

Modes of learning and Industry taxonomies

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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

The paradox and the built in STI-bias

The Paradox: 'Systems with a lot of good domestic science but less successful in innovation'

- Reflects the limited perspective with too much focus on Science based learning (STI) to the neglect of Experience based learning (DUI).
- Reasons for bias:
 - **STI-learning can be measured and manipulated more easily than DUI-learning – cf. the Meadow-project in Europe.**
 - **The policies involved are less controversial – cf. The LOK-program in Denmark.**

The double change in global context

- ICT and access to elements from the science base becomes increasingly important for firms in all sectors – **calls for a strengthening of STI-mode of learning**
- But these changes and globalisation contribute to accelerating change and requires learning organisations – **calls for a strengthening of DUI-mode of learning**

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- 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 interaction with users.

Implications

- Implies broad definitions of innovation systems, innovation policy and knowledge management.
- ICT and access to elements from the science base becomes increasingly important for firms in all sectors – **calls for a strengthening of STI-mode of learning**
- But these changes and globalisation contribute to accelerating change and requires learning organisations – **calls for a strengthening of DUI-mode of learning**

Two kinds of bias in industrial policy

- 1) Promoting the science base of high-tech firms assuming DUI takes care of itself
- 2) SME policies sometimes neglects the importance of linkages to sources of codified knowledge

The big challenge lies in stimulating firms to combine the DUI- and the STI-mode.

Four industry taxonomies (Maleki paper)

- OECD on High tech vs Low tech
- Pavitt on the role of knowledge supply and demand (cf Archibugi 2001).
- Malerba on Mark 1 and Mark 2
- Aasheim and Gertler on Synthetic and Analytic knowledge

Some common problems

- Moving from firm characteristics to grouping sectors.
- Sectors are heterogenous.
- Sectors evolve – cf clothing industry in Denmark 1950 and 2000.
- Illustration (Synthetic/Analytic knowledge) DUI/STI in HT and LT sectors.

DUI and STI learning in High Tech and Low Tech Manufacturing

Variables:	Low Learning Cluster	STI Cluster	DUI Cluster	DUI/STI Cluster	<i>N</i>
Manufacturing high tech	0.2231	0.2645	0.2314	0.2810	<i>121</i>
Manufacturing lowtech	0.3522	0.1321	0.2893	0.2264	<i>159</i>
All firms	0.4249	0.1171	0.2673	0.1908	<i>692</i>

Testing Sector Taxonomies

- Use firm surveys to cluster firms according to how they create new knowledge and learn.
- Analyse the presence of clusters in sectors.
- Construction of new aggregates (alternatives to sectors) that are more relevant than sectors from the point of view of knowledge creating firms?

The learning economy and creativity

- Acceleration of innovation requires rapid learning and selects rapid learners.
- A need to compress the process of knowledge creation and knowledge exploitation in time and space.
- The creative class and creative industry perspective as illustration.

Creativity

- Need for a balanced creative system:
Creative Thinkers do not promote economic performance without Creative Doers and creative Problem-solvers.

Defining a creativity system.

- If we are interested in how creativity affects the **performance** of a system we need take into account:
 - Creative **doers** as well as creative **thinkers** (Entrepreneurs as well as Inventors).
 - **Problem solvers** as well as **problem creators** (Equilibrators as well as Innovators)
- A system with creative thinkers but without doers would not be efficient. Neither would a system of innovators without creative problem solvers

Four types of activities constituting the creativity system

	Innovation process	Problem solving process
Creative thinking	Invention	Establishing new standards
Creative doing	Innovation	Discretionary Learning (DUI)

Separating the creative from the rest is not a good idea!

- Separating creative classes, creative industries and creative sites (cities) from the rest in order to promote or attract the creative is politically unsound.
- Most national systems (with the US as exception) ranked at the top in terms of competitiveness are characterized by strong elements of creativity in the ‘non-creative’ parts of the economy.

Florida's class analysis applied to Danish private sector

- Table on distribution of total employment between respectively the creative class and creative work.

	Creative work	Routine work
Creative class	30%	10%
Working and service class	30%	30%

- **Thanks for your attention!**