Firms Strategies in Alternative Energy Markets

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Outline

- Historical origins from the 1970s – 2000s of global firms and individual country strategies
- Observations and the main research question
- Three explanations given for the changing configuration
- The theoretical framework
- Hypotheses development
- Methodology

1970-mid 1980s: First move towards alternative energies

Events drawing attention to alternatives…

- Oil price rise (price of oil quadrupled by 1974 to nearly US$12 per barrel)

- Revives political security concerns on long term energy availability

- Marginal public awareness appealed to by study groups (Club of Rome (*Limits to Growth)*, air pollution concerns)

1970- mid1980s: move towards alternative energies

…trigger responses from market main actors

- Government

- Japan (Sunshine Project), U.S (PURPA, NREL, Clean Air Act 1970), Denmark (RE Committee, RisØ), Brazil (ethanol production)
- Increase in R&D Energy Investments

- Firms

- Solec/Solarex/Solar Technology International
- Vestas (diversification)/BP (acquisition)
- Exxon -Solar Power Corporation/ARCO-ARCO Solar/Mobil- Mobil Solar Energy (JV with Tyco Laboratories)
- Sharp, Matsushita, Hitachi, Toshiba, NEC

During the 1970s and mid-1985

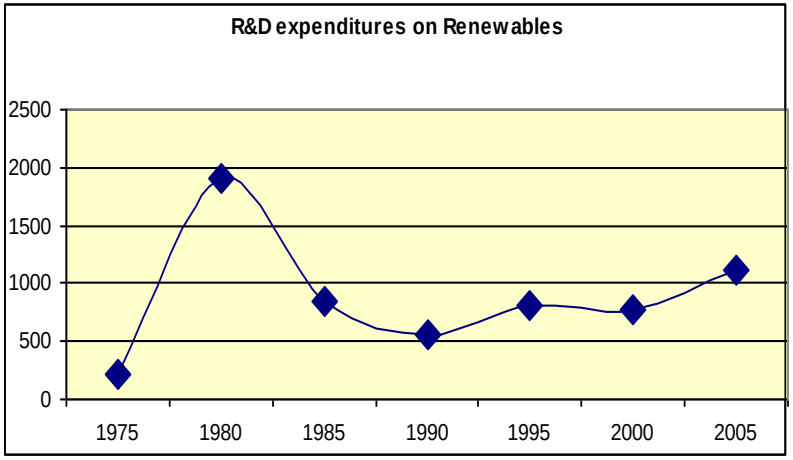
- Developments along the internal combustion (IC) engine trajectory, the three-way catalyst, Muskie Act 1973, finding CFC substitutes

- Kemp (1994), moving to a new trajectory, will require new skills, education and training

- Emission norms and product standards were insufficient measures that led end-of-pipe solutions instead of 'clean' technology or cleaner production processes(Soete and Kemp,1992).

1985-1990: the Downside for Alternatives

- Government response
  - Decline in R&D expenditure
  - End-of-pipe solutions
  - Phasing out of incentives



- Firm response

  -Exit of firms (Hitachi, Toshiba and NEC)

  -Sale of solar units (Exxon sold off its unit to Solarex)

Renewed attention 1990s-2000s

- **Triggers**
- Climate change concerns/more awareness , UNFCCC
- Energy Security Concerns/Energy Demand (developing countries)
- Oil price increases in 2000s
- **Response**
- Toyota/Honda/GM/Kyocera, Sanyo and Sharp
- BP/Shell/GE/Seimens/DuPont
- VC funded start-ups (e.g. Nanosolar)
- Moser Baer/St.Gobain/Applied Materials

Differences in *two* Periods

- Broadening of energy base by many, large non-energy/oil & gas/electrical firms and more number of acquisitions and alliances than in 1970s and 80s

- Entry of large agricultural, biotechnology firms and semiconductor firms, automobile and glass manufacturers

- Wider range of technologies explored, existence of competing technologies and the application of nano, microchip and laser technology

Observation and Research Question

Changing configuration over the years – in terms of the number of firms, number of technologies and type (cross-sectoral participation)

So, what is causing the configuration of the alternative energy market to change?

Explanation (1)

Nature of Technologies

- The combinatorial nature of technologies (Mytelka, 2003) has resulted in the cross-sectoral participation of firms like Dupont, Cypress Semiconductor and Applied Materials

- Crossing of trajectories: development along a trajectory is co-dependent on trajectories of other technologies. For eg., innovation in solar PV is strongly integrated with the development path of the semiconductors and optical laser trajectories

- Science base, patent activity and system embeddedness

Explanation (2)

Nature of Competition & Market Entry

- Shortening of product life cycles, faster access to innovation, sharing high risks & technological uncertainties and anticipation of higher regulatory requirements
- Adoption of innovation strategies (a shift from internal R&D to the external scouting for technology, Arora & Gamberdella (1990) and Pisano (1990))
- Innovation strategies are affecting market competition and have given firms, particularly large firm, access to new technologies and markets
- These strategies act as entry barriers to new entrants, determines the speed of dominant design emergence, costs are reduced and systemic constraints are removed Mytelka et al., (1998)

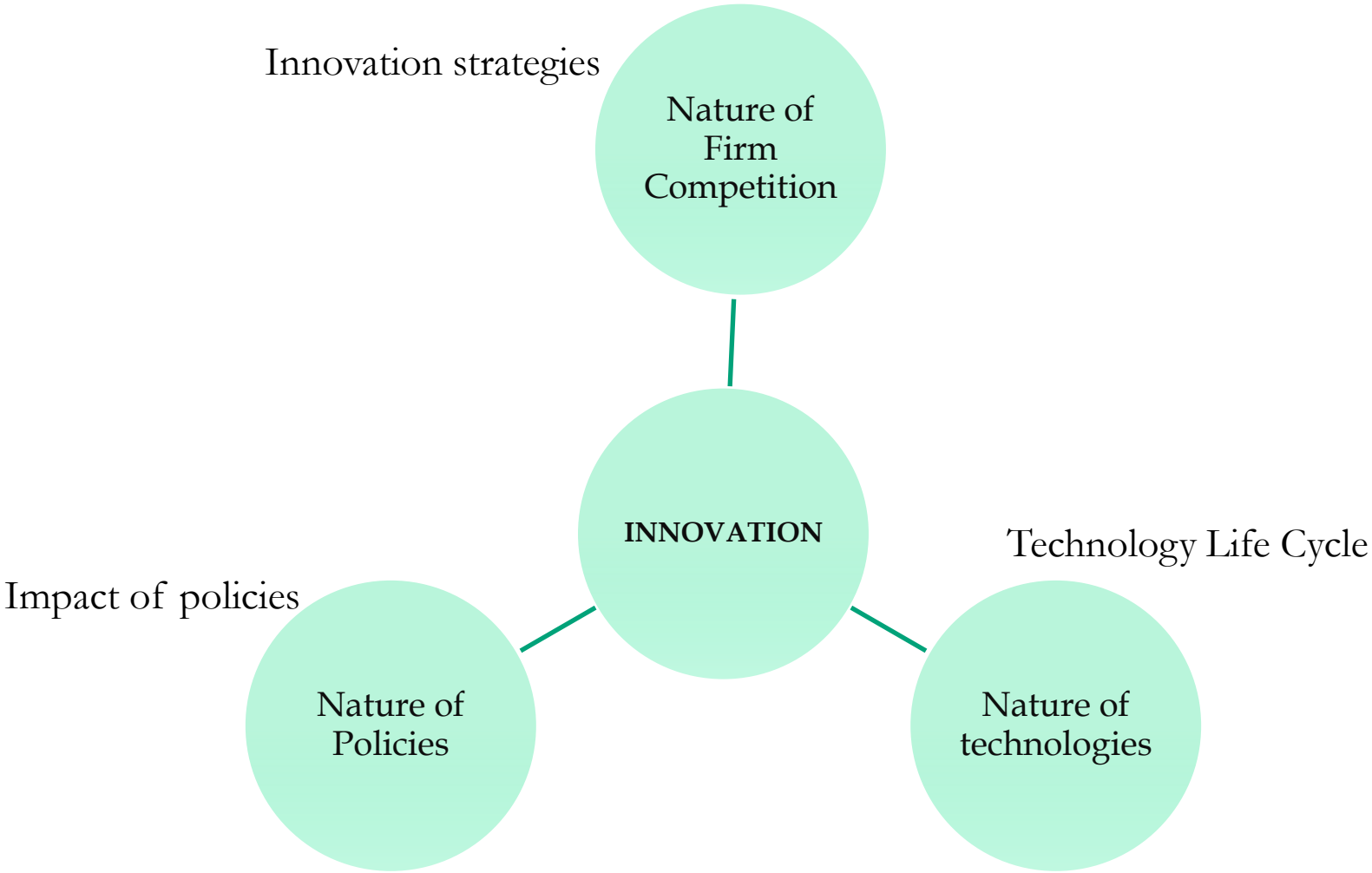
Explanation (3)

Nature of policies (*technology specific support schemes Vs. market based mechanisms*)

- Overcome lock-ins, eg. Cowan and Gunby (1996) marked localized learning, uncertainty and unpredictable pay-offs (of new technologies)

- Existence of interrelated technological trajectories or systems (Rosenberg, 1989) or the combinatorial nature of the technologies (Mytelka, 2003) . *Energy deregulation policies* in the EU

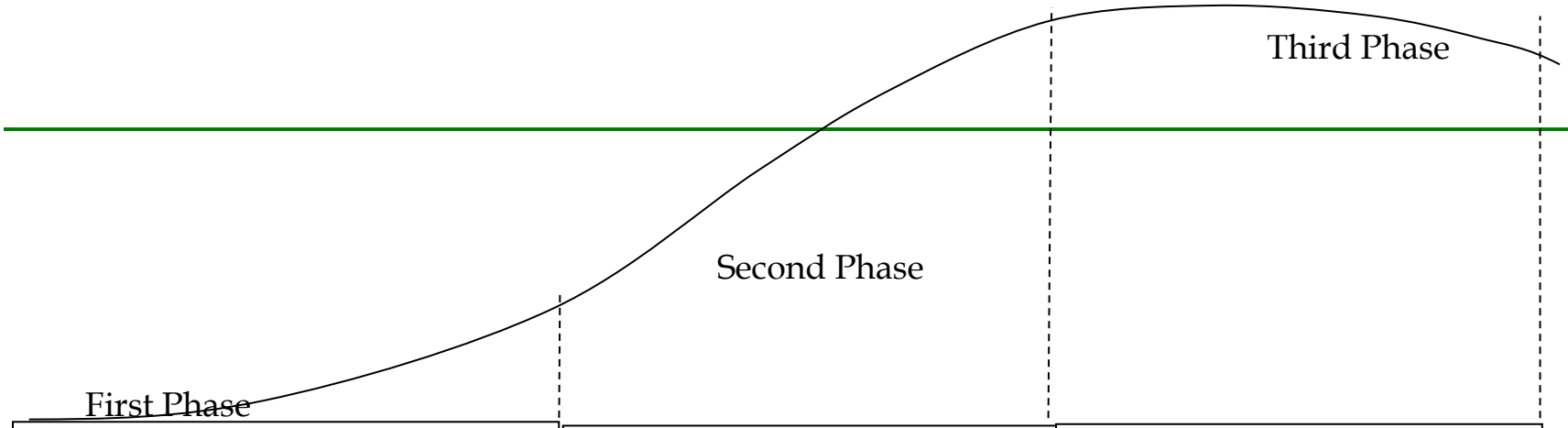
Theoretical Framework



Theories and Concepts Used

Actors	Selection Environnent	Selection Mechanisms
Firms	Market	Innovation Strategies and competition
Government	Policies and regulations	Feed-in tariffs, taxes and incentives
Technology	Technological Paradigm	Innovation Process

- Evolutionary Economics
- Theories of Technical Change
- Technology Life Cycle
- Theories of Innovation Strategies



Nature of competition

Strategies w/t public R&D centers, universities, rise of small & entrepreneurial firms, network oligopolies

Nature of technology

High patent activity, high degree of embeddedness and highly science based

Policies: R&D subsidies

Hydrogen fuel-cell technologies

Nature of competition

With smaller firms, rivals, cross-sectoral firms, internal R&D

Nature of technology
Relatively low patent activity, low degree of embeddedness and relatively low science based activities

Policies: Technology specific support schemes

Solar PV technologies

Nature of competition

Suppliers, users, internal R&D, acquisitions

Nature of technology

Very low patent activity, no or little degree of embeddedness and very low science based activities

Policies: Market based instruments

Wind technologies

Technology Life Cycle and Interactive Learning (Innovation Strategies)

Hypotheses

- **Hypothesis 1:** Under conditions of technological uncertainty, firms that engage in innovation strategy with research organizations and universities have a higher level of innovation or patent activity than those that do not

- **Hypothesis 4:** Small successful firms engage in innovation strategies like technological alliances or acquisitions with other firms particularly in the first two stages of the technology

- **Hypothesis 5:** In the mature stage of the technology, internal R&D expenditure of firms increases, and firms move away from the acquisition of horizontal firms to non-horizontal firms

- **Hypothesis 8:** The more standardized the technology the lesser the number of innovation strategies between horizontal firms

Methodology

Methodology

- Survey of top 300 global firms in wind, solar PV and HFC and test the hypotheses (*questionnaire-design-stage)*

- Case studies of 5 firms for an in-depth analysis of inter-firm interaction for innovation since 1970s. Firm-supplier relations, horizontal innovation networks

Variables

- Use of patents data, inter-firm alliances like technological joint venture, technological acquisitions, internal R&D, technology transfer between firms and universities

Issues

Extent of study? Degree of an innovation strategy varies with the TLC. Degree of an innovation activity is measured by *resource sharing* and *knowledge spillovers* between firms (Ahuja, 2000)

Can innovation strategies be an interactive form of learning and *when*?

THANK YOU!