

Enriching the indicator base for the economics of knowledge

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October 10th 2006
Seminar D-MTEC
ETHZ

Messages

- Economics of innovation as an empirically disciplined science
- The study of innovation requires that we gather and learn the fact of technology and organization themselves, be in the form of the changing qualities of goods, the organization of research, or the contents of patents.
- Data based on remote proxies provide us only with a blurred image of the phenomena, accompanied by a highly disturbing feeling of uncertainty about having mastered the hard facts
- A restless challenge: enlarging the scope of empirical material that economists will come to regard as legitimate, and perhaps even routine, in applied research

Knowledge management as a new organizational practice

- KM covers any intentional and systematic process or practice of acquiring, capturing, sharing and using productive knowledge, wherever it resides, to enhance learning and performance in organisations
- Until recently, our knowledge about KM was limited to:
 - Anecdotal evidence and ad hoc surveys
 - Managerial (and gourous') discourses
 - Research in management/organization science

- *“At Hoffmann-Laroche a knowledge management initiative in 1993-1994 reformed the process of developing new drug application...”*
- *“At Hewlett-Packard, the amount of product knowledge required to effectively use and support complex computer products has exploded..So in 1995, the company implemented a knowledge management tool called “case-based reasoning to capture technical support knowledge and make it available to personnel around the world”*
- *“The core message of this book is that only sustainable advantage a firm has comes from what it collectively knows, how efficeintly it uses what it knows, and how readily it acquires and uses new knowledge”*
 - Davenport and Prusak, *Working Knowledge*, HBSP, 1998

« The atmosphere surrounding this problem is dreadful. Thick and dense clouds shade the crucial points. They are almost impossible to reach »

Wittgenstein



- We would like to know a bit more
- Since many firms are spending money on KM, one would expect that they are getting something in return (at least on the average)
- Is KM more than a fashionable “social technology” widely adopted during the early and mid-1990s and then slowly declining?

Designing a research strategy

- Preconception : can one make an economic case about KM?
- Empirical research : highlighting the phenomenon with systematic data collection and analysis
- The big question : does it lead to more innovation, productivity gains?
- Proceeding toward the usual prescriptions of economics : the manipulation of incentives and inputs to achieve particular goals and the policy implications
- Implications for systematic and regular data collection

Preconception : KM as an economic case

- Learning by doing
- Knowledge as fixed cost in production
- Knowledge is fragmented
- Weak persistence
- Costs of transfer
- Tacit and codified knowledge
- « Organizational complements » and the ability of firms to realize value from ITs

1 - Learning-by-doing

- Massive innovative activities “without R&D”
- Any activity involving the production of a good (or the provision of a service) can generate learning and hence knowledge: such a characteristic gives many activities a potential value in terms of knowledge production
 - *“The motivation for engaging in the activity is the physical output, but there is an additional gain, which may be relatively small, in information which reduces the cost of further production”* (Arrow, 1962)
- Some learning-by-doing is based on experimental concept, where data is collected so that the best strategy for future activities is selected : performing experiments “on line”
- When occurring « by doing », experimental learning is limited because it can conflict with the normal performance that has to be achieved
- KM as promoting experimental learning by doing

2 – Knowledge as a fixed cost in production

- A piece of knowledge does not need to be produced more than once : the same piece of k. can be used over and over by as many people as wish to, at any scale of operation
- Thus the production a piece of K. is like a fixed cost in the production of goods and services
- There is a critical issue of “optimal use of knowledge” (Machlup, 1962)
- KM as optimizing knowledge
 - Not-reinventing the wheel
 - Creating best practices
 - Looking outside

3 – Knowledge is fragmented

- Knowledge fragmentation stems from division (division of labor, increasing specializations) and dispersion (local situations) of K.
- The structures of knowledge constantly need to be rebuilt and integration costs are increasing
- KM as solving integration problems

4 - Knowledge is weakly persistent

- If the practice of a task is interrupted, forgetting occurs and when performance is resumed after an interruption, it is lower than the level achieved prior to the interruption (Hirsch, 1952; Argote et al. 1990)
- Weak memory is due to high turnover, technological change, failure of human memory, absence of system of codification
- KM as maintaining organizational memory

5 - Knowledge is costly to transfer

- Stickiness refers to the incremental expenditure required to transfer a unit of information to a specified locus in a form usable by a given information seeker (Von Hippel, 1994)
- Sticky knowledge makes innovation more difficult to do when it is based on integration and recombination of pieces of pre-existing knowledge
- KM as reducing transfer costs

6 - Knowledge codification

- Tacitness makes knowledge difficult to transport, memorize, recombine and learn and creates inefficiency at system level
- Codification involves high fixed costs but enables agents to perform a number of operations at very low marginal costs
 - Once a recipe has been written, it can be disseminated at a very low cost or even virtually free of cost (given the new ICTs)
- The main function of codification : increasing memory capacity and developing learning programs
 - What is codified is not the complete knowledge: it is a learning program – set of instructions that helps to reproduce the knowledge (i.e. decrease the marginal cost of reproduction)

7 - Organizational complements and IT investments

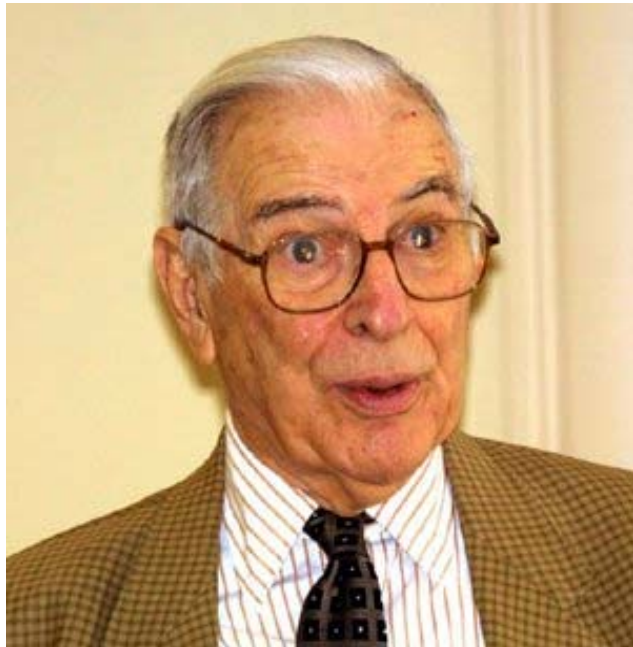
- Productivity paradox
- Organizational complements play an important role in the ability of firms to realize value from their ITs investments
- KM as complementary organizational capital

KM = Investing in...

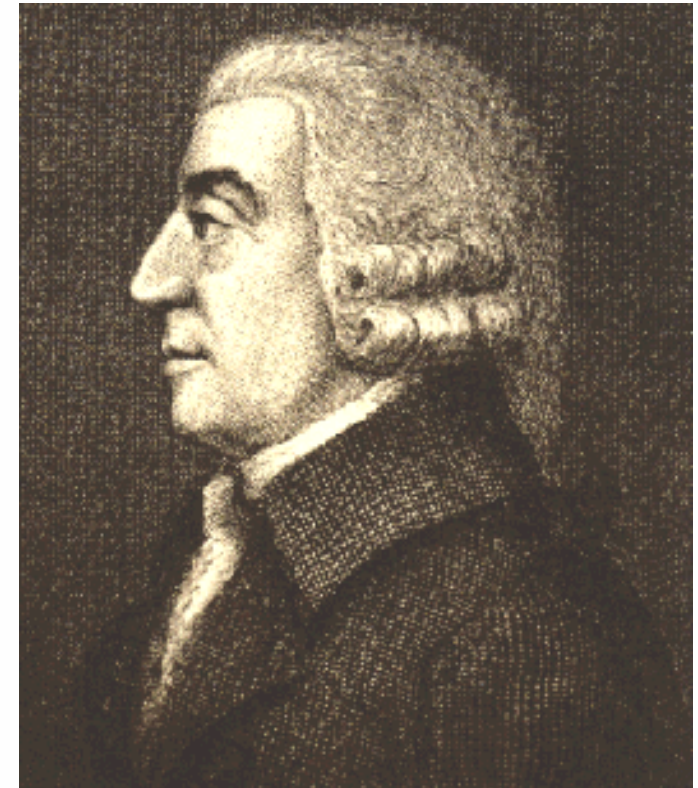
- Promoting experimental learning “on line”
- Optimizing the use of knowledge (as a fixed cost in production)
- Building organizational memory
- “Unsticking” information and codifying knowledge
- Enhancing ability of firms to realize value from ITs

KM as an economic case

- From this preconception based on economic concepts, one can infer that there is some good reasons to think that KM is likely to be a profitable investment for firms and other organizations



“What do we mean by the optimum utilization of knowledge?”



Not only did Arrow pioneer in modelling the economic implications of the existence industrial progress curve, but at the same time he posed the base of the modern economics of invention as a commodity



“**Taciturnity**” describes failures to express feasibly codifiable information and may therefore create private and social inefficiencies

« One of the greatest improvements that has been made upon this machine, since it was first invented, was the discovery of a boy who wanted to save his own labor »

We know very little

- A project initiated by CERI at OECD and STATISTICS CANADA
- Four objectives :
 - building systematic data bases on KM practices
 - using the unique opportunity of « official » surveys at national level to link KM data with other data
 - contributing to the stabilisation of meanings and standardisation of terminology of KM strategies;
 - creating an international public good

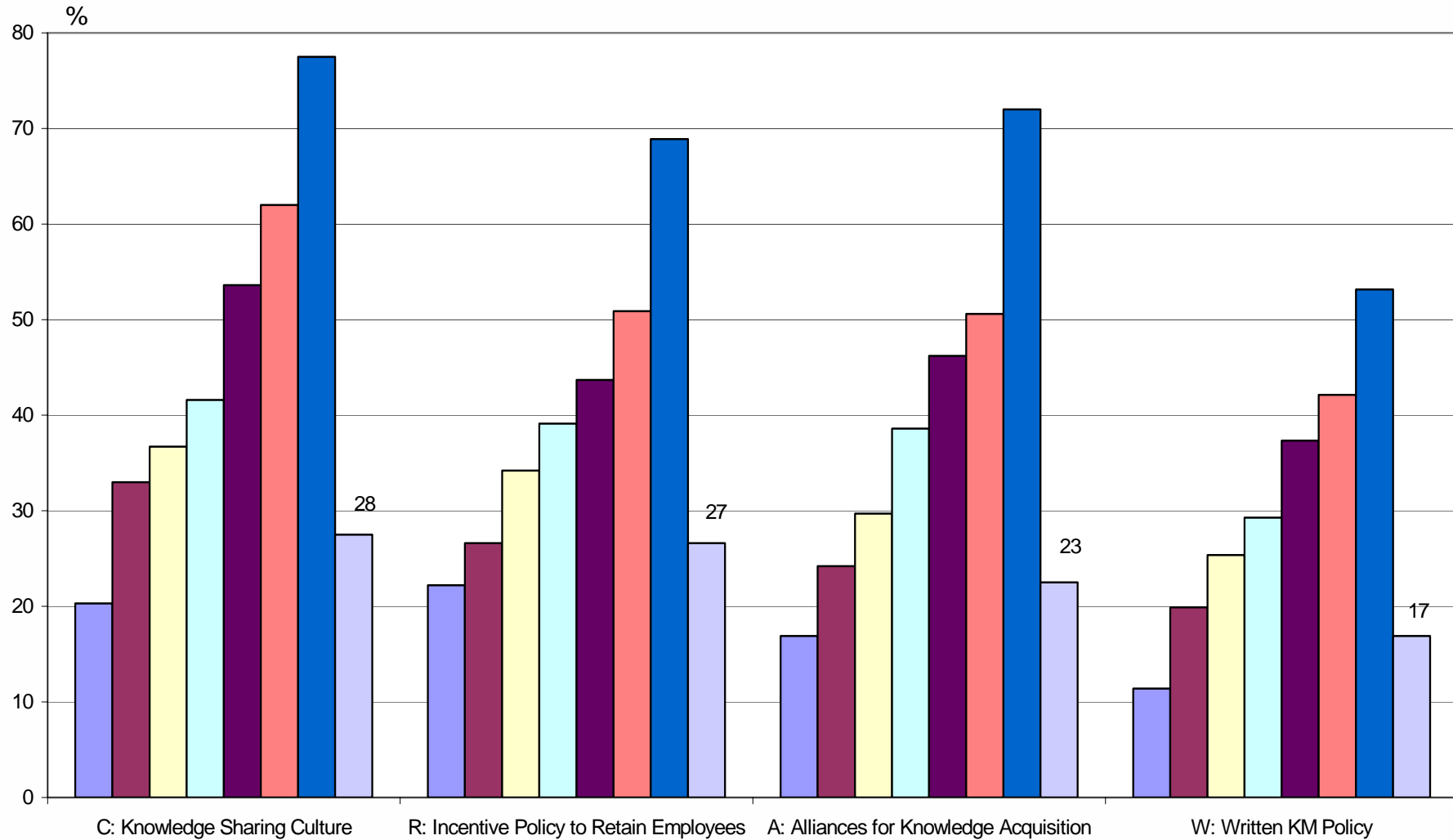
We know very little

- Two approaches
 - Doing the pilot study
 - opportunity to test the full questionnaire and to collect information on a large range of issues
 - Lodging few KM questions in a regular innovation survey (CIS3)
 - opportunity to question a very large number of firms
- Survey on the use of 23 knowledge management practices
 - Knowledge sharing
 - Codification
 - Training and mentoring
 - Knowledge capture and acquisition
 - Communications
 - Policies and strategies

We know more

- Knowledge management is measurable and aggregate statistics can be produced
- KM practices diffuse across the economy like technology diffusion
- Other related results
 - size matters, as well as high tech intensity
 - The role of codification
 - complementarities with other factors

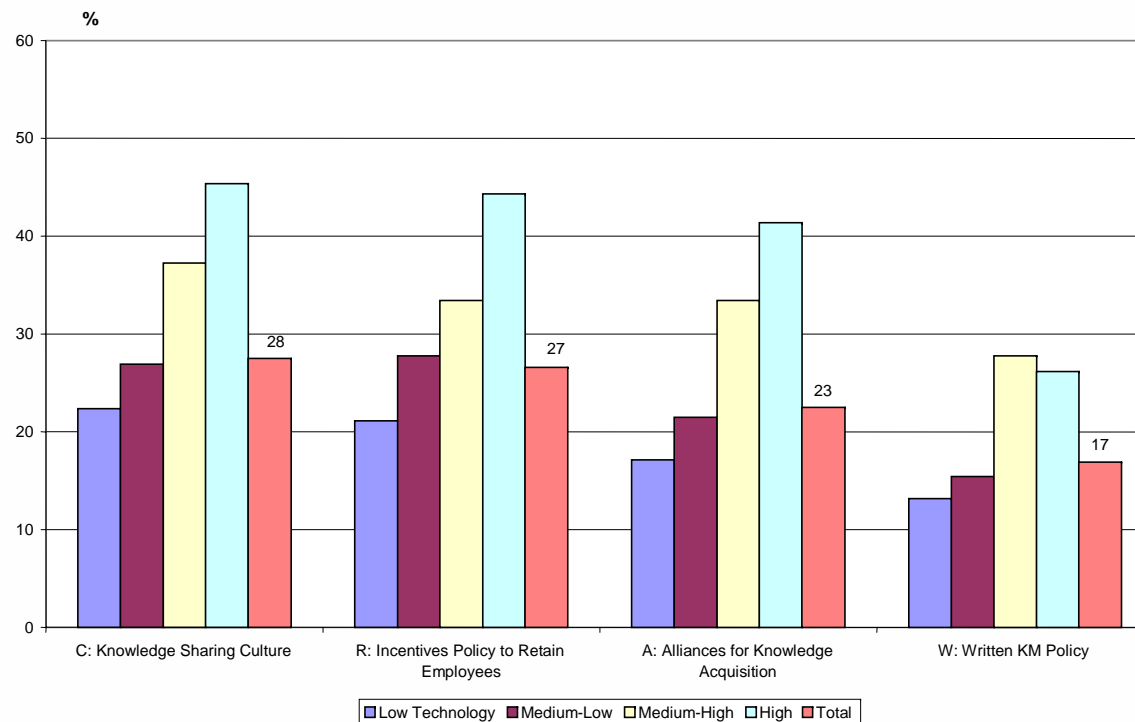
We know more



■ 20 to 49 employees
 ■ 50 to 99 employees
 ■ 100 to 249 employees
 ■ 250 to 499 employees
 ■ 500 to 999 employees
■ 1,000 to 1,999 employees
■ 2,000 employees or more
■ Total



We know more



We know more

	Product-only innovators	Process-only innovators	Product and process
Knowledge codification	40%	53%	61%
* Regularly updating databases of best practices	35%	53%	57%
* Preparing written documentation	35%	50%	54%

We know more: Complementarities

- KM practices are more widespread in firms:
 - that had adopted: new methods of management; Internet as a search tool
 - that are intensive in R&D

The big question : does it matter?

- Whether an increase in inputs in KM activities would lead to more output?
- Unless this question is answered in the affirmative, there is no point in proceeding toward the usual prescription of economics, the manipulation of incentives and inputs to achieve particular goals
- That there is such a relationship may appear self-evident (based on our preconception), but actually there is little evidence in support of it
- Usual evaluation problem in social science

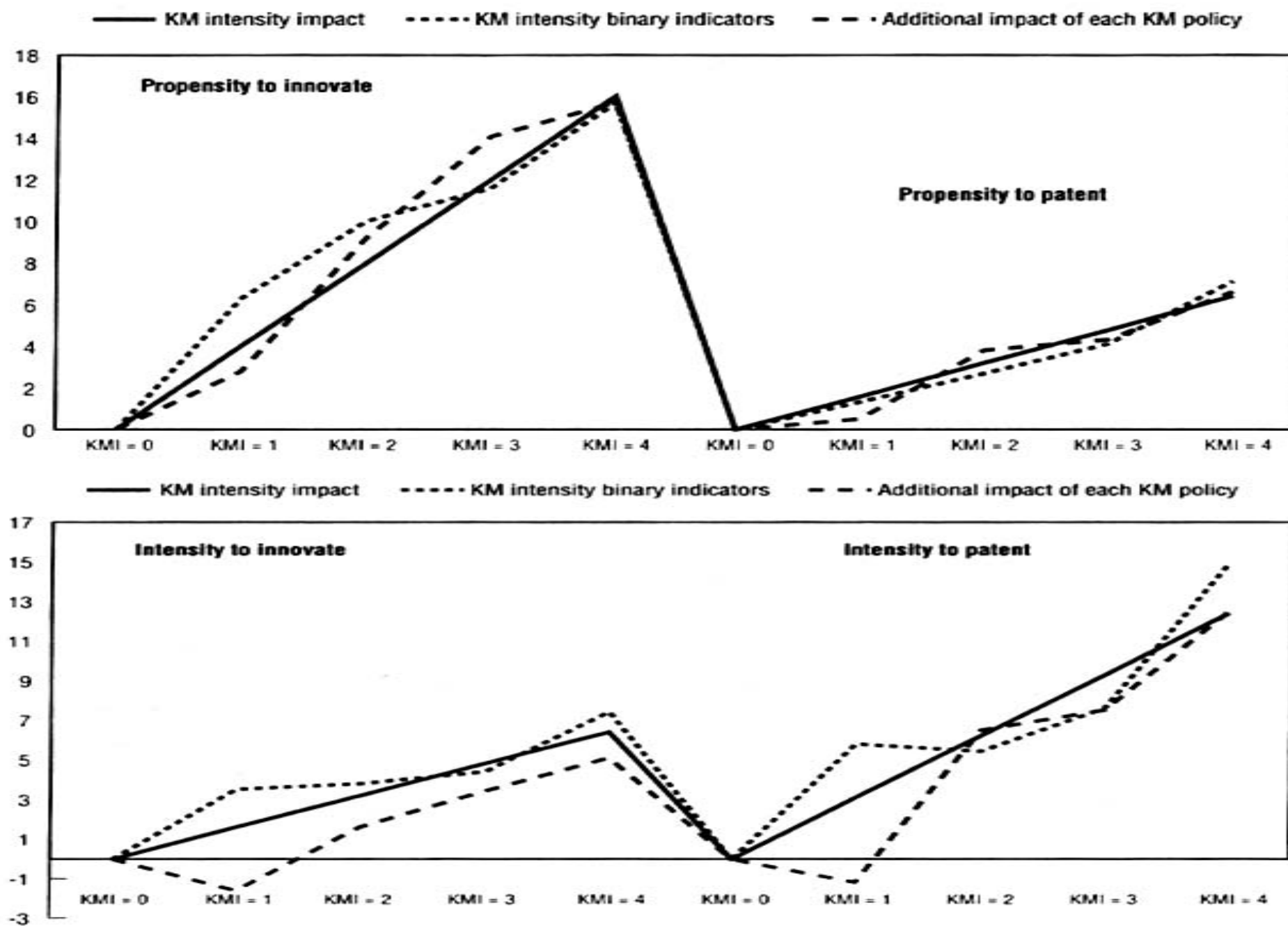
Does it matter?

- KM intensity
 - 4 KM practices: to retain employees, to promote K sharing culture, to establish alliances to acquire K., to have a written KM policy
 - Firms tends to adopt KM practices jointly, which suggests the definition of a KM intensity indicator :
 - = 0 when the firm implement none of the four KM practices
 - = 1,2,3,4 respectively, when the firm implements at least one, two, three or all four
 - KM intensity increases strongly with size, technological intensity

Does it matter?

- KM intensity and innovation performance
 - Estimation of the specific impact of KM on innovation, controlling for other factors and firm characteristics
 - To assess innovation : four variables
 - Propensity to innovate (introduction of innovation in year n)
 - Innovation intensity (share of turnover from innovation in the overall turnover in year n)
 - Propensity to patent (patent in year n)
 - Patent intensity (the share of turnover protected by patents in the overall turnover in year n)

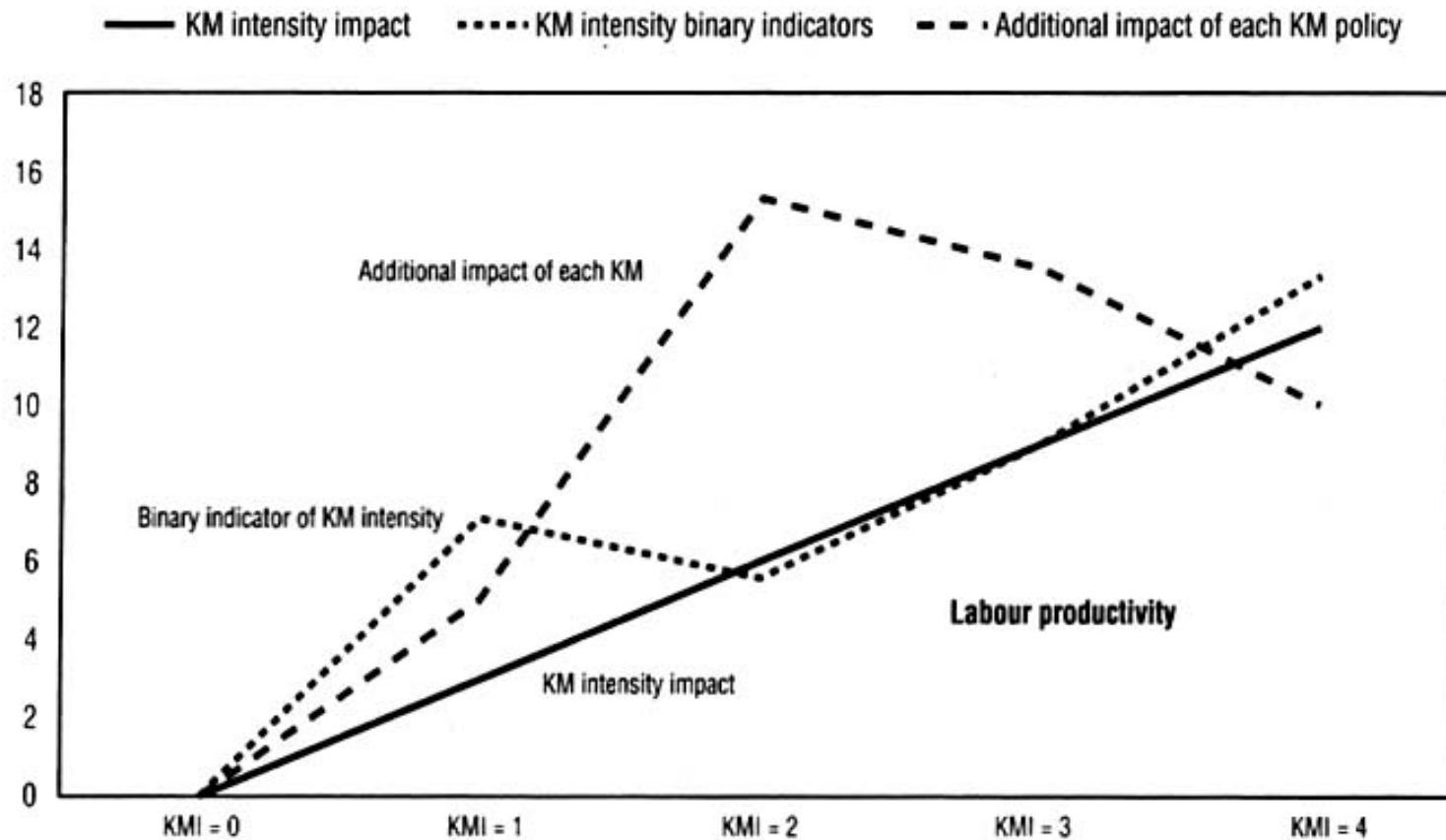
Figure 6.5. Estimated Impacts of Knowledge Management Practices on Innovation Performance, “all else equal”



Does it matter?

- All things being equal, labour productivity is higher and very significantly so, by about 10% for firms implementing a policy to retain executives and employees ® than for firms which do not, and by about 5% for firms promoting a culture of © than for firms which do not.
- At the opposite, all else equal, labour productivity is not statistically different (or barely so) between firms declaring they have or that they have not a policy to establish alliances to acquire knowledge (A), and a knowledge written policy (W)

Figure 6.6. Impacts of Knowledge Management Practices on Labour Productivity, “all other things being equal”



Does it matter?

- « *Microdata suggest that the surge in productivity that we now see in the macrostatistics has its roots in over a decade of computer-enabled organizational investments. The recent productivity boom can in part be explained as a return on this intangible and largely ignored form of capital* » Brynjolfsson and Hitt, 2004

Modelling incentives for KM

- The next major step deals with the existence and identity of factors and incentives affecting the level and type of KM activities
- For example modelling incentives for KM in situations where the agent is required to perform multiple tasks
 - Solving a problem (main task)
 - Codifying the problem solving process (KM task)
- Theoretical base: work on structure of contracts between principal and agents in multiple tasks context (Holmstrom and Milgrom, 1991)

Modelling incentives

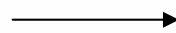
- The firm's profits are dependent on two distinct activities: service delivery and KM
- For each dimension of effort I , the employee chooses an effort level, e_i , yielding output $Y(e_s, e_{km})$ with Y increasing in e_s and e_{km}
- Simply put, the firm's problem is to offer incentive to elicit the optimal (feasible) level of effort
- When output is generated by workers (or teams) exerting effort across two or more different tasks, there is need to **optimally balance** incentives across these tasks.
- If it is not done, people will inefficiently allocate too much effort towards those tasks with the highest marginal return to them

Policy implications

- KM benefits are not like R&D benefits. They are easier to internalize and so no economic case can be made for KM practices as an investment that requires public support
- Instead of financial incentives, information provision may be a policy goal: *“awareness is of course the start..after all if people are unaware of KM and its benefits, they can’t be expected to exploit them”* (UK department of Industry)

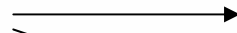
Alert! Anecdotal evidence on a phenomenon of wider relevance

Preconception : stylized facts



R1 There are “good economic reasons”

Systematic data analysis



R2 descriptive statistics



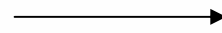
R3 survey as a research tool

Does it matter?



R4 : impact on innovation and productivity

Factors and incentives affecting the level of activities

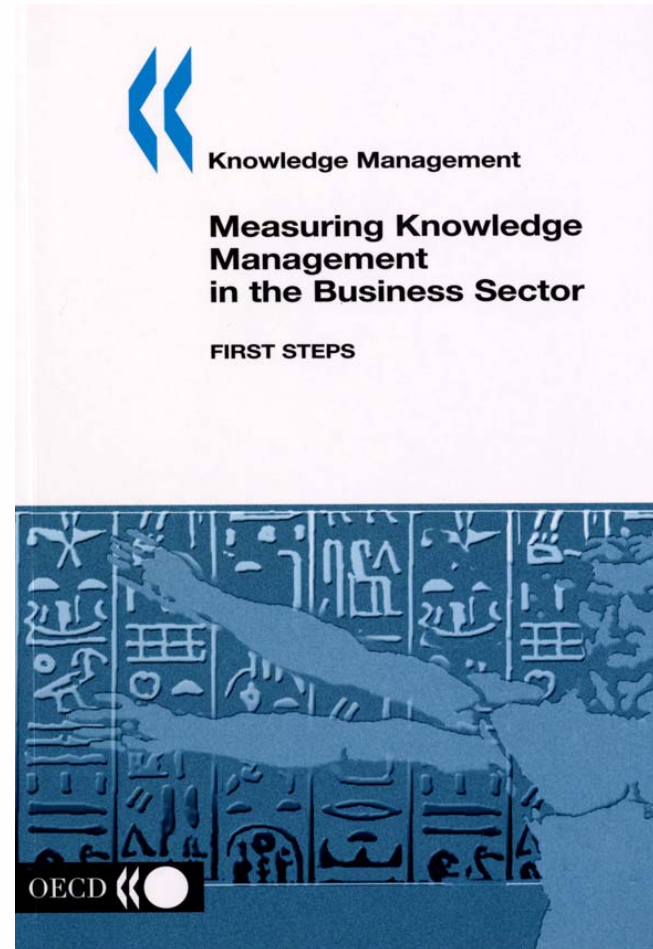


R5 : balancing incentives in multi task setting

R6 : policy implications

Failures on the market for indicators

- The survey offered some good results to the international economic and policy audience
- Strong economic case of implementing KM
- Agregate measures are possible
- Statistical tools have been tested, improved and are available
- KM's impact on innovation and productivity



Failures on the market for indicators

- However the « proof of concept » is by no means sufficient to impose internationally new indicators and routinize the data collection
- KM indicators are not ideal **now**
 - Precision, absence of bias, stability over time, comparability across different environments, difficulty to manipulate, aggregation, low cost
- A new indicator will get improved over time if enough time is given to it
- The first phase of building and using a new indicator is perilous (increasing returns)

Failures on the market for indicators

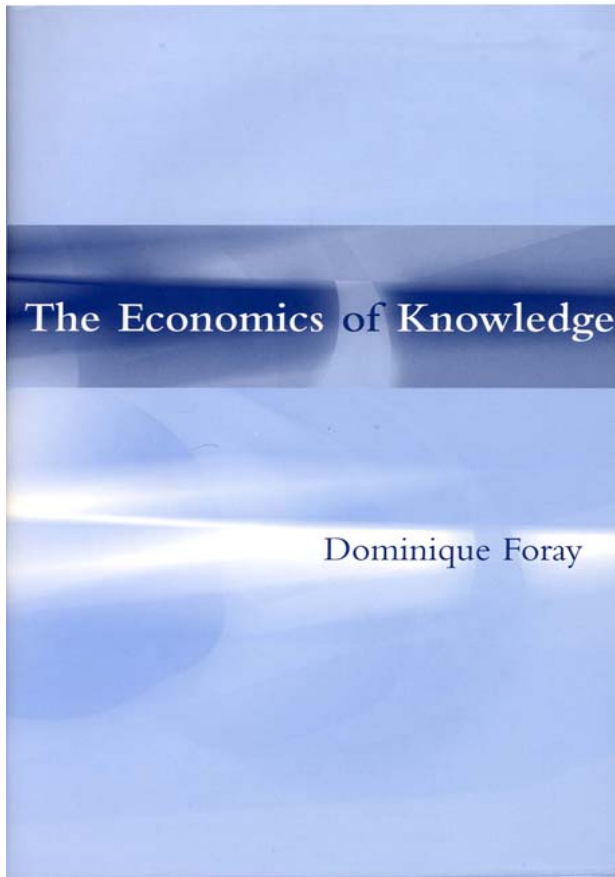
- Sources of increasing returns on the market for indicators:
- High fixed costs
- Network externalities
- Strategic complementarities
- Time series effect
- Learning a new code
- Scarce resources are : attention and time (for policy makers and business community)

Conclusion

- The case of the development of KM indicators shows that it is difficult to enlarge the scope of empirical material that economists will come to regard as legitimate, and perhaps even routine, in applied research
- Proof of concept is not a guarantee for international success
- Many failures on the market for indicators
- It is not clear that KM's indicators will be **developed** further
- This is a challenge for the economics of innovation as an empirically disciplined science

- Elements for hope
- Most recent revision of the Oslo Manual extends coverage of innovation to « organizational innovation »
- The four basic questions about KM practices used to estimate KM intensity have been lodged again in CIS4
- Empirical studies about new human resources management practices are flourishing and converge toward conclusions that such new HRM practices raise performance

- However systematic surveys on human resources and industrial practices are still undersupplied in spite of the centrality of this class of innovation
- The complementary investments in new KM and other new HRP (“meta-investments”) are likely larger than investments in the IT itself...but they go largely uncounted
- A task is to better measure these intangibles that are increasingly important to knowledge-driven growth and firm performance



Thanks