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Project Level Approaches for Open Innovation

Project Characteristics and Configurations

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Research Motivation

Open Innovation:

- Explanation of the in- and outbound innovation activities of firms (Chesbrough, 2003)
- Increasingly detailed understanding of aspects
 - Breadth and depth (Laursen & Salter, 2006)
 - Influence of different sources (Köhler et. al., 2012)
- And of benefits
 - Reduces the risks, time and costs associated with innovation (Chesbrough, 2006)
 - Access to resources and novel knowledge (Van de Vrande et. al., 2009)
 - Increased innovation performance (Laursen & Salter, 2006, etc.)

Research Motivation

Relevance of project level focus:

- Primary level of strategy execution (Shenhar & Dvir, 2007)
- Point of execution for open innovation activities (Haas, 2010)
- Challenges of linking firm level strategy and distinct OI outcome

Contributions:

- Test established concepts and findings at project level
 - Search breadth and knowledge sources
- Introduce new concepts:
 - “Knowledge Breadth”
 - “Source Breadth”

Research Motivation

Search Breadth: (Laursen & Salter, 2006)

- Increasing breadth is curvilinear to firms' innovation performance
- More beneficial for mature technologies and incremental innovations

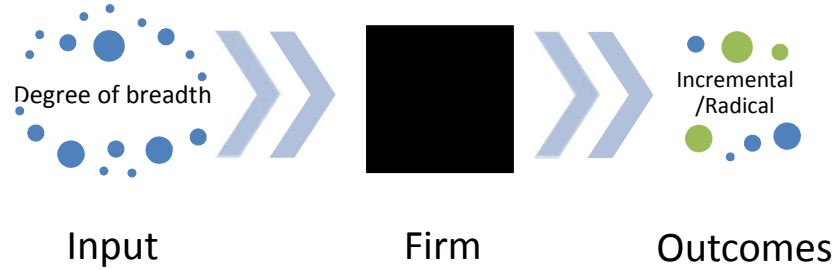
Knowledge Sources: (Köhler et. al., 2012)

- Different sources benefit different types of innovation
- Science based search most beneficial to radical innovations

However:

- Firm engage in multiple simultaneous activities (O'Reilly & Tushman, 2013)
- Establishing explicit input-output link difficult at firm level

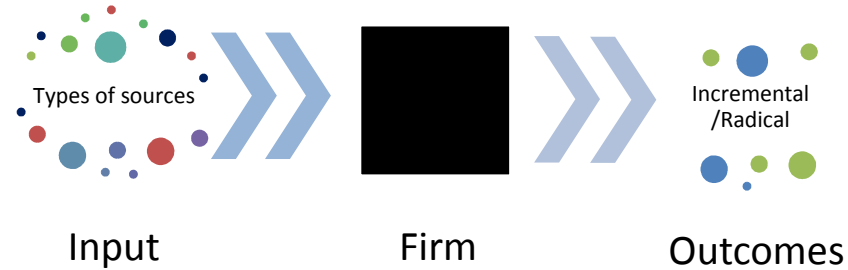
Linking Breadth and Outcome



H1: The influence of search breadth takes an inverted u-shape to project's innovation potential

H2: The positive influence of search breadth on innovation potential is higher for projects focused on mature rather than for immature technologies

Linking Sources and Outcome



H3: The positive influence of science based search on innovation potential is higher for innovation projects within immature than mature technologies

Source Breadth

“Source Breadth”:

- Search breadth, i.e. number of sources (Laursen & Salter, 2006)
- Search direction, i.e. type of source (Köhler, 2012)

- Influence of the number of same-type sources used?

H4: The positive influence of increasing source breadth on innovation potential is higher for mature than for immature technologies

Knowledge Breadth

Knowledge Breadth:

- Distant search and recombination of diverse knowledge → Radical innovation (Katila & Ahuja, 2002; Rosenkopf & Nekar, 2001; Rosenkopf & Almeida, 2003)
- Importance of heterogeneity vs. homogeneity of knowledge
- Influence of amount of different knowledge domains used?

H5: The positive influence of increasing knowledge breadth on innovation potential is higher for immature than mature technologies

Data: EU FP7

EU data on energy R&D projects

- Project-level data on 1,729 projects
- Firm-level data on 13,986 actors

Maturity Measure: (Abernathy & Utterback, 1975)

- Market penetration; cross-checked with LCOE
- Mature technologies, incremental innovation:
Wind, hydro, heating/cooling, general RES, energy efficiency, bio
- Immature technologies, radical innovation:
Geothermal, ocean, FC, hydrogen, clean coal, “*future technology and novel materials*”, sust. auto. electro-chemical, solar

Data: Dependent Variables

Expert Rating:

- Project rating (0-100)
- Performed by 3-5 independent experts
 - Initially individually, subsequently as consensus
- Evaluates technological excellence, impact of results and commercial potential
- Proxy for quality/potential (Amabile et. al., 2005; Poetz, Schreier, 2012; etc.)

Data: Explanatory Variables

Breadth:

- Number of project participants (count)

Knowledge Source:

- Science-based source on project (0/1)

Source Breadth:

- Number of science-based sources (count)

Knowledge Breadth:

- Number of different NACE codes on project (count)

Controls:

- Turnover, size, call_id, NUTS

Model and Robustness

Model:

- Linear regression OLS
- Score non-normal distributed

Robustness:

- Robust standard errors
- Results stable when dropping outliers and transforming score
- Robust in non-linear models
- Variance Inflation Factor checks; mean VIFs:
 - Radical: 2.04
 - Incremental: 2.02
 - Full: 2.11

Regression Results

H1: *The influence of **search breadth** takes an inverted u-shape to project's innovation potential*

H2: *The positive influence of **search breadth** on innovation potential is higher for projects focused on mature rather than for immature technologies*

Project Type Variables	Mature		Immature	
	Coef.	S.E.	Coef.	S.E.
breadth	1.872***	0.273	-1.699***	0.455
breadth2	-0.0318***	0.00774	0.0351**	0.0170
university_part	-0.716	1.359	3.612**	1.751
uni_breadth	4.621***	0.512	2.998***	0.701
uni_breadth2	-0.261***	0.0474	-0.234***	0.0732
knowledge_breadth	-3.183***	0.719	13.04***	1.133
knowledge_breadth2	0.176***	0.0547	-1.397***	0.111
turn_over	-3.716***	1.359	-3.629**	1.583
size	-0.237	1.335	-0.406	1.628
call_id	0.629***	0.0347	0.272***	0.0432
nuts	-0.00329***	0.00109	-0.00194	0.00130
Constant	21.00***	2.309	23.41***	2.555
Observations	8,672		5,314	
R-squared	0.120		0.079	

Robust standard errors provided.

*** p<0.01, ** p<0.05, * p<0.1

Regression Results

H3: *The positive influence of **science based search** on innovation potential is higher for innovation projects within immature than mature technologies*

H4: *The positive influence of increasing **source breadth** on innovation potential is higher for mature than for immature technologies*

Project Type Variables	Mature		Immature	
	Coef.	S.E.	Coef.	S.E.
breadth	1.872***	0.273	-1.699***	0.455
breadth2	-0.0318***	0.00774	0.0351**	0.0170
university_part	-0.716	1.359	3.612**	1.751
uni_breadth	4.621***	0.512	2.998***	0.701
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knowledge_breadth	-3.183***	0.719	13.04***	1.133
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Constant	21.00***	2.309	23.41***	2.555
Observations	8,672		5,314	
R-squared	0.120		0.079	

Robust standard errors provided.

*** p<0.01, ** p<0.05, * p<0.1

Regression Results

H5: *The positive influence of increasing knowledge breadth on innovation potential is higher for immature than mature technologies*

Project Type Variables	Mature		Immature	
	Coef.	S.E.	Coef.	S.E.
breadth	1.872***	0.273	-1.699***	0.455
breadth2	-0.0318***	0.00774	0.0351**	0.0170
university_part	-0.716	1.359	3.612**	1.751
uni_breadth	4.621***	0.512	2.998***	0.701
uni_breadth2	-0.261***	0.0474	-0.234***	0.0732
knowledge_breadth	-3.183***	0.719	13.04***	1.133
knowledge_breadth2	0.176***	0.0547	-1.397***	0.111
turn_over	-3.716***	1.359	-3.629**	1.583
size	-0.237	1.335	-0.406	1.628
call_id	0.629***	0.0347	0.272***	0.0432
nuts	-0.00329***	0.00109	-0.00194	0.00130
Constant	21.00***	2.309	23.41***	2.555
Observations	8,672		5,314	
R-squared	0.120		0.079	

Robust standard errors provided.

*** p<0.01, ** p<0.05, * p<0.1

Contributions

Source Breadth:

- Mature/Incremental benefit from multiple similar sources
- Immature/Radical benefit less from multiple similar sources

Knowledge Breadth:

- Mature/Incremental innovation projects suffer from increase in knowledge domains
- Immature/Radical innovation projects benefit from increase in knowledge domains (Curvilinear)

In combination:

- Mature benefits from more sources with expert knowledge within narrow domain
- Immature benefits from few sources with diverse knowledge from broad domains

Thank You

Backup Slides

Upcoming Work

Method:

- Additional robustness checks
- Quantile regression model
- Private firms (suppliers)

Source Breadth:

- Include other sources
 - Private firms (suppliers); Public bodies; Research organizations

Commitments of Actors:

- Explore role of each participant's financial contributions

Temporal Aspect

- Track reconfigurations of different actors across time (potentially 10 years)

Robustness checks

Tobit regression:

- Significance remains, coefficients stronger

Non-linear functions:

- Power (log/log)
- Logarithmic (log of score)
- Polynomial (squared term of score)
- Significance and coefficients robust for all

Tobit Regression Results

Variables	Mature		Immature	
	Coef.	Robust S.E.	Coef.	Robust S.E.
breadth	3.351***	(0.500)	-1.996***	(0.709)
breadth2	-0.0576***	(0.0134)	0.0362	(0.0276)
university_part	1.208	(2.804)	6.483**	(2.667)
uni_depth	8.557***	(0.926)	3.356***	(1.052)
uni_depth2	-0.464***	(0.0820)	-0.229**	(0.112)
knowledge_breadth	-6.640***	(1.331)	18.37***	(1.855)
knowledge_breadth2	0.382***	(0.102)	-2.077***	(0.191)
turn_over	-6.074**	(2.560)	-3.826	(2.363)
subsidiary	-4.216***	(1.507)	4.796***	(1.370)
size	-0.958	(2.522)	-2.417	(2.405)
call_id	1.071***	(0.0645)	0.391***	(0.0654)
nuts	-0.00517**	(0.00205)	-0.00353*	(0.00197)
Constant	1.425	(4.425)	15.85***	(3.756)
/sigma	52.45***	(0.816)	40.54***	(0.725)
Observations	8,672		5,314	
left-censored obs at score<=25	3741		1535	
uncensored obs	2950		2334	
right-censored obs at score>=75	1981		1445	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1