUI-mode)* learning are more innovative than firms biased toward one mode.

- Calls for analytical efforts that establish the connection between knowledge creation through research and knowledge creation through organisational learning and inbteraction with users.

- Implies broad definitions of innovation systems, innovation policy and knowledge management.

Implications for how to define innovation systems

- In order to explain how new ideas are brought to the market and transformed into economic performance it is necessary to take into account both science-based learning and experience-based learning

- Human ressources and organisation within and across firms are important dimensions of the innovation system.

- Triple Helix is a Sub-system within the NSI and presenting it as a substitute for NSI is misleading!

Innovation is relevant both for Low tech and High tech-sectors

- Most attention so far to 4. Great potential also in 2 and 3.

	Low tech	High tech
DUI-mode	1.	2.
STI-mode	3.	4.

Innovation systems and innovation policy

- Look for missing links, underutilized competencies
- Do not forget to build competence also on the user side
- Low cost government operations can be to:
  - map the national innovation system
  - pursue technological forecasting
  - promote new network formations
  - complement to cluster policy

The Broader Agenda: Inequality, insecurity and innovation

- Individual versus collective entrepreneurship
- The small country paradox and the distribution of costs and benefits of change
- The global learning divide and unsustainable growth patterns in the North as well as in the South.

The broader agenda for Growth and Development – four kinds of capital

	Easy to reproduce	Difficult to reproduce
Tangible	Production capital	Natural capital
Non-tangible	Intellectual capital	Social capital

Future challenges: People, learning and systemic context

- More systematic research on how learning by doing, using and interacting takes place. Development of indicators and taxonomies.

- Deepening our understanding of how people learn differently in different national systems and how it affects patterns of innovation.

- Linking learning to labour mobility, networking and social context.

- Arundel et al (2007) in ICC as a step ahead.

Innovation systems and development – some lessons from AfricaLics workshop

- Distinction between catching up (middle income) and 'innovating out of poverty' (low income). In both cases more focus on demand for knowledge!

- In low income countries a need to understand:
  - How to dynamise the informal sector – including gender dimension.
  - Develop new indicators for competence building.
  - Build manufacturing strength on raw material.
  - Upgrade skills for design and engineering
  - The new role of Brics in the South

On the need for global governance innovation

- The most developed studies of innovation systems take a national perspective but there are systems at the level of the firm, the sector, the region and the technology.

- Today the strength of national governance and international competition has become a problem for solving global problems and crises (environmental, financial and demographic crises).

- How can Globelics perspective be developed to help overcome this fundamental contradiction? A new role for Brics – building new transnational framework for transnational innovation systems?

Global entrepreneurial efforts in organising NSI-research as LICS

- **Globelics (see ww.globelics.org) 2002**
  - BRICS –project (Brasil, Russia,India, China and South Africa the important role of Cassiolato)
  - Catch-up (Columbia University and Nelson as the central entrepreneur)
- **Cica-lics – China network 2005**
  - Academy
  - Workshop.
- **India-lics 2010**
- **AfricaLics 2012 (the new challenge!)**

- THANK YOU FOR YOUR ATTENTION