
Organisation and innovation

- I will start this lecture with a quote from R. Freeman's in his 1995 CJE article, 'The 'National System of Innovation' in Historical Perspective' (p. 18):

“... it is essential to emphasise the interdependencies between innovations and between technical innovations and organisational innovations. A theory of technical change which ignores these interdependencies is no more helpful than a theory of economics which ignores the interdependencies of prices and quantities in the world economy.

Objectives

- Overview of the literature on the relation between organisation design and innovation
 - Consider how different types of knowledge, including the classic distinction between tacit and codified knowledge, relate to different organisational forms
 - Present the results of empirical survey-based research on the adoption of different organisation forms and their relation to innovation performance for European member nations
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Some working definitions

- *Organisational structure* commonly refers to the groupings of people and tasks into subunits and business functions, and to the systems used to ensure coordination and control both horizontally and vertically within the boundaries of the organization.
 - Organisational structures can be characterised by the extent of horizontal and vertical differentiation with the horizontal dimension expressing the division of labour and the vertical showing authority relations between managers and employees
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Some working definitions

- The *organisation of work* refers to how work is actually divided into tasks, the bundling of task into jobs and assignments and the interdependencies between workers in performing the job.
 - Jobs can be broad or narrow and involve can differ in terms of the degree of employee control and discretion over his or her work.
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Some working definitions

- The literature describes various ways in which the key features of organisation structure and work organisation can be combined to form different *organisational designs*. Different designs are characterised by differences in the type of coordination mechanism, the division of labour and the nature of authority and employee control. The organisational design impacts on what employees learn and do in work and on the performance of the organisation.
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Organisational design and innovative performance

- A large literature in economics, management and political science addresses the relation between organisational design and economic performance, including innovative performance:
 - Learning organisations (Senge, 1990, Garvin 1993)
 - High-performance work systems (Applebaum, 2000, Guest)
 - HRM complementarities (Ichniowski et al. 1997; Huselid et al. 1997)
 - J-firm vs. A-firm. A (Aoki, 1986)
 - Varieties of Capitalism (Hall and Soskice, 2001)
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Hierarchical vs. flat organisational design

- One of the reoccurring distinctions developed in this literature is that between hierarchical or centralised organisational structures and flat or decentralised ones. This differences is linked to the organisation of work, style of employee learning and economic performance. In hierarchical structures jobs and tasks tend to be more specialised and learning narrower and more restricted. In terms of the sources of economic performance this points to a fundamental trade-off between specialisation and adaptability.
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Classic example: Burns and Stalker's (1961) contingency theory

- Mechanistic organisations: specialisation of tasks; hierarchical structure of control, knowledge of the whole organisation located at the top. Found in relatively stable environments.
 - Organic organisations: tasks are continually adjusted and redefined through interaction in work; a network structure of control and lateral communication; knowledge may be located at all levels. Appropriate to changing environments requiring innovative responses.
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Another now classic example: Aoki (1986)

- A-firm: hierarchical functional design, high degree of task specialisation, predominantly vertical lines of communication and control. The A-firm benefits from the gains of specialisation and is adapted to an unchanging environment.
 - J-firm: relatively decentralised structure with less sharp divisions between functions; tasks and jobs are wider and flexible; predominately horizontal lines of communication. The J-firm sacrifices the gains of specialisation for greater flexibility and a capacity to adapt to a changing environment.
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A more recent example: Dessein and Santos (JPE, 2006) 'Adaptive organisations'

- Adaptive organizations provide employees with flexibility to tailor their tasks to local information. Coordination is maintained by limiting specialization and improving communication. Extensive specialization results in organizations that ignore local knowledge...
 - Alternatively, by letting employees stick to some pre-agreed action plan, organizations can ensure coordination without communication.
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A more complex typology: Mintzberg's five archetypical organisational designs

- Simple structure: an organic type centrally controlled by one person. Can respond quickly to changes in environment.
 - Machine bureaucracy: mechanistic design with high levels of specialisation, standardisation and vertical control
 - Professional bureaucracy: a decentralised mechanistic design which accords high autonomy to the individual professional; Characterised by individual and functional specialisation
 - Divisionalised form: a decentralised organic form in which quasi-autonomous units are loosely connected by a centralised authority.
 - Operating Adhocracy: flexible project-based structure in which coordination is achieved through mutual adjustment. Designed to deal with instability and complexity.
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Summary: organisation design, employee learning and adaptability

- These different models and typologies suggest that firms are more adaptable and that their innovative capacity will be greater when task specialisation is limited, employees have sufficient autonomy to use and adapt to local information, and coordination is achieved through extensive horizontal communication and processes of mutual adjustment.
 - Can we go beyond this basic conclusion to say something about the relation between organisational design and different types or styles of learning and innovation?
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Organisational design, types of knowledge, and styles of learning

- A. Lam (1998) develops a modified version of Mintzberg's organisational taxonomy and connects it to a taxonomy of forms of knowledge developed notably by Blacker (1995). This provides insight into the relation between organisational design and innovation style by focusing on the different ways that knowledge is developed and used within the organisation
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Characterising knowledge

- The knowledge of the firm is analysed along two dimensions, epistemological and ontological:
 - The first, epistemological, concerns the modes of expression of knowledge, namely, Polanyi's (1962; 1966) distinction between **explicit and tacit** knowledge.
 - The second, ontological, relates to the locus of knowledge which can reside at the **individual or collective** levels. These two dimensions give rise to four different forms of organizational knowledge: 'embrained', 'embodied', 'encoded' and 'embedded' knowledge
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Blacker's (1995) taxonomy knowledge types

Epistemological dimension	Ontological dimension	
	Individual	Collective
Explicit	Embrained knowledge	Encoded knowledge
Tacit	Embodied knowledge	Embedded Knowledge

Knowledge types

- Embrained knowledge (individual and explicit) is dependent on the individual's conceptual skills and cognitive abilities. It is abstract or theoretical knowledge usually acquired through formal education.
 - Embodied knowledge (individual and tacit) is the practical, individual type of knowledge on which Polanyi (1962; 1966) focused. It is learnt through experience and in training based on apprenticeship.
 - Encoded knowledge (collective and explicit) is shared within organisations through formal information systems and is associated with high degrees of specialisation and standardisation
 - Embedded knowledge (collective and tacit) is built into routines, habits and norms that cannot easily be transformed into information systems. Embedded knowledge is produced in an interaction among different members of the organisation. It is contextual and dispersed.
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Characterising organisations in terms of knowledge

- All organisations potentially contain a mixture of knowledge types, but their relative importance differs. Organisations may be dominated by one type of knowledge rather than another. To each of the knowledge forms there corresponds an ideal type organisation. We distinguish four ideal typical organisational forms, using two dimensions: the degree of standardisation of knowledge and work, and the dominant knowledge agent (individual or collective)
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Organisational coordination and dominant forms of knowledge (Lam, 1998)

	Knowledge agent (autonomy and control)	
	Individual	Organisation
High standardisation of knowledge and work	Professional bureaucracy (embrained knowledge)	Machine bureaucracy encoded knowledge
Low standardisation of knowledge and work	Operating Adhocracy (embodied knowledge)	J-form Organisation (embedded knowledge)

Contrasting organisational models with different learning/innovation capabilities

<p>Professional bureaucracy</p> <p>Embrained knowledge</p> <p>Narrow learning inhibits innovation</p>	<p>Machine bureaucracy</p> <p>Encoded knowledge</p> <p>Shallow learning, limited innovation</p>
<p>Operating adhocracy,</p> <p>Embodied knowledge</p> <p>Dynamical learning, radical innovation</p>	<p>J-form organisation</p> <p>Embedded knowledge</p> <p>Cumulative learning, incremental innovation</p>

Learning and innovation in the J-form organisation

- “The J-form organisation combines the stability and efficiency of a bureaucracy with the flexibility and team dynamics of an adhocracy. It allows an organic, non-hierarchical team structure to operate in parallel with its formal hierarchical managerial structure.”
 - “The J-form organisation is an adaptive and innovative organisation. It is marked by a tremendous capacity to generate, diffuse and accumulate tacit knowledge continuously through ‘learning-by-doing’ and interaction. It has a unique capability to generate innovation continuously and incrementally. However, learning in the J-form organisation is also potentially conservative. Its stable social structure and shared knowledge base can reduce the capabilities of the organisation to learn from individual deviance and the discovery of contrary experience. The J-form organisation may find it difficult to innovate radically.”
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Learning and innovation in the operating adhocracy

- “The knowledge base of an operating adhocracy is diverse, varied and organic. A large part of the knowledge in use is 'organic' i.e. tacit knowledge generated through interaction, trial-and-error and experimentation in problem-solving. It is an organisation capable of divergent thinking, innovation and creative problem-solving. Its learning and innovative capabilities stem from: 1) the way its collaborative approach to problem-solving facilitates the distribution and dissemination of knowledge; 2) the high degree of autonomy given to individuals and entrepreneurial project teams leads to a diverse and varied knowledge base; and 3) its strong market-discipline exerts pressures on individuals to accumulate their knowledge and expertise in line with shifting market opportunities.”
 - “The frequent re-structuring and shifting of individuals between project teams means that tacit knowledge may not be fully and adequately articulated before an individual moves on. An operating adhocracy is highly efficient in the utilisation and generation of tacit knowledge but is not well equipped to accumulate it.”
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Empirical strategy: measuring organisational forms for the EU-15

- Research based on the third European Working Conditions Survey (EWCS) carried out by the European Foundation for the Improvement of Living and Working Conditions
 - in March 2000,
 - in each of the 15 member States of the European Union.
 - Survey methodology based on a multi-stage random sampling (method called 'random walk')
 - with face-to-face interviews at employees' home
 - (about 1500 persons in each country).
 - Field of our study : salaried employees working :
 - in establishments with at least 10 persons
 - in both industry and services, but excluding agriculture and fishing; public administration and social security; education; health and social work; and private domestic employees.
 - Total population studied : 8 081 persons
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Work Organisation Variables

- **Team work**
Does your job involve, or not, doing all or part of your work in a team?
 - **Job rotation**
Does your job involve, or not, rotating tasks between yourself and colleagues?
 - **Autonomy in work methods**
Are you able, or not, to choose or change your methods of work?
 - **Autonomy in work pace**
Are you able, or not, to choose or change your speed or rate of work?
 - **Learning new things in work**
Generally, does your main paid job involve, or not, learning new things?
 - **Problem solving activities**
Generally, does your main paid job involve, or not, solving unforeseen problems **on your own**?
 - **Complexity of tasks**
Generally, does your main paid job involve, or not, complex tasks?
 - **Responsibility for quality control**
Generally, does your main paid job involve, or not, assessing yourself the quality of your own work?
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Work Organisation Variables

- **Quality norms**
Generally, does your main paid job involve, or not, meeting precise quality standards?
 - **Monotony of tasks**
Generally, does your main paid job involve, or not, monotonous tasks?
 - **Repetitiveness of tasks**
Please tell me, does your job involve short repetitive tasks of less than a minute?
 - **Automatic constraints on work rate**
On the whole, is your pace of work dependent, or not, on automatic speed of a machine or movement of a product?
 - **Norm-based constraints on work rate**
On the whole, is your pace of work dependent, or not, on numerical production targets?
 - **Hierarchical constraints on work rate**
On the whole, is your pace of work dependent, or not, on the direct control of your boss?
 - **Horizontal constraints on work rate**
On the whole, is your pace of work dependent, or not, on the work done by colleagues?
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Summary of results for the 4-cluster solution

(percent of employees in each cluster)

	Learning organisation	Lean production	Taylorism	Traditional organisation	All
Autonomy fixing work methods	89,1	51,8	17,7	46,5	61,7
Autonomy setting work rate	87,5	52,2	27,3	52,7	63,6
Learning new things in work	93,9	81,7	42,0	29,7	71,4
Problem solving activities	95,4	98,0	5,7	68,7	79,3
Complexity of tasks	79,8	64,7	23,8	19,2	56,7
Responsibility for quality control	86,4	88,7	46,7	38,9	72,6
Quality norms	78,1	94,0	81,1	36,1	74,4
Team work	64,3	84,2	70,1	33,4	64,2
Job rotation	44,0	70,5	53,2	27,5	48,9
Monotony of tasks	19,5	65,8	65,6	43,9	42,4
Repetitiveness of tasks	12,8	41,9	37,1	19,2	24,9
Horizontal constraints on work rate	43,6	80,3	66,1	27,8	53,1
Hierarchical constraints on work rate	19,6	64,4	66,5	26,7	38,9
Norm-based constraints on work rate	21,2	75,5	56,3	14,7	38,7
Automatic constraints on work rate	5,4	59,8	56,9	7,2	26,7

Source : Third European Working Condition survey. European Foundation for the Improvement of Living and Working Conditions

The forms of work organisation in the EU

- **Learning forms of work organisation:**
 - autonomy in work
 - learning dynamics (learning new things, problem solving)
 - complexity of tasks
 - responsibility for quality control
 - low work rate constraints, repetitiveness and monotony
 - team working and job rotation not characteristic
 - *“Swedish socio-technical” model*
 - *“Operating adhocracy” model (Mintzberg)*

 - **Lean forms of work organisation:**
 - team working
 - job rotation
 - quality management (quality norms and quality control)
 - learning dynamics
 - work rate constraints, repetitiveness and monotony
 - relatively low autonomy in work
 - *“Lean production” (Womack et alii; MacDuffie et alii)*
 - *“Controlled autonomy” model (Appay; Coutrot)*
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The forms of work organisation in the EU

- **Taylorist forms of work organisation:**
 - work rate constraints, repetitiveness and monotony
 - low autonomy, learning dynamics, complexity, responsibility in quality control
 - team working and job rotation over-represented
 - *traditional taylorism and “flexible taylorism”*

 - **Traditional or simple structure or forms of work organisation:**
 - under-representation of all organisational variables, except tasks monotony
 - *simple organisational structure*
 - *informal and non codified work methods*
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Forms of work organisation across European nations

- **‘Learning’ forms of work organisation:**
 - + : **Netherlands, Denmark and Sweden**
 - - : **Southern countries and Ireland**
 - **‘Lean’ forms of work organisation:**
 - + : **UK, Ireland, Spain and France**
 - - : **Netherlands, Denmark, Sweden, Germany and Austria**
 - **‘Taylorist’ forms of work organisation:**
 - + : **Southern countries and Ireland**
 - - : **Netherlands, Denmark and Sweden**
 - **‘Simple’ forms of work organisation:**
 - + : **Southern countries**
 - - : **Netherlands, Denmark, Finland and UK**
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National Differences in Organisational Learning Modes

(percent of employees by organisational class)

	Learning organisation	Lean production	Taylorist organisation	Simple organisation
Belgium	38,9	25,1	13,9	22,1
Denmark	60,0	21,9	6,8	11,3
Germany	44,3	19,6	14,3	21,9
Greece	18,7	25,6	28,0	27,7
Italy	30,0	23,6	20,9	25,4
Spain	20,1	38,8	18,5	22,5
France	38,0	33,3	11,1	17,7
Ireland	24,0	37,8	20,7	17,6
Luxembourg	42,8	25,4	11,9	20,0
Netherlands	64,0	17,2	5,3	13,5
Portugal	26,1	28,1	23,0	22,8
United Kingdom	34,8	40,6	10,9	13,7
Finland	47,8	27,6	12,5	12,1
Sweden	52,6	18,5	7,1	21,7
Austria	47,5	21,5	13,1	18,0
EU-15	39,1	28,2	13,6	19,1

Source : Third European Working Condition Survey. European Foundation for the Improvement of Living and Working Conditions

Innovation modes based on Community Innovation Survey data for 14 EU-member nations

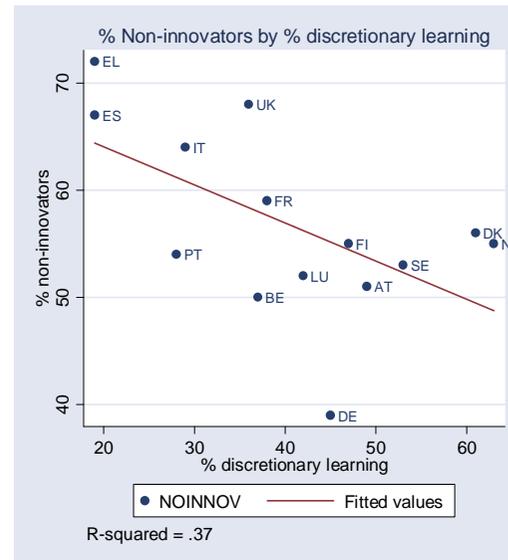
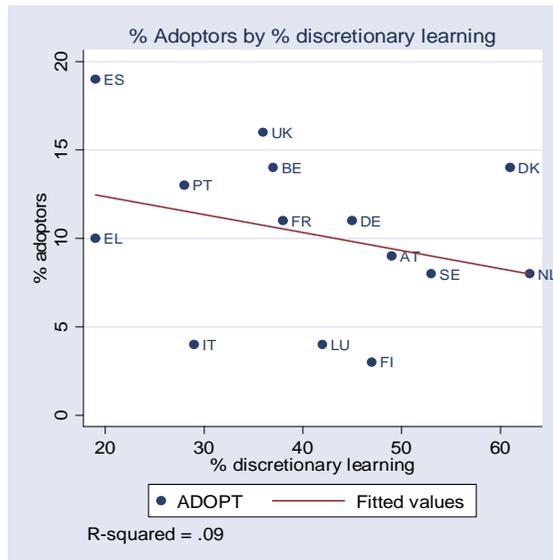
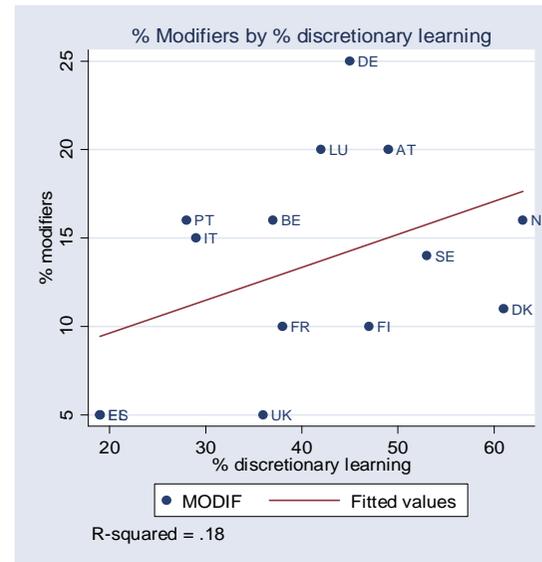
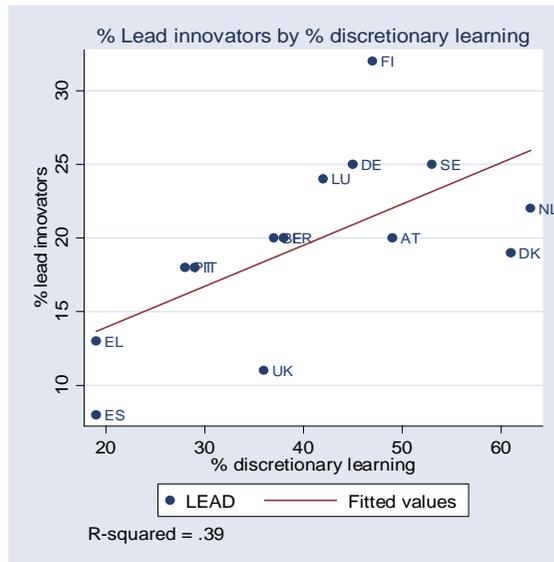
- *Lead innovators*: For these firms, creative in-house innovative activities form an important part of the firm's strategy. All firms have introduced at least one product or process innovation developed at least partly in-house, perform R&D at least on an occasional basis, and have introduced a new-to-market innovation. These firms are likely sources of innovations that are later adopted or imitated by other firms.
 - *Technology modifiers*: These firms primarily innovate through modifying technology developed by other firms or institutions. They do not perform R&D on either an occasional or continuous basis. Many firms that are essentially process innovators that innovate through in-house production engineering will fall within this group.
 - *Technology adopters*: These firms do not develop innovations in-house, with all innovations acquired from external sources. An example is the purchase of new production machinery.
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Table 2.8 Distribution of Innovation Modes in
14 EU Member Nations, 1998 - 2000

	Leaders	Modifiers	Adopters	Non – innovators	Total
Belgium	20	16	14	50	100
Denmark	19	11	14	56	100
Germany	25	25	11	39	100
Greece	13	5	10	72	100
Italy	18	15	4	64	100
Spain	8	5	19	67	100
France	20	10	11	59	100
Luxembourg	24	20	4	52	100
Netherlands	22	16	8	55	100
Portugal	18	16	13	54	100
UK	11	5	16	68	100
Finland	29	10	3	55	100
Sweden	25	14	8	53	100
Austria	20	20	9	51	100

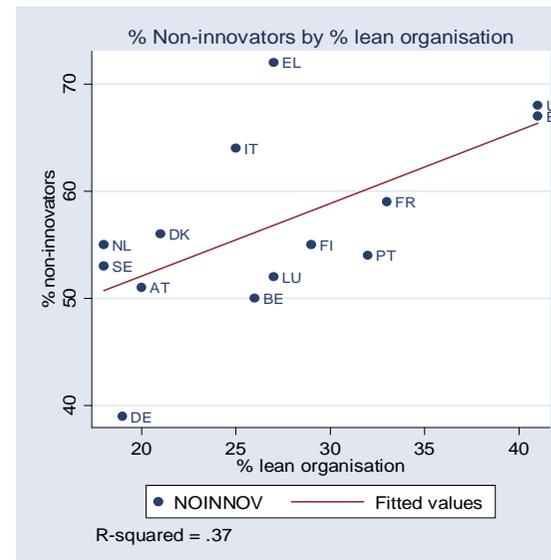
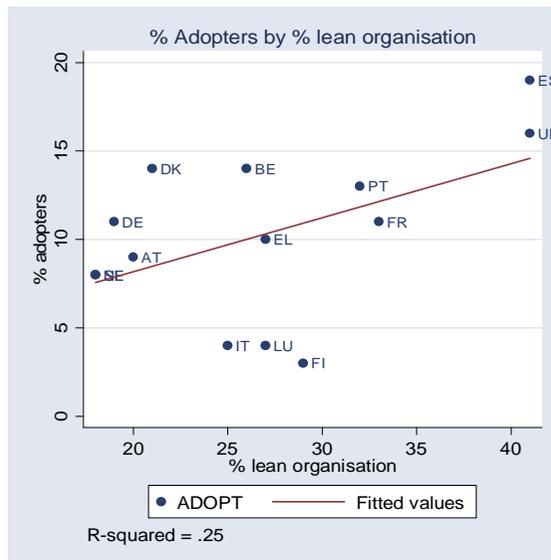
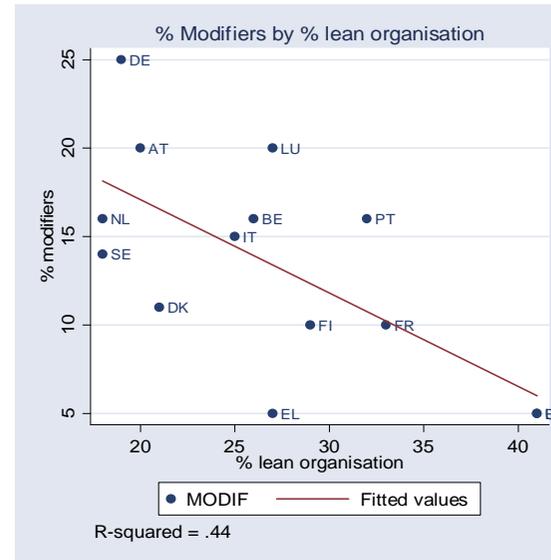
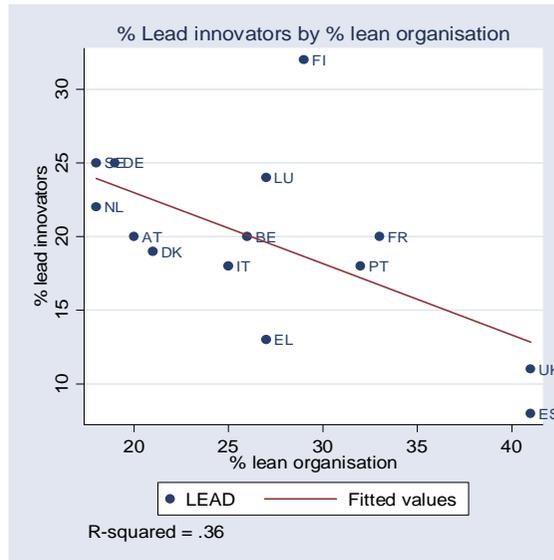
Source: Arundel et al. 2007

Figure 2.1 Correlations between innovation modes and discretionary learning, all sectors



Source: Arundel et al. 2007

Figure 2.1 Correlations between innovation modes and lean organisation, all sectors



Source: Arundel et al. 2007

Conclusions

- In nations where work is organised to support high levels of discretion in solving complex problems, firms tend to be more active in terms of innovations developed through their own in-house creative efforts. In countries where learning and problem-solving on the job are constrained, and little discretion is left to the employee, firms tend to engage in a supplier-dominated innovation strategy. Their technological renewal depends more on the absorption of innovations developed elsewhere
 - The results indicate that learning and interaction within organisations and at workplaces are at least as important for innovation performance as learning through interactions with external agents. Therefore, in order to understand national systems of innovation it is necessary to bring the organisation of work and employee learning into the analysis. Early conceptions of national innovation systems were built upon an analysis of interactive learning between producers and users. Now the analysis needs to be founded also on an understanding of learning organisations and the way people interact and learn at the workplace in different national economies
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Conclusions

- Another implication is that indicators for innovation need to do more than capture material inputs such as R&D expenditures and human capital inputs such as the quality of the available pool of skills based on the number of years of education. Indicators also need to capture how these material and human resources are used and whether or not the work environment promotes the further development of the knowledge and skills of employees. One step toward more adequately addressing the relation between organisation and innovation is to gather and analyse complementary firm-level data on both innovation modes and organisational forms.
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