
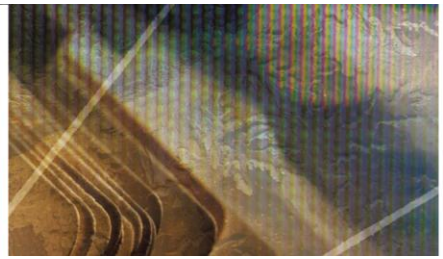


Open innovation and firm innovation performance

Preliminary findings, Norway

OECD business symposium, February 26th

Sverre J. Herstad

NIFU STEP

openING project

- Funded by Eranet Vision
  - Complementary to OECD work on OI
- Purposes
  1. Link ”open innovation” concept to established innovation system approaches and theory
  2. Explore the use of Community Innovation Survey microdata to map and analyze open innovation
     - Develop indicators and descriptive statistics
     - Investigate openness and innovation performance
  3. Policy implications

Participants

- Norway
  - NIFU STEP Studies in innovation, research and education
  - Sverre J. Herstad
- Austria
  - MCI Management Centre Innsbruck
  - Bernd Ebersberger
- Denmark
  - CFA Danish Centre for Studies in Research and Research Policy
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- Belgium
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  - Els van De Velde and Bart Clarysse

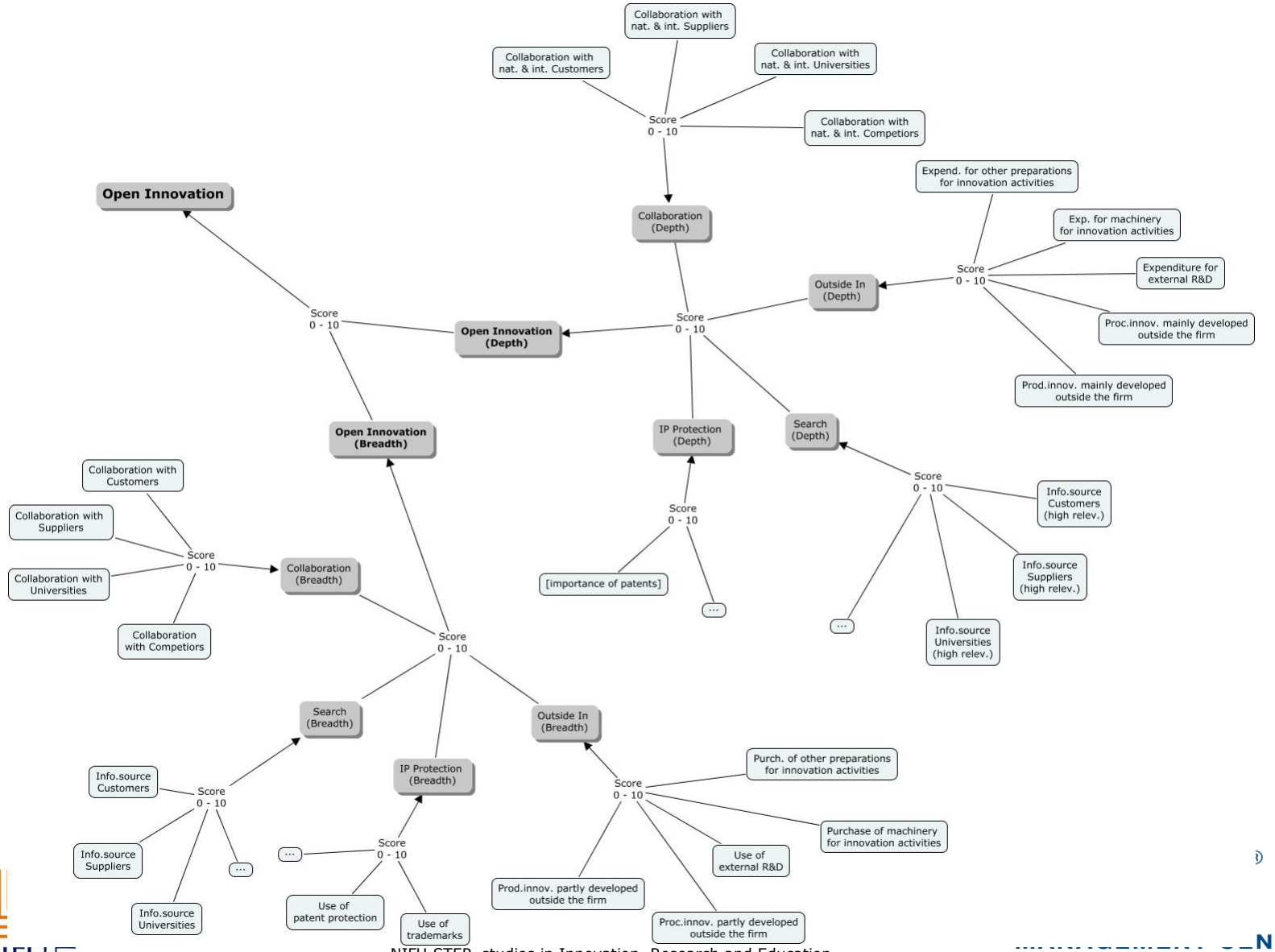
Open innovation operationalised

- Chesbrough as point of departure….
  - "…*the purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively"* (Chesbrough et al 2005:1)
- Five dimensions
  - *Search:* where to look for ideas and information
  - *Outside-in:* purchases of R&D, patents, knowledge embodied in machinery, components, etc
  - *Collaboration:* interactive knowledge development
  - *Protection*: Use of IPR measures
  - *Commercialization:* means of generating returns
- Breadth and depth (Laursen and Salter 2006)
  - Breadth: Range of available sources/means used
  - Depth: Intensity of use

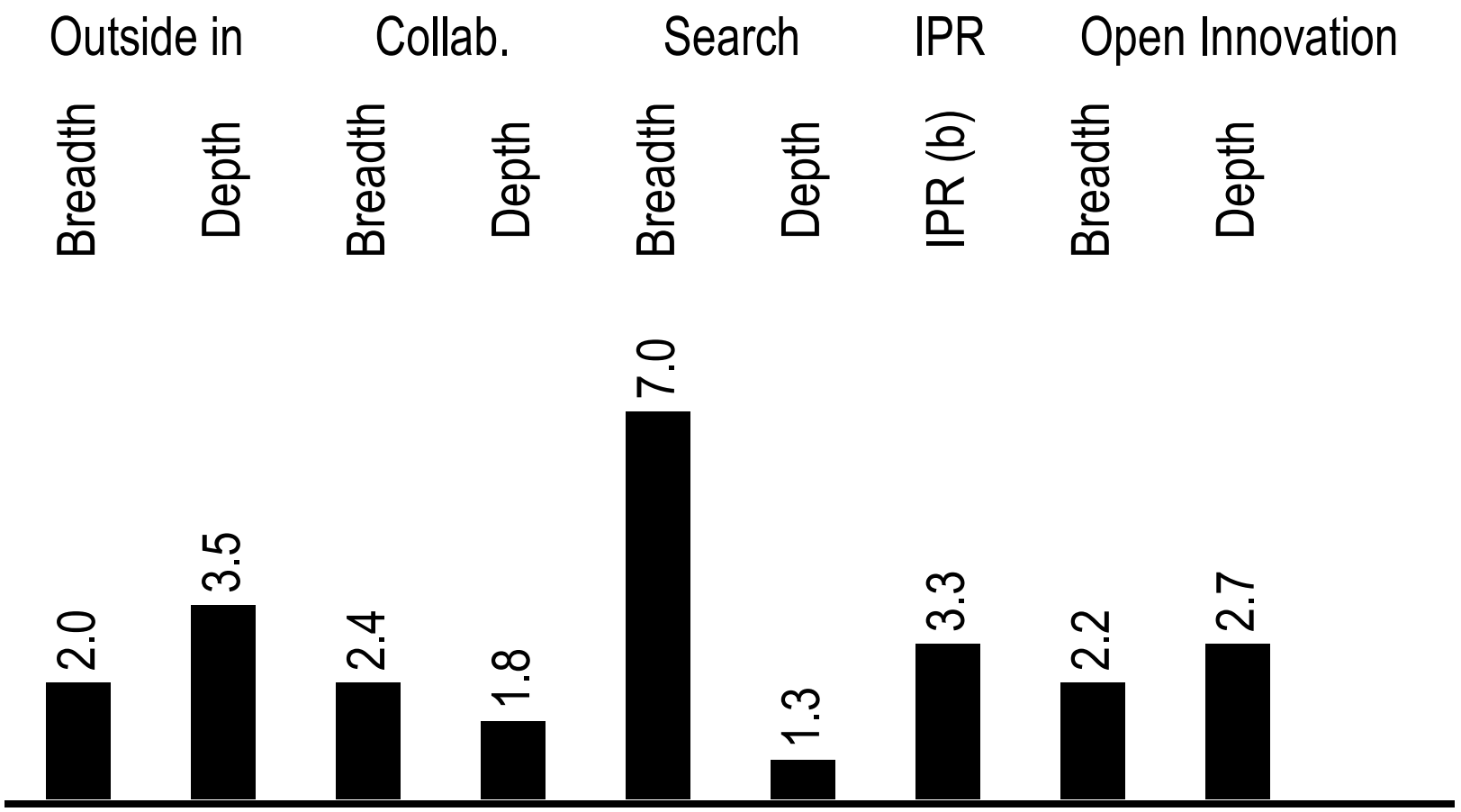
Innovation survey data allows us to construct OI indicators

- Dimensional
  - Search breadth and depth
  - Outside-in breadth and depth
  - Collaboration breadth and depth
  - IPR breadth
- Composites
  - Composite breadth and depth indicators
  - Composite OI indicator
- Scaled 1-10
  - A breadth score of 10 = the full range of sources/means are used
  - A depth score of 10 = all stated or measured as important
- Alternative means of commercialization is not covered by CIS
  - Licensing revenues
  - Sales of patents, know-how
  - Spin-off firms

System of OI indicators



Overall indicator scores, Norway



Performance analysis

- Probit regressions
  - Dependent variable: Likelihood of being among top innovation performers in own sector
- Explanatory variables
  - Intramural R&D
  - Open innovation indicators
- Control variables
  - International market orientation
  - Part of corporate group?
  - Number of employees
  - Sector
- Stepwise analysis, four models
  - from impact of composite OI only to impact of all individual dimensional indicators

Overall relationship to performance, Norway (N=1404)

- Overall OI practices have a positive and significant impact on innovation performance
  - This stems from overall *breadth* of OI practices
  - Positive impacts from increase in
    - Range of available information sources used
    - Range of collaboration partners used
    - Range of sources for external technology used
    - Range of IPR measures used
  - No impact from depth of OI practices, except
    - Negative impact from collaboration depth
- Strong, positive impact from intramural R&D

Danger of collapsing differences across activities

- Laursen and Salter (2006): No clear-cut relationship between innovativeness and search
  - "…may be related to the complexity of technological knowledge bases in different industries"
- Canadian/US MINE project (Miller 2004)
  - No "best" innovation practice/strategy can be identified by correlation with performance
  - Firms are set within different structured contexts which constrain and orient their innovation strategies, creating different "games"
  - What strategies and competencies which lead firms to succeed depends on the demands of the games in which they compete
- Structured contexts - technological regimes
  - Regime approach as "intellectual framework" for understanding heterogeneity in industry contexts and hence innovation behavior across firms (Nelson and Winter 1977, Marsili and Verspagen 2002, Castellacci fortc)

Technological regimes and open innovation

- Implied by Chesbroughs own definition of OI:
  - Modes and intensity of open innovation will vary across sectors
  - Different degrees and modes could be related differently to performance
- Diversity in availability of knowledge externally, and the form in which it can be sourced
  - Cumulativeness, complexity and geography (Malerba and Orsenigo 1993) of knowledge bases
- …the rate of technological change supported by the market
  - i.e. "opportunity conditions" (ibid)
- …and the degree to which knowledge can be protected from imitation
  - i.e. appropriablity conditions (ibid)

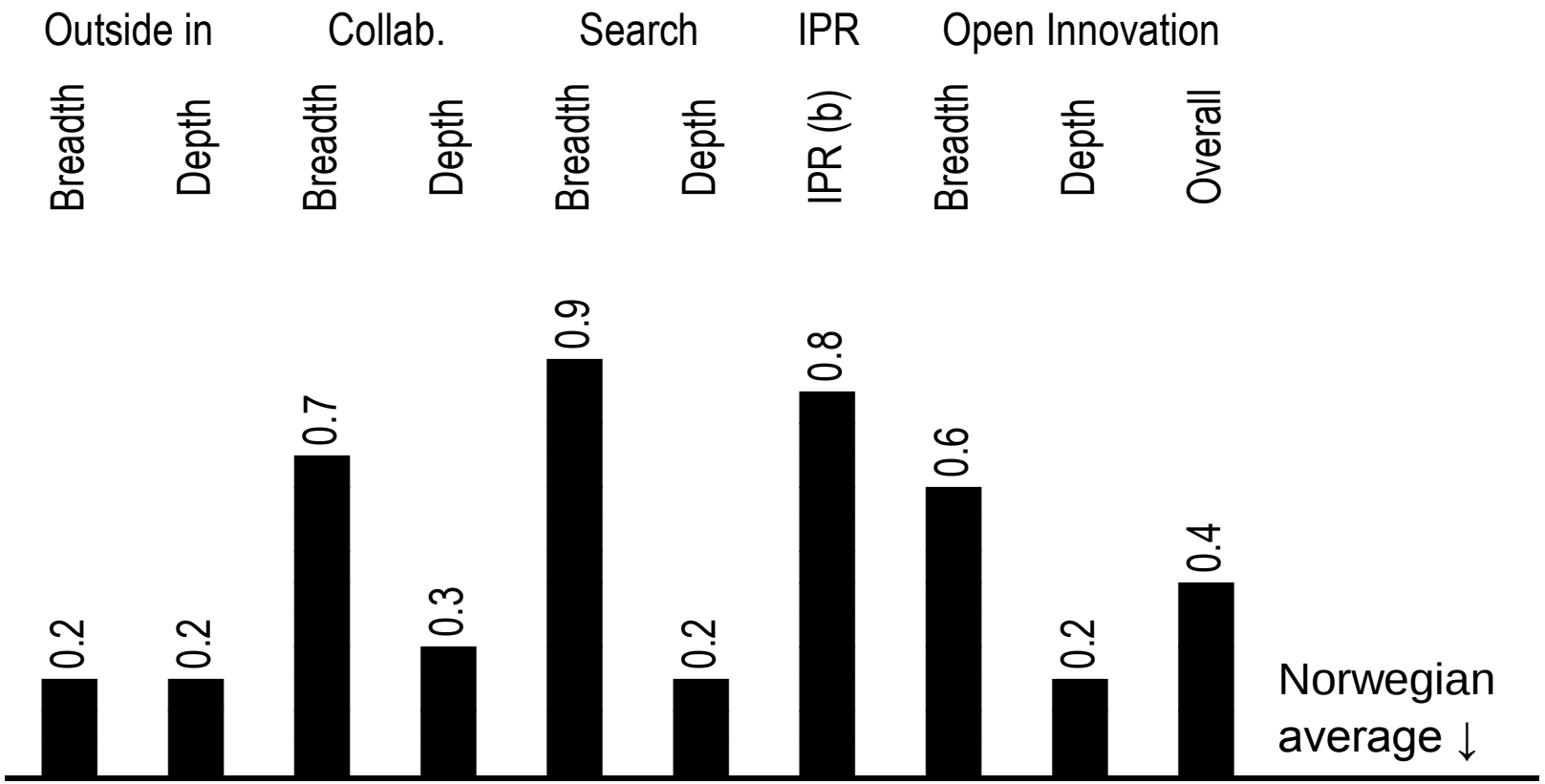
Marsili and Verspagen (2002) taxonomy

- Derived from a summary of empirical evidence on
  - Technological ”distance” between activities
  - Technological opportunities
  - Technological entry barriers
- Initially only manufacturing
  1. Science-based
  2. Fundamental processes
  3. Product engineering
  4. Complex (knowledge) systems
  5. Continuous process
- Extended with a subset of services
  6. Knowledge intensive services

Science-based regimes

- High levels of technological opportunity
- Scientific knowledge enables a continuous stream of new products
  - Scientific research results may be directly integrated into knowledge base to sustain product innovations
- High cumulativeness, high barriers to entry
  - Large companies, relying on a broad set of complementary capabilities, specialized ”core” knowledge bases
- Examples: Pharmaceuticals, electronics, life sciences

OI Profile, Science based regimes in Norway (N=102)



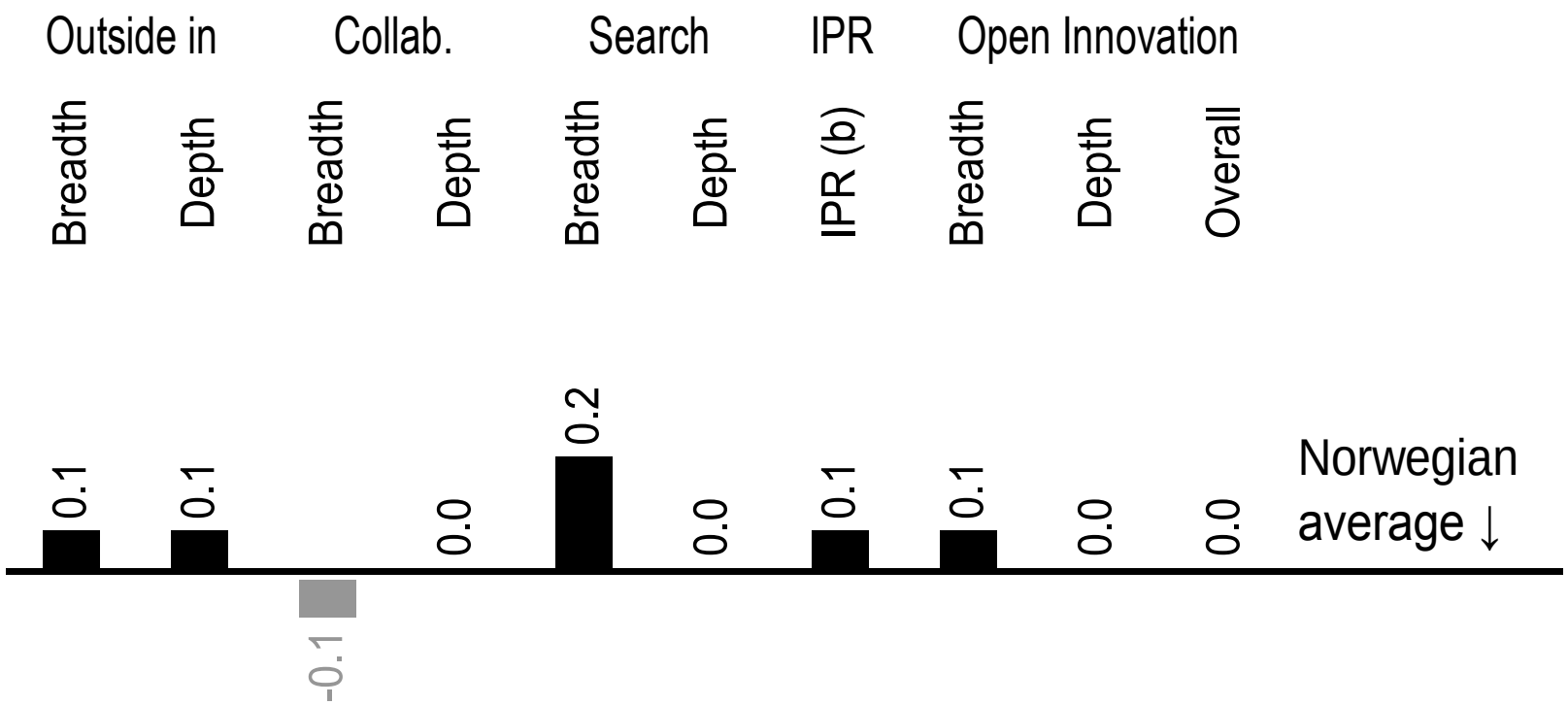
OI and performance, Science-based regimes in Norway

- Overall OI practices increase innovative performance
  - Stemming from *depth* of OI practices
- No innovation performance effect of OI breadth, except
  - Negative performance effect of external technology sourcing (outside-in breadth)
- Intramural R&D increase innovation performance strongly

Product engineering

- Predominance of mechanical engineering technologies
- Medium to high levels of technological opportunity
- Diversity of technological trajectories explored by firms
- Examples: Shipbuilding, machinery and instruments, weapons and ammunition

OI Profile, product engineering, Norway (N=434)



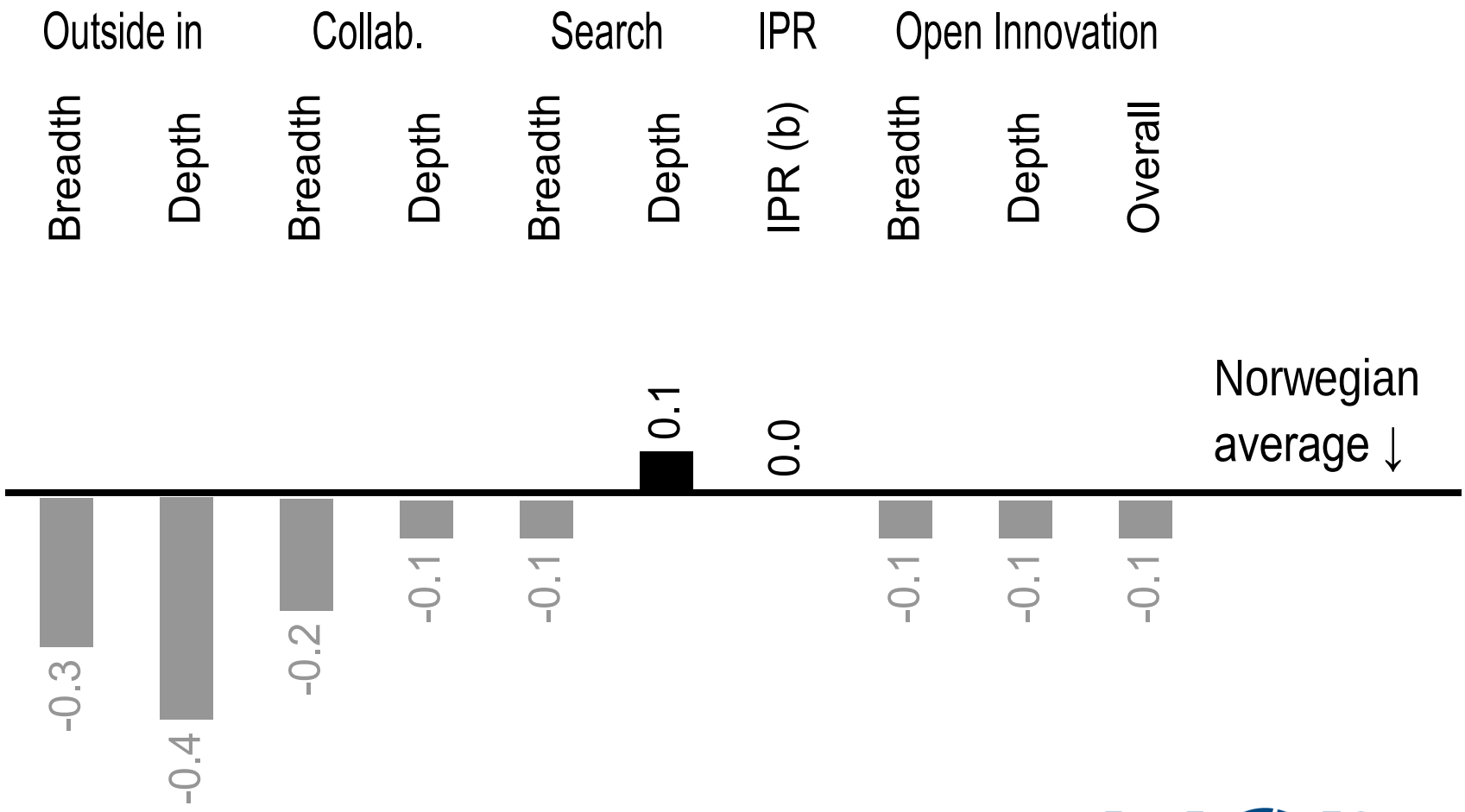
OI and performance, product engineering, Norway

- Overall OI practices increase innovative performance
  - Stemming primarily from *breadth* of OI practices
    - Search
    - Collaboration
    - Outside-in
    - IPRs
- Intramural R&D has no significant effect on innovation performance
- A strong, positive correlation with international market orientation

Knowledge intensive services (Aslesen 2006)

- Services concerned with the supply and management of knowledge assets
- ”Point of fusion” (den Hertog 2002) between
  1. General scientific and technical knowledge
  2. Experiences acquired by KIBS firms in interaction with clients, and refined
  3. Tacit knowledge of client firms
- Norwegian sample dominated by
  - Hardware/software consultancy firms
  - Architectural and engineering activities

OI profile, KIBS excl. financial services (N=381)



Open innovation and performance, KIBS

- Overall OI practices increase innovation performance
  - Stemming from impact of OI *breadth*
    - Search breadth
    - Outside-in breadth
    - Collaboration breadth
- Searching too deeply effects performance negatively
- Very strong impact of intramural R&D
- No impact from IPR breadth

By way of concluding….

- Impact of *intramural* R&D on performance is generally strong
- There may be "weakness in strong ties" (Grabher)
  - Broad, by implication international, innovation search is important
  - "Deep" dependence on external collaboration partners appear to depress own innovation performance
- Diversity in external sources of inputs + intramural R&D as schematic "best practice"?
  - Don't rely excessively on single means for sourcing knowledge externally
  - Remain focused on intramural R&D, with awareness as to how it is organized
  - Use available IPR measures
- But this takes on numerous empirical forms
  - OI strategies will by their very nature be specific to industries and their contexts
  - Policies need to be sensitive to this diversity

Food for policy thought – Norway

- A well-developed system of policy tools emphasizing external sourcing and collaboration
  - Strong emphasis on involvement of research institutes
  - Clustering and networking
- Organizational cultures sustain ”openness” – knowledge sharing – and learning within organizations (European Working Conditions Survey)
  - Nordic countries score high above EU averages on indicators for inter- and intra-organizational interaction and learning
- But are there sufficient public incentives for build-up of internal R&D capacity?
- Danger of over-emphasis on tools targeting national collaboration and sourcing?

Issues for future research

- Open innovation understood within broader theoretical perspectives on dynamics in economies
  - Distinguish more clearly between private and social returns
  - The sum of individual (private) rational action does not necessarily create the best collective action (social) outcome
- Substitution or complementarity between open innovation and intramural R&D?
  - OI leveraging impact of intramural R&D at both firm and economy levels?
    - Ongoing production, diffusion and recombination of knowledge increases economy performance
  - OI substituting intramural R&D?
    - Collective free-riding – let somebody else do the R&D