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R&D, perception and innovation

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- **Background**

- The paper is inspired by evolutionary and behavioural theory where it is argued that firms pursue different approaches to innovation and develop different kinds of innovations (Nelson & Winter, 1982; Nelson;1991; 1995).
- Empirical analysis of firm heterogeneity in relation to innovation is on the other hand lacking.
- Recent theoretical advances in evolutionary economics have a loose empirical foundation (Fagerberg, 2003).



- **Main Objective**
- Firm heterogeneity and search
- Organizational search is an important source of firm heterogeneity and driver of innovation (Cyert & March, 1963; Nelson & Winter, 1982).
- Search: Activities and strategies firms initiate in order to overcome problems and to discover better ways of doing things.



- The objective in the paper is to take a closer look at the range of search activities / pathways firms use in the innovation process and relate different search pathways to different types of innovation.
- Focus on two sources of search activity: R&D and firm perceptions
- Both constitute independent search pathways to innovation.



- **R&D**
- R&D is a well established theoretical measure of search.
- “Institutionalization of inventive activity” (Nelson, 1961).
- “Planned”, builds on past knowledge and expertise (Helfat, 1994; Nelson & Winter, 1982; Dosi, 1988).
- R&D is an important predictor of innovation (Mairesse & Mohnen, 2005; Crepon et al, 1998; Reichstein & Salter, 2006)
- What we lack are studies that relate different types of R&D activities to different types of innovations.
- Pose Internal and external R&D as predictors of product, process, organizational and market innovation.



- **Cognitions / Perceptions**

- In performance feedback theory, perception of problems are an important source of search activity (Cyert & March, 1963; Greve, 2003).
- Firms initiate search activity when their performance falls below a socially constructed aspiration level.
- Prior research on performance feedback theory has demonstrated that perception of “bad” performance are related to both R&D and innovation (Greve, 2003).
- We lack studies on whether perception of other problems initiate search activity and are related to innovation.



- Because firms have different perceptions and cognitions (Fagerberg, 2003; Dosi & Marengo, 2007), perceptions is another potential source of heterogeneous search activity.
- I pose firms perception of these problems as possible determinants of innovation: innovation cost”, “lack of finance”, “lack of qualified personnel”, lack of technological information”, lack of market information”, lack of a cooperation partner for innovation”, “Market dominance by established firms” and “uncertain demand”.



- **DATA**

- Forth version of the community innovation survey for Norway
- The survey is broadly representative of the Norwegian firm population with 10 or more employees.
- I have answers from 4655 firms. But due to some item-non response this drops to around 4200 firms in the analysis.
- Survey contains a lot of information about: R&D, the problems firms face in the innovation process, and about product, process, market and organizational innovation.



- **Method**

- Use logistic regression to analyze firms propensity to innovate where internal, external R&D and perception variables are entered as predictors.
- The “propensity to innovate” is estimated separately for product, process, organizational and market innovation.
- A methodological problem: Time overlap between dependent and independent variables. Assume that R&D and perception are related to innovation but not the other way around.
- “Firm perceptions” are the perceptions of the firm management , in most cases CEO.



**PRODUCT
INNOVATION**

**PROCESS
INNOVATION**

Beta

OR

Beta

OR

R&D VARIABLES

External R&D

0,605***

1,83

0,569***

1,77

Internal R&D

2,774***

16,03

1,885***

6,59

INNOVATION OBSTACLES

High innovation cost

0,297***

1,35

0,305***

1,36

Lack of finance within the enterprise

-0,004

1,00

0,010

1,01

Lack of finance from outside sources

-0,036

0,96

-0,092

0,91

Lack of qualified personnel

0,045

1,05

0,172***

1,19

Lack of technological information

-0,021

0,98

0,199**

1,22

Lack of market information

0,324***

1,38

-0,130

0,88

Lack of co-operation partner for innovation

-0,104

0,90

-0,004

1,00

Market dominated by established incumbents

-0,119*

0,89

-0,087

0,92

Uncertain demand

0,202***

1,22

-0,038

0,96

FIRM FACTORS

Firm size

0,130**

1,14

0,250***

1,28

Group

0,107

0,90

0,078

1,08

R

0,59

0,37

N

4165

4165



**ORGANIZATIONAL
INNOVATION**

**MARKET
INNOVATION**

	ORGANIZATIONAL INNOVATION		MARKET INNOVATION	
	Beta	OR	Beta	OR
R&D VARIABLES				
External R&D	0,569***	1,77	0,347***	1,41
Internal R&D	0,383***	1,47	1,160***	3,19
INNOVATION OBSTACLES				
High innovation cost	0,054	1,06	0,106**	1,11
Lack of finance within the enterprise	0,263***	1,30	0,046	1,05
Lack of finance from outside sources	-0,014	0,99	0,029	1,03
Lack of qualified personnel	0,129**	1,14	0,105	1,11
Lack of technological information	0,137*	1,15	0,076	1,08
Lack of market information	-0,131	0,88	0,218***	1,24
Lack of co-operation partner for innovation	0,027	1,03	-0,145**	0,87
Market dominated by established incumbents	0,186***	1,20	0,175***	1,19
Uncertain demand	0,017	1,02	0,055	1,06
FIRM FACTORS				
Firm size	0,202***	1,22	0,037	1,04
Group	0,579***	1,78	0,150*	1,16
R	0,2		0,27	
N	4165		4165	



- **Key results:**
- Both internal and external R&D are positive determinants of the organizational ability to innovative in a diverse way.
- In some contrast to prior research we have found that both internal and external R&D are positive predictors of product, process, organizational and market innovation.
- This finding adds to recent papers where the importance of R&D for innovation have been explored (Mairesse & Mohnen, 2005; Crepon et al, 1998).



- Controlling for R&D, perception of problems are also related to innovation.
- I find a nice “micro-link” at the firm level between perception of problems and the types of innovations firms develop in order to solve the perceived problems.
- Ex 1: Firms perceiving “uncertain demand” and “lack of market information” to be problematic have a higher propensity to develop product and market innovations.
- Ex 2: Lack of qualified personnel is a positive predictor of process and organizational innovation.



• **Conclusion**

- Different types of R&D and firm perceptions constitute distinct search pathways to innovation.
- Both R&D and firm perceptions are significant predictors of the organizational capacity to develop product, process, organizational and market innovations. Both are important sources of firm heterogeneity in relation to innovation.
- Empirically “confirmed” the important idea in evolutionary theory that firms are different, pursue distinct approaches to innovation, and hence develop different types of innovations.