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Good performers, bad performers

*Empirical evidence on e-business usage,
innovation, and corporate performance*

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Motivation

- Nicholas Carr (2003): „IT doesn't matter“
 - IT is infrastructure, everyone has it
 - No source of sustainable competitive advantage because it is ubiquitous
- But: IT enables innovation
 - Process innovations
 - Product / service innovations
 - More important than the technology itself is what firms do with it

ICT and innovation

– ICT may be viewed as:

- A **product innovation** or a new market from the perspective of the suppliers, if their technological invention is successfully introduced to the market.
- An **enabler of process innovation** from the perspective of the adopter, if the implementation succeeds, the routines are changed, and the new system is actually utilized.
- An **enabler of product or service innovation** from the perspective of the adopter, if the ICT is successfully used to offer a new service or to deliver products to customers in a way that is new to the enterprise.

Strategic relevance of innovation

- Firms conduct innovation because they seek
 - Profitable investment opportunities
 - Strategic advantage (superior product or production method can enhance a firm's market share – up to monopoly position)
- Innovation related to:
 - Higher growth rates (Mansfield 1968, Audretsch 1995)
 - Higher survival rates (Audretsch 1995, Cefis and Marsili 2003)
 - Profitability (Geroski 1993)
 - Better credit rating (Czarnitzki and Kraft 2004), threshold
 - Greater stock market value (Griliches 1981, Blundell et al. 1999)

Appropriability problems

- Benefits of innovation not always appropriable by innovator
 - Customers, imitators, other industry participants may also benefit
 - Difficulty to protect innovation from imitation (Levin et al. 1987, Teece 1987)
- Mechanisms to protect private gains:
 - Patents
 - Secrecy
 - Lead time (“time is money” – Baumol 2002)
 - Complementary capabilities and assets
- Results depend on type of innovation, type of firm and market (Cohen et al. 2000)

Research questions

- How much innovation is due to ICT?
- Do innovative firms perform better?
- Are IT-based innovations superior/inferior to other kinds of innovation?

Firm performance

- Numerous measures of performance
 - Depends on the perspective (management, employees, stake holders...)
 - “Performance” is broader than “productivity”
- Performance depends on various factors
 - Market of operation
 - Economies of scale
 - Market power
 - Firm-internal resources (e.g. technology, human resources)
 - Innovative activities
 - Process innovation
 - Product / services innovation

Estimation - I

$$y_{ij} = f(\bar{x}_{ij}, u_j, \varepsilon_{ij})$$

$i = 1, \dots, N$ firms

$j = 1, \dots, J$ markets

y_{ij} = performance of firm i in market j

x_1 = innovations

x_2 = firm size

x_3 = market share

x_4 = % of employees with university degree

x_5 = number of e-business technologies used by the firm

u_j = unobservable market-specific effect

ε_{ij} = unobservable firm-specific effect

$$E[u_j | \bar{x}_{ij}] \neq 0$$

Estimation - II

- Qualitative information about performance during the year before the survey
 - Profitable (yes / no)
 - Turnover development (increase / same / decrease)
 - Employment development (increase / same / decrease)
- $y=1$ if a specific criteria is observed, $y=0$ otherwise

$$p_{ij} = \Pr[y_{ij} = 1 | \bar{x}_{ij}, u_j] = E(y_{ij} | \bar{x}_{ij}, u_j) = F(\bar{\beta}' \bar{x}_{ij} + u_j)$$

$$\ell_i = \sum_j \ln[\exp(\bar{\beta}' \sum_j \bar{x}_{ij} y_{ij}) / \sum_{d \in B_i} \exp(\bar{\beta}' \sum_j \bar{x}_{ij} d_j)] \quad \text{with}$$

$$B_i = \left\{ d = (d_1, \dots, d_J) \mid d_j = 0 \text{ or } 1 \text{ and } \sum_j d_j = \sum_j y_{ij} \right\}$$

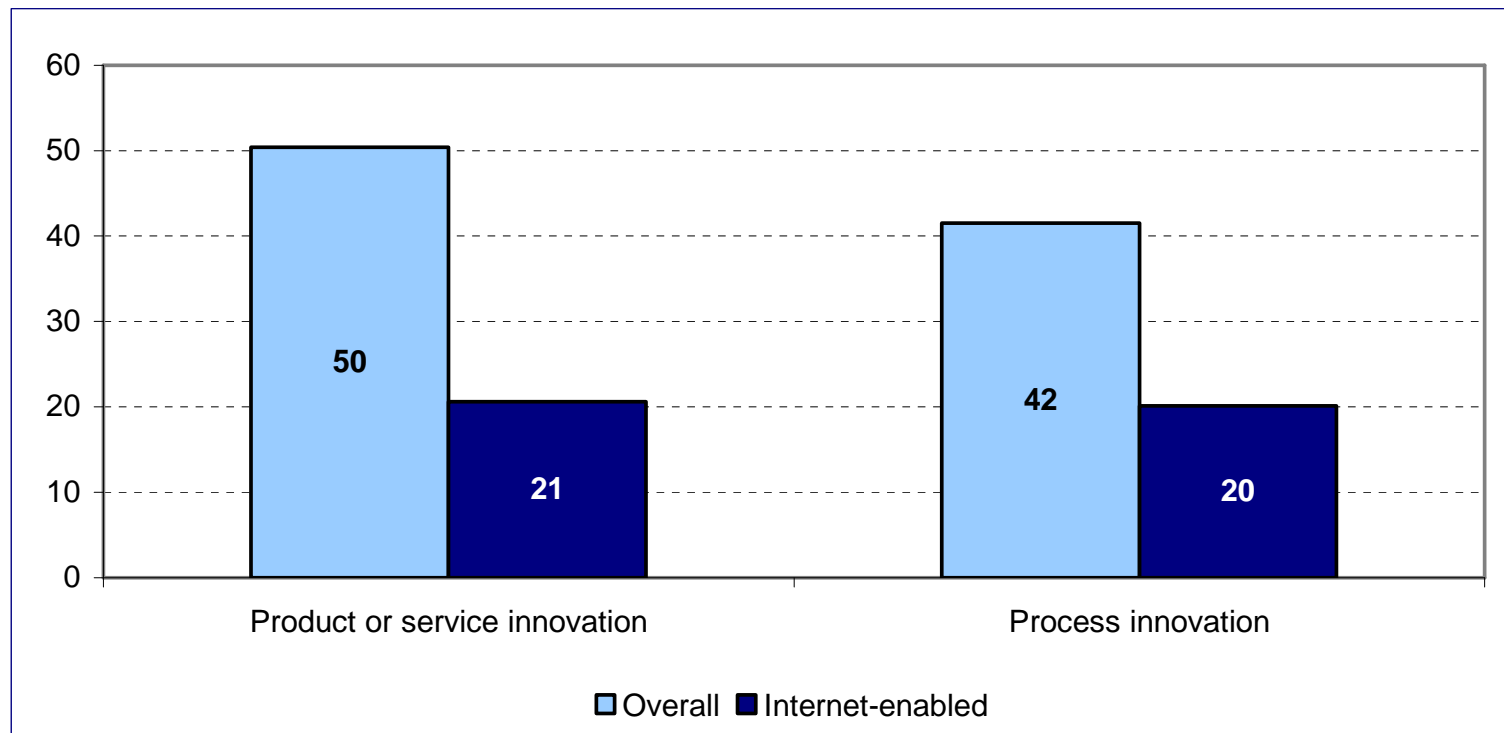
Data

– *E-business Market W@tch*

- Research project sponsored by the European Commission, DG Enterprise
- Since 2001, the project monitors the uptake and consequences of e-business in various sectors of the enlarged European Union
- Data from annual enterprise survey 2003 (Nov), N=7,302
- 25 European countries, 11 sectors, heterogeneous coverage
- 101 country-sector cells (“markets”), each with representative coverage (50-100 obs)
- Rich questionnaire (> 50 questions)

Innovative activities

*Innovative activities in 10 sectors and 25 countries
in the European Union, 2003*, in %*



Base: all enterprises without missing values, unweighted. Reporting period: November 2003.
N = 7,046 for product innovations, N = 7,079 for process innovations.

Source: e-Business W@tch (2004)

Results

| <i>Fixed effects logit, grouped by country-sector cell</i> | y=turnover increase(yes) | y=profit(yes) | y=employment increase(yes) |
|--|-----------------------------|---------------|-------------------------------|
| Product inno. (Internet-enabled) | .394** | .375** | .413** |
| Product inno. (other) | .424** | .257** | .381** |
| Internal inno. (Internet-enabled) | .381** | .02 | .541** |
| Internal inno. (other) | .313** | .027 | .45** |
| 10-49 employees | .269** | .072 | .901** |
| 50-249 employees | .310** | -.071 | .879** |
| >250 employees | .398** | -.064 | .853** |
| 1-5% market share | .244* | .459** | .084 |
| 6-10% market share | .506** | .508** | .247 |
| 11-25% market share | .401** | .882** | .418** |
| >25% market share | .44** | .744** | .171 |
| % employees with college degree | .001 | -.001 | .002 |
| # e-business technologies (0-7) | .149** | .031 | .028 |
| <i>N</i> | 5,900 | 6,013 | 6,753 |
| <i>J</i> | 101 | 100 | 101 |
| <i>Log likelihood</i> | -3,488 | -2,415 | -3,078 |

Conclusions

- ICT is an important enabler of innovation
- All four kinds of innovation are positively associated with turnover & employment growth
- Only product/service innovations are positively associated with profitability, Internet-enabled stronger
- ICT-enabled innovations are at the very least not inferior to other kinds of innovations
- Appropriability problems (“best practice”)

Implications

- “Best practice” solutions may at best generate temporary excess returns, as long as competitors have not yet successfully copied the practice.
- Sustainable advantage due to ICT:
 - If technology is customized, complementing some other scarce resource of the firm, thus limiting imitation
 - If technology is used to innovate new product or service that is valuable to customers and cannot be perfectly copied by rivals
- Innovation potentials of ICT do not seem to be exhausted yet.