



ICT, innovation and firm performance – a microeconomic data analysis

Daniel Nepelski





Overview



- Objectives
- Study description
- Analyzed topics
- Main results
- Policy implications

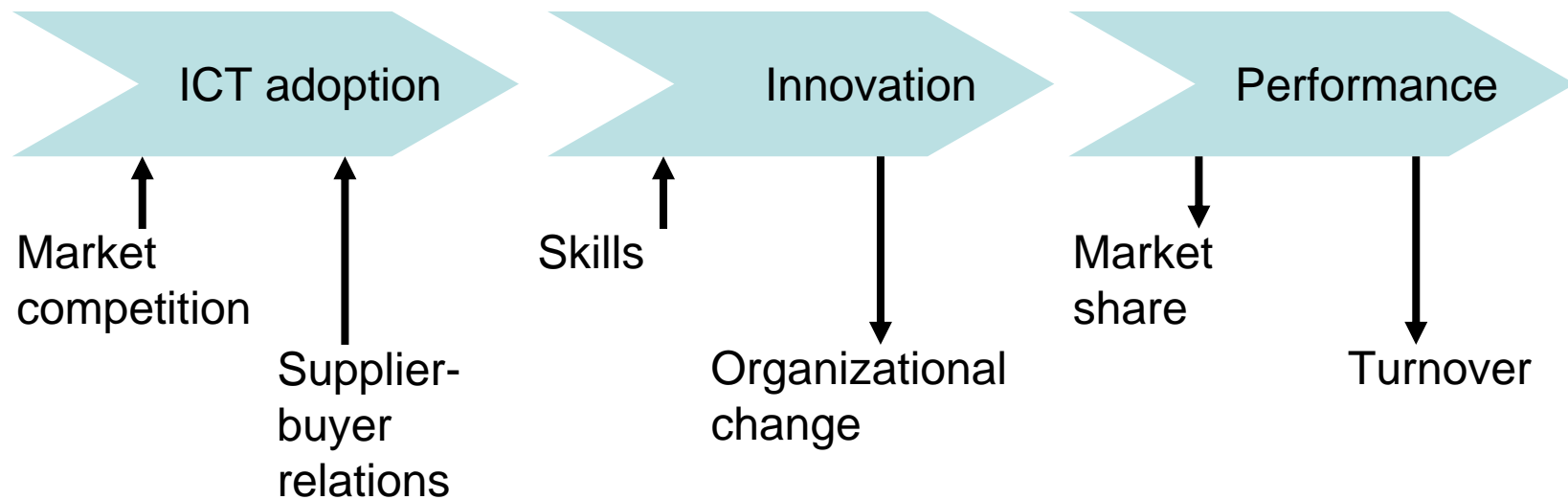
1. To derive from microeconomic theory empirically testable hypotheses regarding:
 - the facilitators of ICT adoption
 - the process of generating value from ICT
 - the impact of ICT on firm performance
2. To formulate policy implications concerning ICT-driven technological progress



Study description

- **Focus of the analysis**
 - ICT-use value chain
 - Study across the sectors of the e-Business Watch 2007/08: Chemicals, Steel, Furniture, Retail and Logistics
 - Independent analyses, but consistent approach
- **Methodology**
 - e-Business Watch 2007/08 survey data
 - Discrete choice models
 - Descriptive statistics
 - Country effects included
- **Limitations**
 - Not necessarily causality effects but relationships between variables

ICT-use value chain



ICT adoption Competition

- **Escape competition**
 - Increasing rivalry drives the innovation process and the adoption of new technologies, as companies seek to escape competition by introducing new products and cutting costs (Arrow 1964, Scherer 1980, Aghion et al. 2005)
- **What about the impact of ICT on competition?**
 - Endogeneity problem

Market rivalry and the intensity of ICT use

| Independent variable | Sector | | | | |
|---------------------------|--------------|--------------|--------------|--------------|--------------|
| | Chemical | Steel | Furniture | Retail | Transport |
| Increasing rivalry | | | | + * | + ** |
| SME | _ *** | _ *** | _ *** | _ *** | _ *** |
| Firm founded before 1998 | | | | | |

+ positive, – negative, no effect. Significance level: ***=.99, **=.95, *=.90



ICT adoption Value chain



- e-Integration: Who invests first and how to divide the benefits?
 - At the outset: relationship-specific investments. Afterwards: negotiations over benefits (Clemons et al. 1995)
 - A *hold-up problem*, i.e. firms could benefit from an investment, but refrain from it due to concerns that it gives the other party more power, and reduce their own profits (Williamson, 1985)
- Supplier-buyer relationships
 - ICT reinforces old paradigms for supplier relations (Helper and MacDuffie, 2003)
 - Close relationships help overcome the hold-up problem



ICT adoption Value chain



- **Results**
 - In all sectors, the use of applications and practices supporting the electronic exchange of information between companies goes together with close relations with business partners
- **Implications**
 - Joint investments and joint innovations
 - Electronic links increases companies' vulnerability and the risk of self-seeking behaviour
 - IT's a matter of trust



Innovation Skills



- The complexity of ICT is a challenge
 - Absorptive capacity necessary in the innovation process (Cohen and Levinthal, 1989)
 - Investments into complementary assets needed to develop new products and processes (Brynjolfsson and Hitt, 2000)
- What skills?
 - General vs. IT-specific skills

Effect of employee skills on ICT-enabled innovation activity

| Independent variable | Sector | | | | |
|---|--------------|--------------|--------------|--------------|--------------|
| | Chemical | Steel | Furniture | Retail | Transport |
| % of employees with higher university degree | | | + *** | + ** | + ** |
| IT practitioners | + *** | + *** | + *** | + *** | + *** |
| SME | - * | | | - * | |
| Firm founded before 1998 | | | | | |

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Innovation

Organizational change

- How ICT changes organizational change
 - High fixed cost, zero marginal cost
 - ICT allows companies to embed business innovations and then implement them across the organisation at a small cost (Terwiesch and Xu, 2004)
- Dismantling ICT capital
 - Infrastructure vs. software

Innovation Organizational change

ICT use and organizational change

| Independent variable | Sector | | | | |
|--|--------------|--------------|--------------|--------------|--------------|
| | Chemical | Steel | Furniture | Retail | Transport |
| Infrastructure index | | + * | + *** | + ** | |
| Software index | + *** | + *** | + *** | + *** | + *** |
| IT practitioners | | | | + *** | + *** |
| % of employees with higher university degree | | | + *** | | |
| SME | | | | | |
| Firm founded before 1998 | | | | | |

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Firm performance

Market share



- ICT allows firms for
 - New products introduction
 - Product differentiation
 - Access to new markets
 - And death of distance
- Can one escape competition?
 - Competition drives ICT use, ICT use drives competition?

Firm performance

Market share

The intensity of ICT use and change in the market share

| Independent variable | Sector | | | | |
|--------------------------|--------------|-------|-----------|--------------|--------------|
| | Chemical | Steel | Furniture | Retail | Transport |
| ICT endowment | + *** | | | + *** | + *** |
| Firm founded before 1998 | | | | - *** | - ** |
| SME | | | | | |

+ positive, - negative, no effect. Significance level: ***=.99, **=.95, *=.90

Firm performance

Turnover

- The payoff of ICT
 - Unclear effects (Chan, 2000, Kohli et al. 2003)
 - Linking performance with ICT-enabled innovation, not ICT endowment (Cleyton et al. 2003, Köllinger 2005)
- Focus on:
 - ICT-enabled innovation
 - What firms do with IT, not whether they have IT

Firm performance

Turnover

Effect of ICT-enabled innovation activity on turnover increase

| Independent variable | Sector | | | | |
|-------------------------------|--------------|-------------|--------------|--------------|--------------|
| | Chemical | Steel | Furniture | Retail | Transport |
| ICT enabled innovation | + *** | + ** | + *** | + *** | + *** |
| SME | | | | | |
| Firm founded before 1998 | | | | | |

+ positive, – negative, no effect. Significance level: ***=.99, **=.95, *=.90



Summary

New and old issues



- ICT is complementary with
 - Skills
 - Supplier-buyer relations
 - And competition
- Software drives innovation
 - Software creates a competitive advantage
- Good news for big and small
 - The use of ICT has a positive impact on firm performance

Policy implications

- **Intangible assets**
 - Skills
 - Inter-firm relations (e.g. e-markets and unfair business practices)
- **Dialogue between ICT-producers and ICT-users**
 - Technology expensive and complicated
 - Conflict of interests between ICT-producers and ICT-users
 - Innovation in the technology-producing sector

Policy implications

- **Competition and IPR policy**
 - The findings may indicate that competition is good for ICT adoption (and vice versa)
 - Protection of relationship-specific investments and collaborative innovations
- **Take into account sector-specific characteristics**
 - Technological trajectories and technologies used
 - Industry maturity, entry and exit levels
 - Market structure, size and number of firms
 - Business strategies
 - Type of competition



Thank you for your attention!