

Technology Maturity & Open Innovation

Changes in open innovation strategies
as technologies mature

Anders Ørding Olsen

Ph.D. Fellow

Copenhagen Business School

Department of Innovation & Organizational Economics

Strategic Research Alliance for Energy Innovation Systems

ao0.ino@cbs.dk / +45 2062 8985



COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Anders Ørding Olsen

Ph.d. Fellow. ao0.ino@cbs.dk

Department of Innovation & Organizational Economics

Research Alliance on Energy Innovation Systems

October 3
2013

Open Innovation

- Availability of partners and knowledge essential (Chesbrough, 2003)
- Positive effect on competitive advantage and performance (Dyer & Singh, 1998; Laursen & Salter, 2006)
- Collaboration take place with range of sources in number of ways (Grant & Baden-Fuller, 2004)
- Increasingly used across sectors (Chesbrough & Crowther, 2006)
- No extensive focus on technology maturity differences

Technology Life Cycles

- As technologies mature changes are observed:
 - Number of firms; type and size of firms; entry/exit patterns; strategies of firms; types of innovation; inputs needed for innovation; competitive landscape; etc..
(Afuah & Utterback, 1997)
- Conditions and opportunities for collaboration change
- Can we reasonably expect that these changes will influence open innovation strategies and outcomes?

Research Gap

- Open innovation positive and widely practiced
- Actors, dynamics, interactions, goals etc. change as tech. matures
- Lack of attention to how open innovation differs across stages of maturity (Dahlander & Gann, 2010)

“How do open innovation strategies change as technologies mature, and what are the outcomes?”

- Contribute to more detailed and nuanced open innovation theory

Open Innovation Strategies

- Search direction (Köhler et. al., 2012)
 - **Type of sources** of knowledge: Science; Product market; Suppliers
- Breadth (Laursen & Salter, 2006)
 - **Number** of different external sources of innovation
- Depth of collaboration (Laursen & Salter, 2006)
 - **Degree** of use of external source of innovation
- Strategy Variables:
 - “Which of the following actors has the firm collaborated with, and to what degree?”
 - Science-collaboration strategy: “Universities or research institutions”
 - Large-firm/incumbent collaboration strategy: “Energy companies”
 - Imitative collaboration strategy: “Our competitors”
 - Supplier collaboration strategy: “Suppliers of components or materials”

Open Innovation Outcomes

- Innovative technology or product
 - New-to-market
- Imitative innovation (Köhler et. al., 2012)
 - New-to-firm only; Technological catch-up
- Process innovation
 - Cost reductions and improved processes
- Outcome Variables:
 - “Which new products/services has the firm introduced?”
 - “Fundamentally new product/technology”
 - “Improvement of existing product”
 - “Business process development”

Fluid Phase

- Technological Maturity
 - No dominant technological design; Incumbent knowledge base obsolete; High need for novel knowledge; (Utterback & Abernathy, 1975; Afuah & Utterback, 1997)
- Open Innovation Strategy
 - Science source of novel tech or products (Köhler et. al., 2012)
 - Draw deeply on the few sources with expertise (Laursen & Salter, 2006)
 - SMEs influenced by necessity effect (Bayona et. al. 2001)

H1a: *“In the fluid phase, **deep science oriented collaboration** strategy has the highest effect on development of new tech or new-to-market products for **large** companies*

H1b: *In the fluid phase, **deep large-firm oriented collaboration** strategy has the highest effect on the development of new tech or new-to-market products for **SMEs***



Transitional Phase

- Technological Maturity
 - Dominant tech. design established; Adapt or abort; (Afuah & Utterback, 1997; Utterback & Abernathy, 1975)
 - Few firms can win dominant design race
- Open Innovation Strategy
 - Imitative innovation (Köhler et. al., 2012)
 - Suppliers do not work for this

H2: *In the transitional phase, **competitor oriented collaboration and actor orientation** has the highest positive effect on imitative innovation*

Stable Phase

- Technological Maturity
 - Cost reduction through process innovation; Strong, deep ties needed; Few large and several SMEs (Afuah & Utterback, 1997; Utterback & Abernathy, 1975)
- Open Innovation Strategy
 - Scan increased no. of sources of expertise (Laursen & Salter, 2006)
 - Large firms seek supplier interaction to reduce costs (Afuah & Utterback, 1997)
 - SMEs seek key-supplier role to sell improved components

H3a: *In the stable phase, **broad supplier oriented collaboration** strategy has the highest positive effect on process innovations for **large** firms*

H3b: *In the stable phase, **deep customer oriented collaboration** has the highest positive effect on incremental product innovations for **SMEs***

Data Set

- Cross-sectional survey in Danish energy sector (n=425)
- Conducted by EIS-project researchers in 2012 and (projected) 2014
 - Oslo-manual inspired, focus on collaboration
- Questions for last 2 years activities on (among other):
 - Core and peripheral technologies
 - Type of collaboration partners
 - Degree of collaboration
 - Purpose of collaborating
 - Result of collaborating

Seperating Maturity

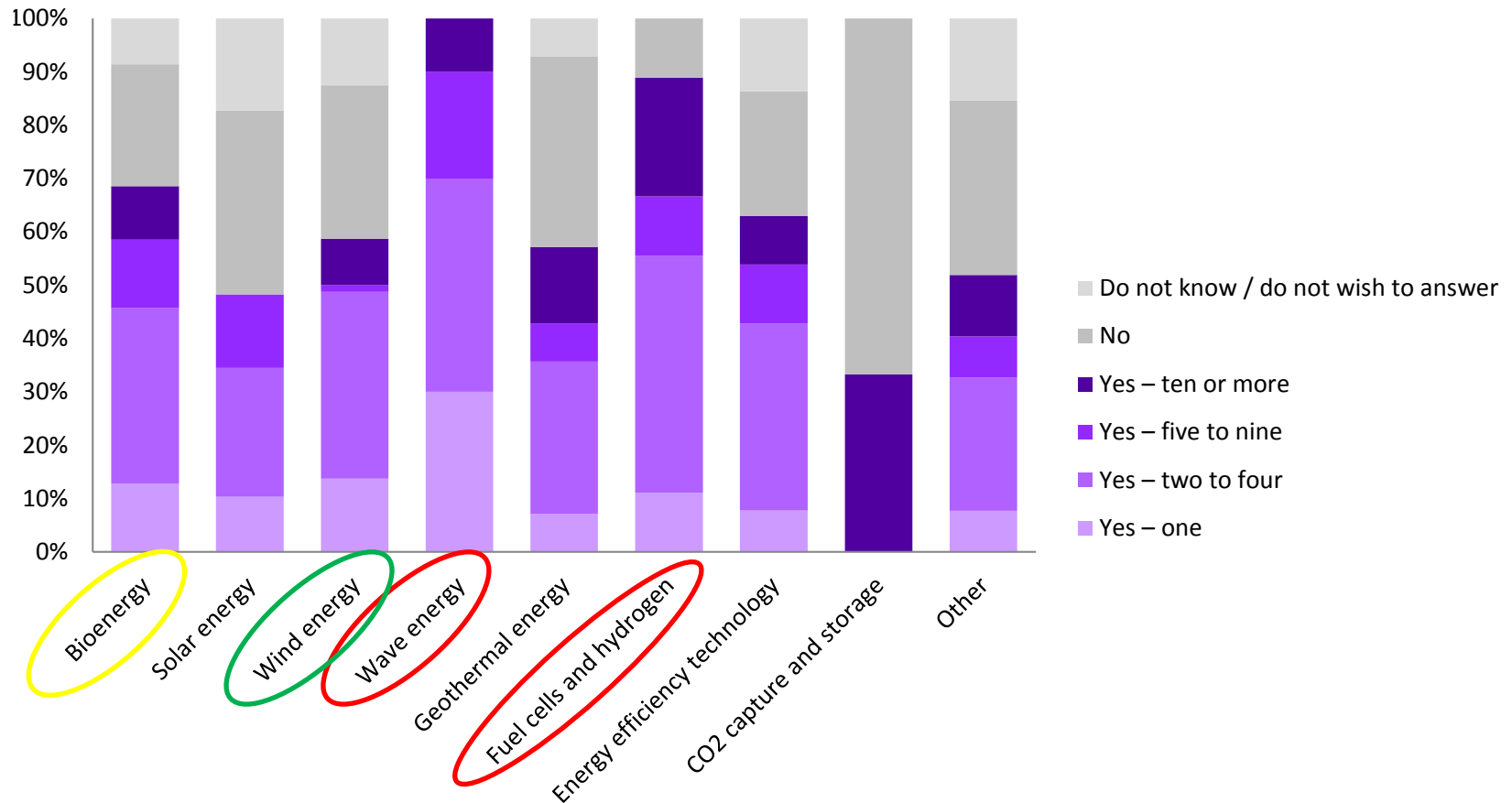
- Technology maturity stages as "fluid", "transitional", or "stable":
 - Expert interviews, installed capacity, no. of firms; avg. firm size; R&D share; CoE;
- Examples of technologies:
 - **Fluid:** Wave, fuel cells, CO2 capture
 - **Transitional:** Solar PV, smart grid, bio
 - **Stable:** Wind, solar thermal



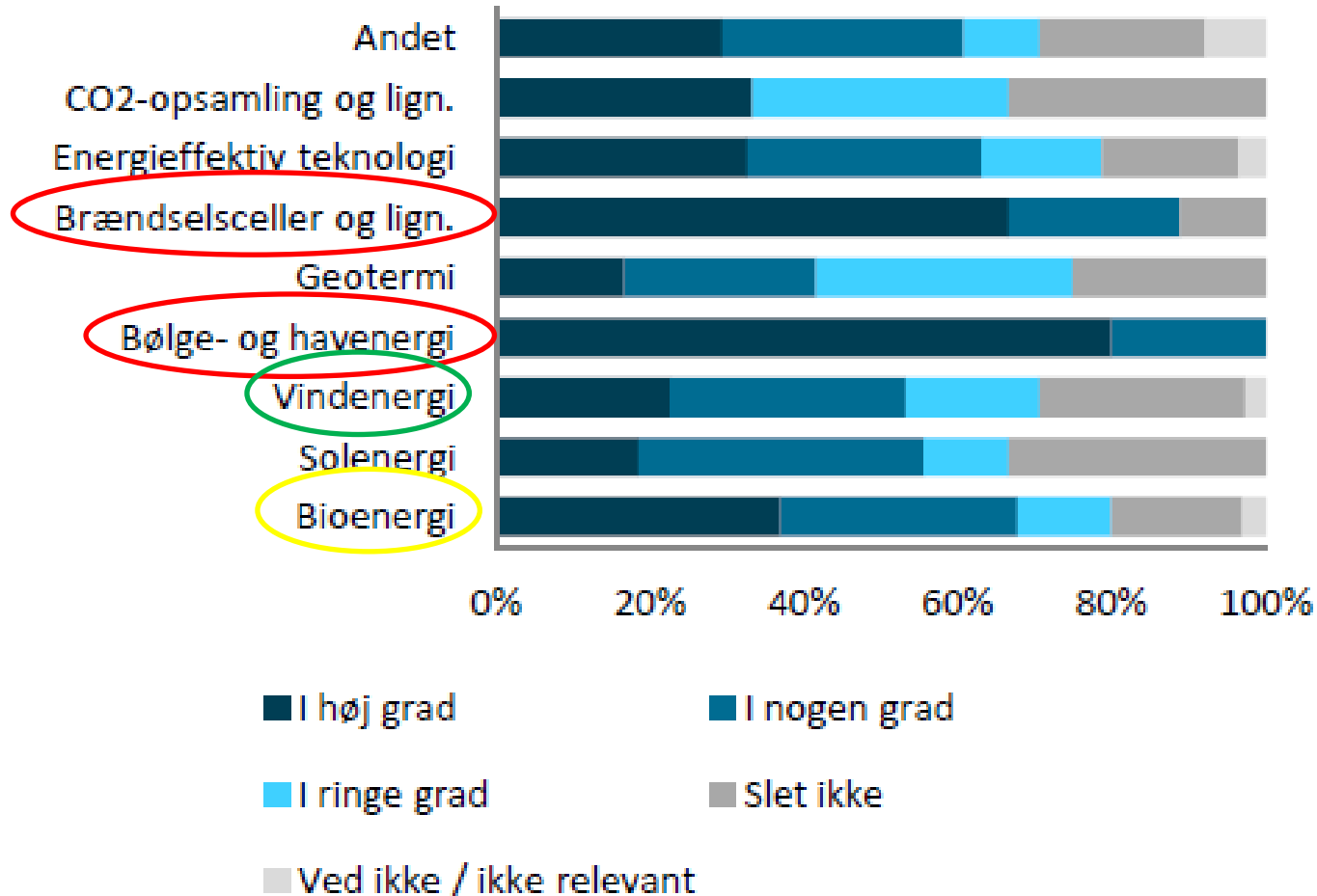
Regression Model

- Multinomial Logit:
 - Outcome likelihood estimation: New tech/product; Improved product; Process innovation
- Outcome = Maturity; Type of src; No. of srcs; Degree of collabrtn; Controls
- Controls:
 - Firm size
 - R&D intensity
 - Lead users
 - Subsidiary

Breadth Collaboration Patterns



Depth Science Collaboration Patterns



Next Steps

- Refine hypotheses w/ deeper theory
- Clean and test data
- Begin analysis

Question & Comments

