

# **The role of openness to external knowledge sources along the innovation process. How do high- tech and low-tech firms differ?**

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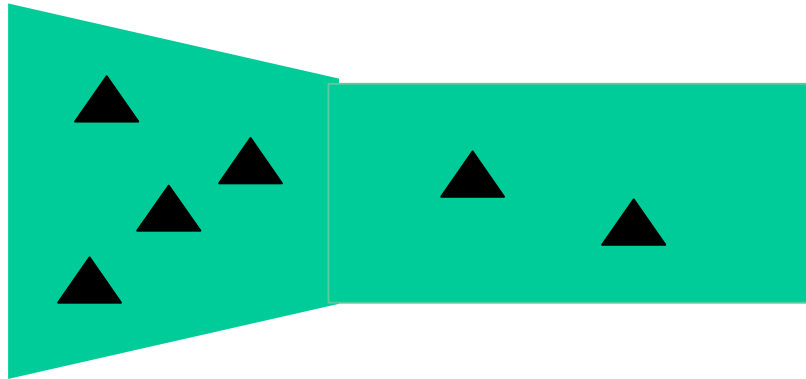
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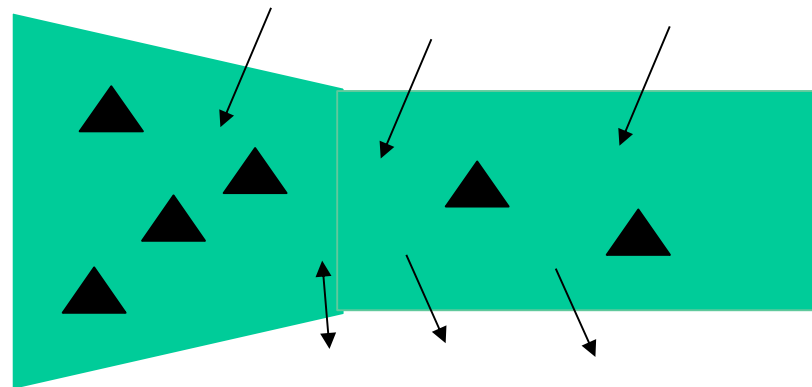
# Agenda

1. Introduction and Motivation
2. Theoretical Baseline and Hypotheses
3. Data
4. Results
5. Conclusion

# 1. Introduction and motivation

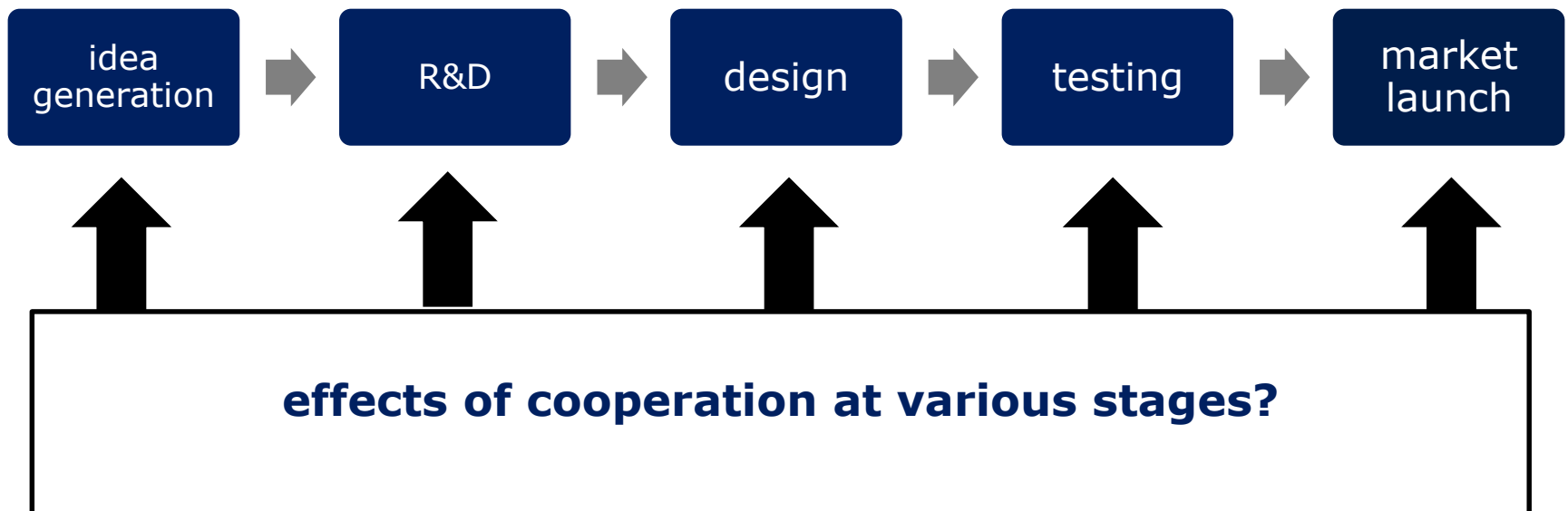


**Closed and open  
model of innovation**



# 1. Introduction and motivation

- strategic value of timing of a collaboration
- stage specific effects in high-tech and low-tech firms

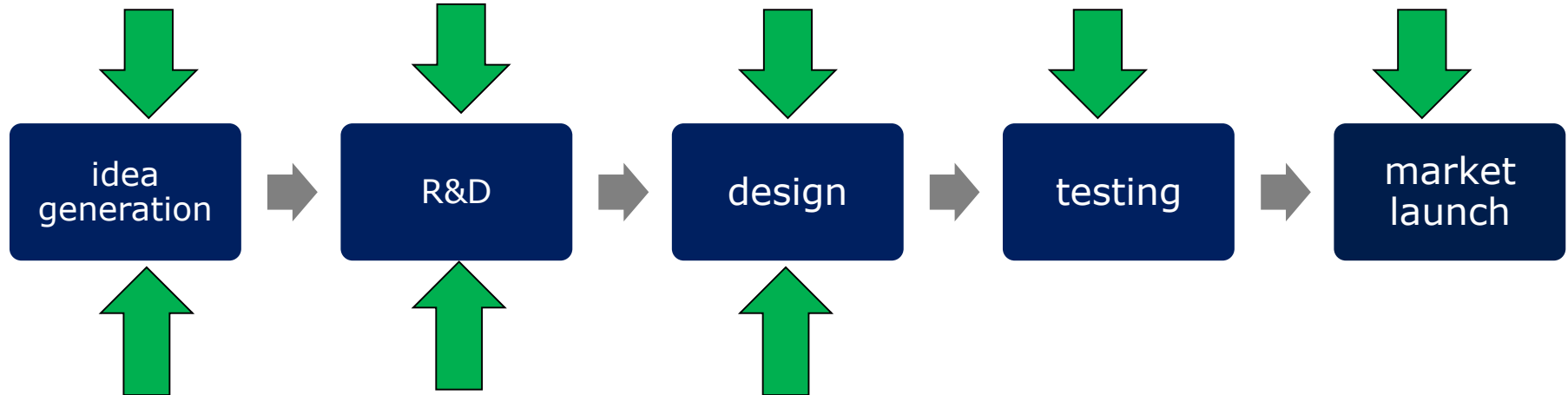


## 2. Theoretical baseline

- Resource-based-view of the firm: deployment and combination of resources as an explanation for firm **SUCCESS** (Barney 1991, Wernerfelt 1984)
- Combinations of knowledge from internal and external sources are difficult to imitate (Kogut & Zander 1992)
- for the integration of external knowledge a firm need **absorptive capacity** (Cohen & Levinthal 1990, Schmidt 2010, Lane & Lubatkin 1998)
- high-tech and low-tech firms have developed different internal capabilities which drive them into different **collaboration partners** (Grimpe & Sofka 2009; Czarnitzki & Thorwarth 2012; Hirsch-Kreinsen 2015)

## 2. Hypotheses – impact of customer collaboration

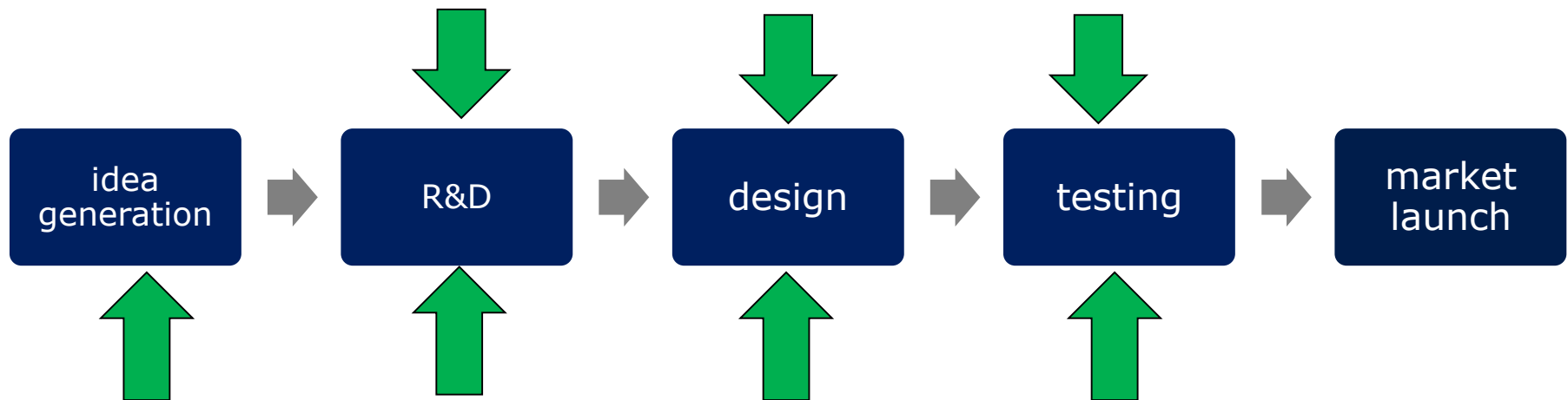
H1b: Collaboration with customers affects the innovative performance of **low-tech firms** at all stages positively.



H1c: Collaboration with customers affects the innovative performance of **high-tech firms** at the early and middle stages positively.

## 2. Hypotheses impact of supplier collaboration

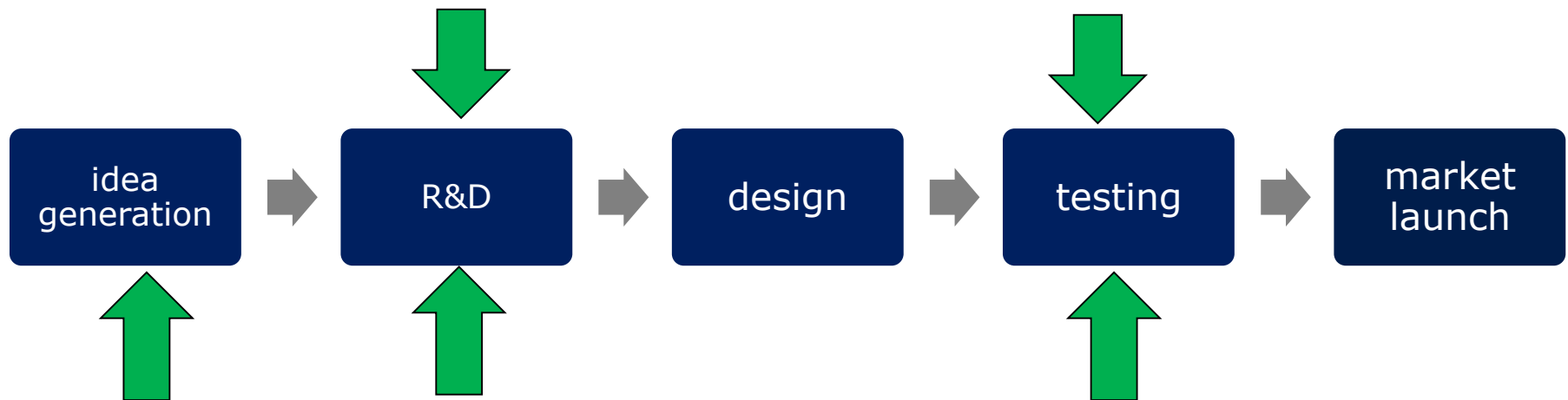
H1b: Collaboration with suppliers affects the innovative performance of **low-tech firms** at the middle stages positively.



H1c: Collaboration with suppliers affects the innovative performance of **high-tech firms** at the early and middle stages positively.

## 2. hypotheses impact of university collaboration

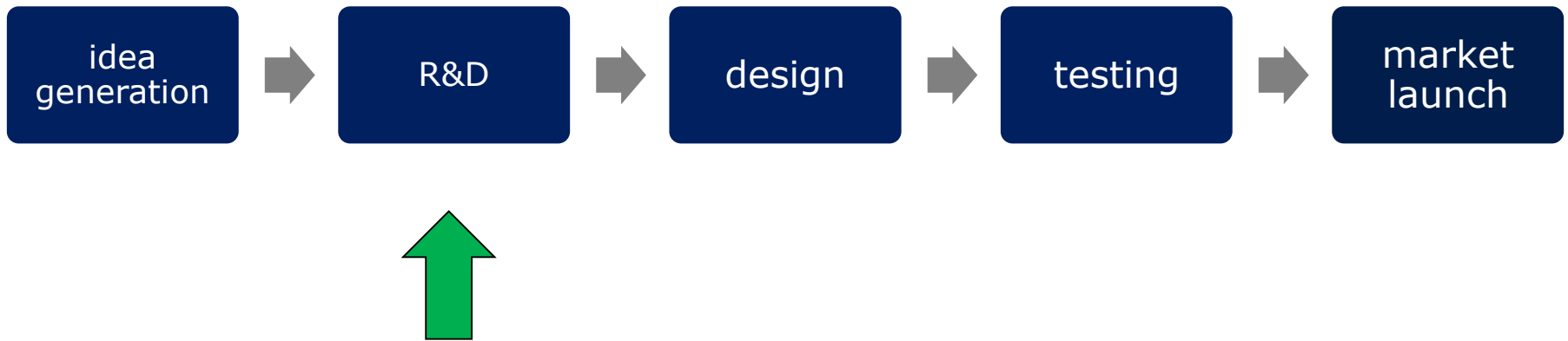
H3b: Collaboration with universities affects the innovative performance of **low-tech firms** at the middle stages positively.



H3c: Collaboration with universities affects the innovative performance of **high-tech firms** at the early and middle stages positively.



## 2. hypothese impact competitor collaboration



H3c: Collaboration with competitors affects the innovative performance of **high-tech firms** at the R&D stage positively.

## data and variables

- Mannheim Innovation Panel (MIP) survey waves 2008 + 2009
- dependent variable: share of innovative sales
- independent variables: cooperation with B2C + B2B customers, material suppliers + service firms, universities and competitors (0/1); stage specific dummies for each of the partners
- control variables: share of employees with university degree, log number employees, export intensity, east west dummy, industry dummies

# percentage of collaborating low-tech and high-tech firms

	idea generation	R&D	design	testing	market launch
<b>business customers</b>	36/ 59	19/37	17/39	22/ 45	26/54
<b>consumer customers</b>	12/22	4/4	4/10	5/10	7/14
<b>material suppliers</b>	15/33	19/40	9/19	13/30	5/10
<b>service firms</b>	11/21	12/32	15/39	15/30	10/22
<b>universities</b>	13/37	19/51	3/11	12/22	2/2
<b>competitors</b>	7/3	2/3	2/5	2/2	1/2

## 4. Results – basic effects

dependent variable: share of innovative sales

business customers	1.932*** (0.223)
consumer customers	0.482*** (0.185)
material suppliers	0.366* (0.192)
service firms	0.314* (0.179)
universities	1.193*** (0.189)
competitors	0.00842 (0.282)
Observations	950
Pseudo R-Square	0.159
Log-Likelihood	-1266
F-Wert	53.21
Prob > F	0

## 4. Results – stage specific effects in low-tech firms

	<b>idea generation</b>	<b>R&amp;D</b>	<b>Design</b>	<b>testing</b>	<b>market launch</b>
business customers	2.119*** (0.435)	0.829 (0.580)	1.668*** (0.549)	1.650*** (0.490)	2.057*** (0.435)
consumer customers	1.518*** (0.495)	2.807*** (0.926)	1.910* -1.071	1.202 (0.743)	2.104*** (0.651)
material suppliers	0.0130 (0.597)	1.318** (0.537)	-0.0792 (0.847)	0.991* (0.593)	-0.0343 (0.850)
service firms	0.0322 (0.565)	1.474*** (0.492)	1.548*** (0.476)	1.189** (0.508)	2.134*** (0.489)
universities	0.989 (0.655)	2.006*** (0.575)	1.688 -1.356	1.695** (0.747)	1.225 -1.322
competitors	1.238* (0.712)	-0.107 -1.529	0.215 -1.494	0.219 -1.631	-2.249 -2.833
Observations	620	620	620	620	620
Pseudo R-Square	0.0641	0.0514	0.0363	0.0460	0.0606
Log-Likelihood	-604	-612.2	-621.9	-615.7	-606.2
F-Value	9.424	7.350	4.313	6.266	9.856
Prob > F	0	0	5.79e-07	0	0

## 4. Results – stage specific effects in high-tech firms

	<b>idea generation</b>	<b>R&amp;D</b>	<b>design</b>	<b>testing</b>	<b>market launch</b>
business customers	0.324* (0.182)	0.158 (0.133)	0.301** (0.151)	0.124 (0.139)	0.153 (0.144)
consumer customers	0.122 (0.158)	-0.250 (0.283)	0.250 (0.252)	0.0981 (0.195)	0.00626 (0.221)
material suppliers	0.182 (0.148)	0.155 (0.139)	0.0929 (0.193)	0.153 (0.152)	-0.127 (0.313)
service firms	0.134 (0.159)	0.0951 (0.154)	0.220 (0.154)	0.279* (0.145)	0.309* (0.186)
universities	0.121 (0.139)	0.395*** (0.133)	0.206 (0.168)	0.223 (0.137)	0.184 (0.265)
competitors	-0.0316 (0.267)	-0.660 (0.442)	-0.384 (0.482)	0.521 (0.433)	-0.809** (0.370)
Observations	330	330	330	330	330
Pseudo R-Square	0.0296	0.0337	0.0300	0.0290	0.0252
Log-Likelihood	-524.8	-522.6	-524.6	-525.2	-527.2
F-Value	2.509	3.101	3.243	2.625	7.538
Prob > F	0.00277	0.000232	0.000125	0.00173	0

## 5. Conclusion

- main contributions:
- sheds light on stage specific impact of external collaboration
- shows differences between high-tech and low-tech firms
- shows that customers are an important partner for both types of firms
- early supplier integration does not pay off with regard to share of innovative sales
- university knowledge has a positive impact even for low-tech firms; they find ways to compensate for their lacking absorptive capacity

Thank you for your attention!  
Comments are welcome!



## Backup – robustness checks

- done:
  - variation in the time lag (1 year and 2 years)
  - weighting of the share of innovative sales by industry average
- planned:
  - variation of the border at which the sample is divided into high-tech and low-tech firms
  - different dependent variable for high-tech firms

## Backup – future research

- What is sourced in: knowledge or technology?
- partner characteristics
- management of the collaboration at different stages (e.g. contract vs. informal collaboration)
- differentiation between universities and research labs
- unexplainable effects
- partial inconsistencies in the results when a different time lag is used
- indirect effects

# 1. Introduction and motivation

- openness for external knowledge as a central part of the innovation activities of a firm (Cohen & Levinthal 1989, Chesbrough 2003, Love et al. 2011)
- supplement of internally existing knowledge; increase of recombination opportunities
- mixed empirical evidence for performance effects of inbound open innovation practices (for an overview: Tsai et al. 2009; Vanhaverbeeke et al. 2014)
- problematic: performance effects of open innovation are not very well understood

# 1. Introduction and motivation

- management of relationships with certain external partners (especially customers and suppliers) (e.g. Yenyurt et al. 2014; Bonner & Walker 2004)
- determinants of open innovation and the role of absorptive capacity (e.g. Berchicci 2013; Tether 2002)
- complementarity and substitution between internal and external R&D (e.g. Cassiman & Veugelers 2002,2006)
- issues of collaboration breadth; risk of over-collaboration (e.g. Laursen & Salter 2006; Berchicci 2013; Leiponen & Helfat 2010)