

Keep searching and you'll find

What do we know about variety creation
through firms' search activities for innovation?

Keld Laursen

Department of Innovation and
Organizational Economics (INO),
Copenhagen Business School,
Kilevej 14a, 2000 Frederiksberg, Denmark
E-mail: kl.ino@cbs.dk,
<http://www.druid.dk/laursen/>

The importance of variety



Copenhagen
Business School
HANDELSHØJSKOLEN

- “Every locality has incidents of its own which affect in various ways the methods of arrangement of every class of business that is carried on in it: and even in the same place and the same trade no two persons pursuing the same aims will adopt exactly the same routes. *The tendency to variation is a chief cause of progress; and the abler are the undertakers in any trade the greater will this tendency be.*” (Marshall 1890/1949: 295, italics added).

The importance of variety



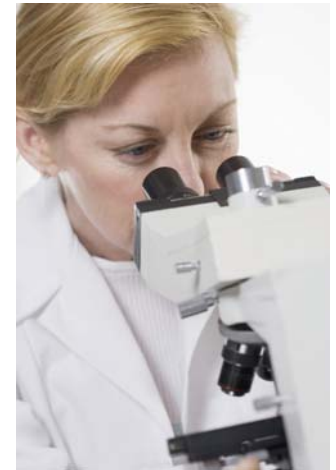
- Innovation is here seen as a result of the novel integration of previously separate bodies of knowledge with a commercial application.
- With this definition of innovation, variety is central to firms' innovative performance.



Firm-level variety



- However, given that firms and their decision-makers have only limited attention available to them (Simon 1947, Ocasio 1997), searching for, and managing such variety is not an easy task as it :
 - Often involves searching for solutions in alien technological domains
 - Demands firms to work with a variety of non-local individuals (such as scientists) or organizations (such as supplier firms) that may each have different norms, habits and rules; often requiring different organizational practices in order to make the search processes successful



Aim



- The reviews contributions found in theoretical and empirical studies of innovation processes at the firm-level:
 - Discuss the advantages of local and non-local search
 - Describe potential triggers for local and non-local search:
 - Talk about the evolution of the literature over time
 - Different search strategies, but very similar technological profiles

Advantages of local and non-local search



Copenhagen
Business School
HANDELSHØJSKOLEN

- **Local search**

- “Local” (search) can be defined to refer to activities that relate quite closely to prior activities, “...by definition implying some experience with the technologies being developed.” (Sorenson and Fleming, 2004)
- Two fundamental reasons may be given for the dominant tendency to conduct local search (Helfat, 1994):
 - Humans’ limited cognitive abilities gives rise to boundedly rational behavior so that managers and other problem solvers are **unable to consider all possible options** for solutions to problems, and are also **unable to accurately evaluate** the potential option’s future prospects for performance.
 - The accumulated knowledge base facilitates learning that is related to that knowledge. For that reason it may often — as a starting point — be wise for a firm to search for innovative solutions for new processes, products and services in areas where **it already has expertise**.

Advantages of local search



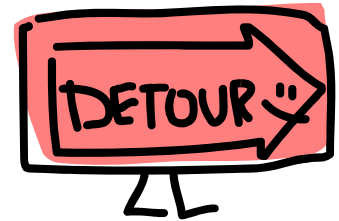
Copenhagen
Business School
HANDELSHØJSKOLEN

- Organizations are “...typically much better at the tasks of self-maintenance in a constant environment than they are at major change, and much better at doing “more of the same” than they are at any other kind of change.” (Nelson and Winter 1982: 9-10)
- Although local search has a lower potential for knowledge recombination of a more radical nature, **the search costs** for local solutions are most often much lower within a familiar domain (Rosenkopf and Almeida 2003). + Resistance to communication across knowledge boundaries (Carlile 2002)
- Since agents develop an understanding of the “local” elements that can potentially be combined, they are better able to invent **with greater reliability** by avoiding elements that did not work in the past (Fleming and Sorenson 2004)



Advantages of non-local search

- Recent contributions have paid a substantial amount of attention to the disadvantageous sides of local search — sides that can be potentially damaging and eventually lethal to organizations when they **become too reliant** on local search
- The setback with local search is that in recurrent cases, the knowledge input required to solve a given problem **will likely not coincide with one's current knowledge base** and therefore the need to go beyond the boundaries of an organization or community for complementary knowledge may be quite prevalent (Postrel 2002)





Triggers for local and non-local search

- “Problemistic” search (fi. based on price competition or rival innovations) [Cyert and March, Greve]
- Slack search — important to recombinations of a more radical nature
- Idiosyncratic situations [Ahuja & Katila], technological exhaustion and expansion beyond national markets
- New technological opportunities



Why organizations often don't get it right

- Limited cognitive abilities of agents (Simon 1947, Ocasio 1997, Gavetti and Levinthal 2000)
- Search is often conducted under extreme time pressure with limited resources -> Firms may adopt too narrow or too broad search routines (Koput 1997)
- Many firms are subject to cognitive bias against external sources and may be myopic in their search processes (March 1991, Levinthal and March 1993)

Organizational responses to the local search problem



Copenhagen
Business School
HANDELSHØJSKOLEN

- A variety of employees with diverse backgrounds — particularly with respect to education
- External sources of innovation and variety
- Science as a map in decoupling of knowledge components (Fleming)
- Broadcast search (Lakhani, Jeppesen)

Some key contributions



Authors	Search variable	Dependent variable	Cost of search	Data type, technology variables	Industry
Helfat (1994)	R&D intensity	R&D intensity lagged	-	R&D data	US Petroleum industry
Stuart and Poldony (1996)	Technological position in comparison to other firms	-	-	Patent data	Japanese semiconductor industry
Rosenkopf and Nerkar (2001)	Four types of exploration	The search variable is the dept. variable	-	Patent data	Optical disk industry
Katila and Ahuja (2002)	Search depth and scope (patent citations)	Number of new product introductions	Through squared terms	Patent data	Robotics industry
Katila (2002)	Competitor search age and external search age (age of cited patents)	Number of new product introductions	Through squared terms	Patent data	Robotics industry
Rosenkopf and Almeida (2003)	Strategic alliances and labor mobility	Knowledge flows (patent citations)	Technological and geographical distance	Patent data	Semiconductor industry
Greve (2003)	R&D intensity (+ innovation launches)	The search variable is the dept. variable	-	R&D and product announcement data	Japanese shipbuilding
Nerkar (2003)	Temporal exploitation and exploration ("recency" and spread measures over time, based on patent citations)	Technological impact and performance measured as patent citations	Through a squared term	Patent data	US pharmaceutical market
He and Wong (2004)	Explorative and exploitative innovation strategies	Percentage of sales from new products	-	Survey data	Manufacturing firms from Singapore and the State of Penang in Malaysia
Fleming and Sorenson (2004)	"Coupling" among components and cites to science	Citation counts to given patents	-	Patent data	US patents, May and June 1990
Nerkar and Roberts (2004)	Proximal and distal technological experience (patent classes)	Sales of new products in the 1 st year in the market	-	Patent data	US pharmaceutical market
Laursen and Salter (2006)	Search breadth and dept among external sources of innovation	Percentage of sales from new products	Through a squared term	Survey data	The UK manufacturing sector
Cassiman and Veugelers (2006)	Internal and externally acquired R&D	Percentage of sales from new products	-	Survey data	The Belgian manufacturing sector
Chen and Miller (2007)	R&D intensity	The search variable is the dept. variable	-	R&D data	The US manufacturing sector



Trends in the litt.

- Quantitative empirical research lagged theoretical insights by more than 10 yrs
- Initial focus on local search through an emphasis on more “realistic” behavioral assumptions
- An establishment of the fact that firms predominantly conduct local search
- An increased focus more recently on:
 - The advantages of conducting boundary spanning search
 - The costs of search (local and non-local)
 - Complementarities between different kinds of search behavior
 - Trade-offs and contingencies

A paradox?



- The literature on variety generation through search for innovation has demonstrated that firms vary in the way and intensity in which they search for new combinations
- Yet, it has been found that firm's observed technological profiles — within the same industry — display remarkably small signs of technological diversity (Patel and Pavitt 1997).



A paradox?

- Two related factors may account for these apparently contradictory finding:
 - Technological profiles, across patent classes of firms are observed *ex post* the search process. So while firms *ex ante* search for knowledge components with different intensities and in different ways, they are often looking for solutions to *similar problems*, given their shared industrial context and technological imperatives (Teece 1988, Patel and Pavitt 1997) — these solutions to similar problems are likely to be classified in the same patent classes.
 - Advanced organizations do not only rely on their own research in the development of innovations, but also use the innovations of competing organizations as an input to their own innovation processes through various forms of imitation mediated by industrial intelligence activities



Future research

- The role of appropriability when conducting search for innovation
 - How do firms engage in knowledge search in the external environment without losing too much essential knowledge?
 - What is the role of appropriability conditions in this context?
- How do firms prioritize their search-for-new-combinations efforts, given the opportunity costs in terms of other alternative investments?



Future research

- What kind of search does problemistic or slack search give rise to?
 - Prior empirical research has focused on the search intensity (Greve 2003, Chen and Miller 2007), but not on the direction of search.
 - So, we need to know under which conditions will organizations search for incremental or radical solutions?

The end of the route...



**Copenhagen
Business School**
HANDELSHØJSKOLEN

Keld Laursen
DRUID,
Department of Innovation and
Organizational Economics,
Copenhagen Business School
<http://www.druid.dk/laursen/>
E-mail: kl.ino@cbs.dk