

An empirical study of environmental innovation: determinants and performance.

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Outline

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Background: practical relevance

- Social pressure and tightening environmental regulation place the reduction of the environmental impact on the industry agenda and stimulate firms to engage into **environmental innovation**.
- **Environmental innovation** refers to new or modified processes, techniques, practices, systems and products to avoid or reduce environmental impact (Kemp et al., 2001).
- Environmental innovation can be attractive for firms due to its potential to generate not only environmental but also **economic benefits** (Christmann, 2000; Eiadat et al., 2008; Rennings et al., 2006).
- This makes especially important the investigation of:
 - (1) **determinants** of environmental innovation
 - (2) the potential of environmental innovation to contribute to **business performance**.

Background: theoretical contribution

Prior research revealed a number of important determinants of environmental innovation (Rennings, 2000; Horbach, 2008):

- Demand side factors
- Supply side factors
- Regulatory/policy factors

However, prior research regarding determinants and performance implication of environmental innovation is not exhaustive:

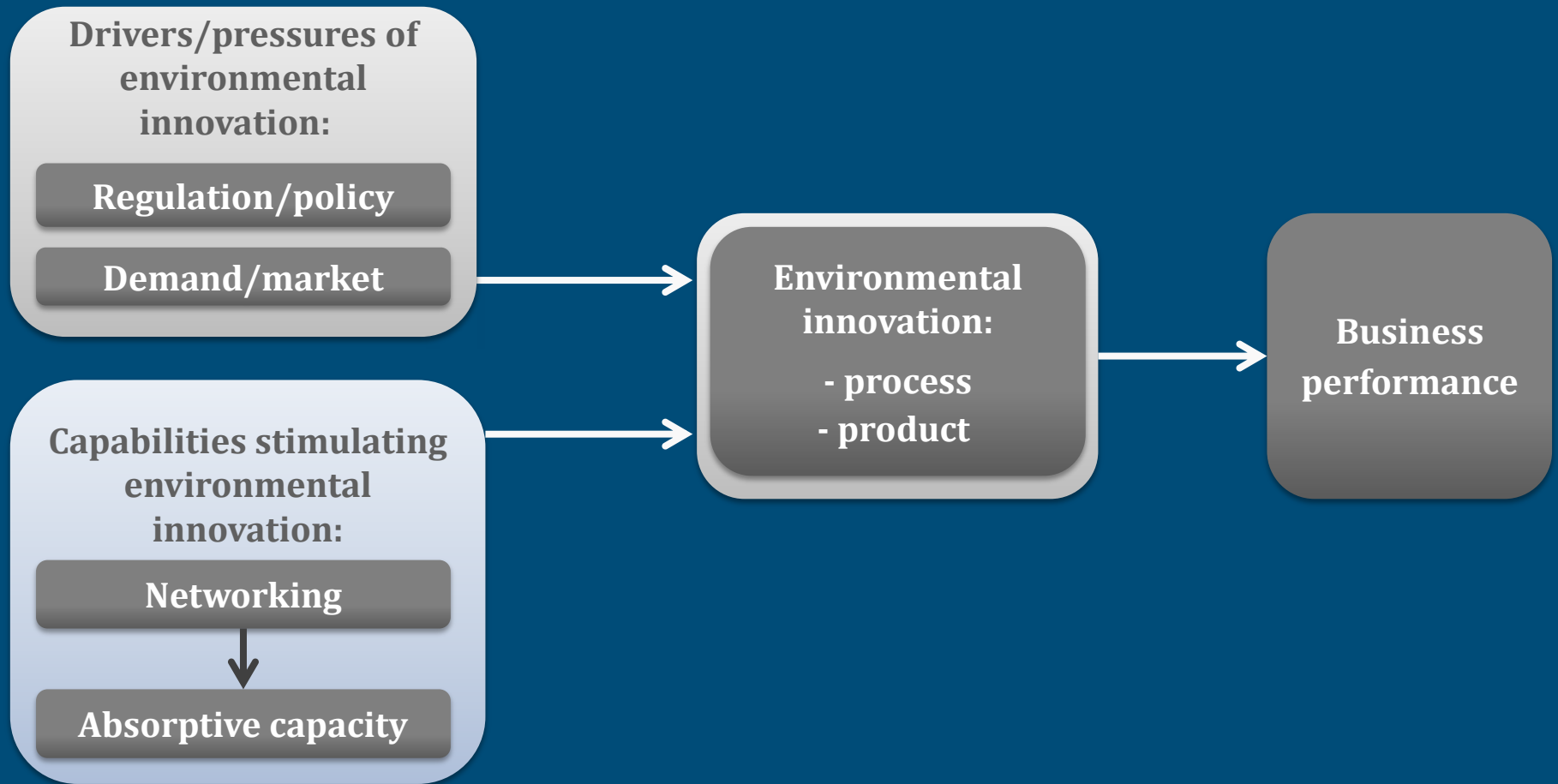
1. Scarce with respect to more recent developments in innovation theory: **networking** (De Marchi, 2012) and **absorptive capacity** (De Marchi, 2012; Delmas et al., 2011).
2. A lack of understanding regarding the contribution of environmental innovation to **business performance** (Lin et al., 2013)

Objective

The paper aims to:

- investigate the impact of **networking** and **absorptive capacity** on environmental innovation taking into account its already established determinants;
- explore the potential of environmental innovation to contribute to **business performance**;
- by analysing empirical data collected among Dutch **food and beverage** (F&B) firms.

Research model



Material and methods:

MATERIAL:

- Online survey conducted in 2013 among 473 firms, preceded by phone-calls.
- 135 respondents with >10 employees operating in the Dutch F&B industry
- 28.5% response rate
- Questions answered on 7-point Likert scale

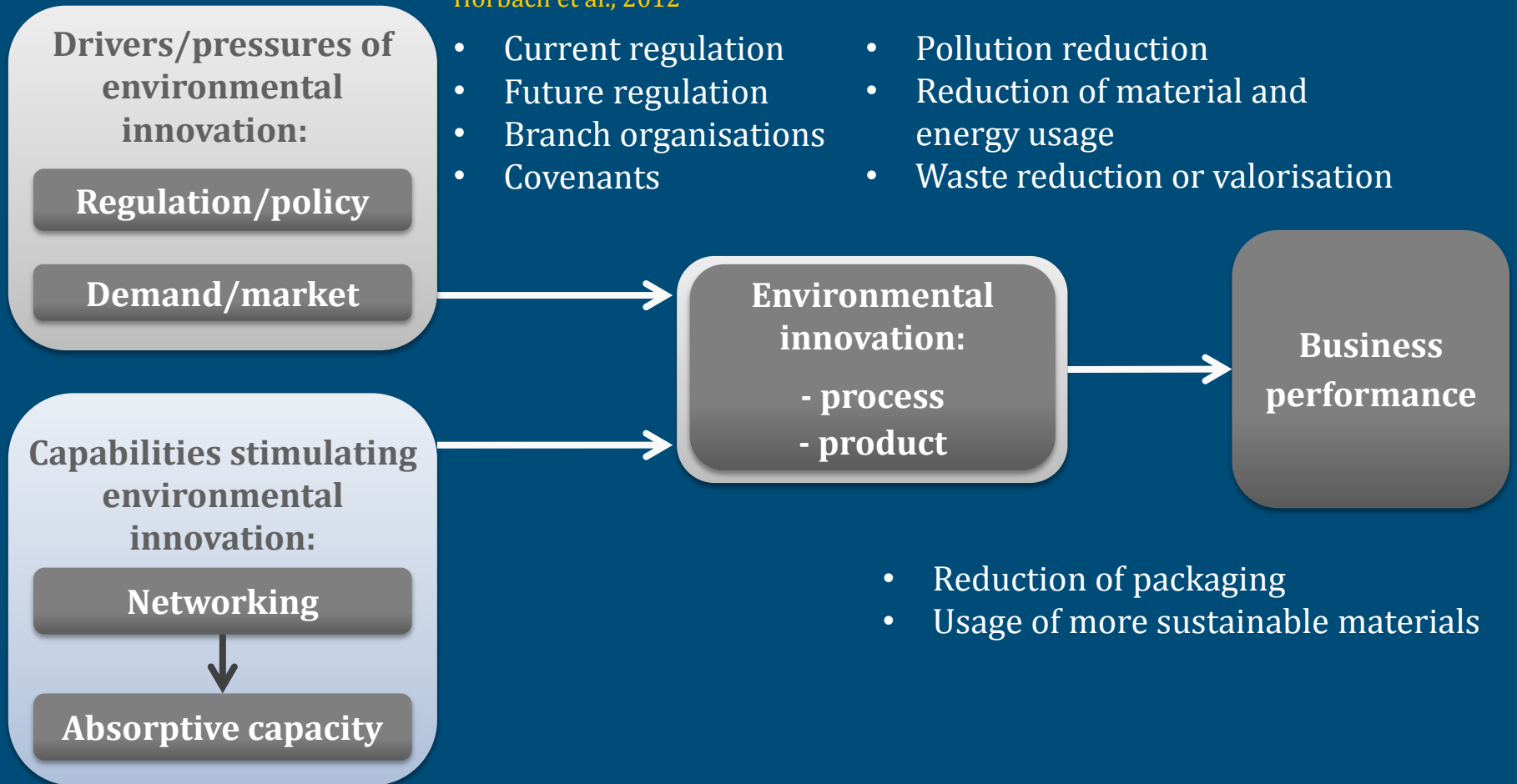
METHODS:

- Exploratory factor analysis (Varimax rotation)
- Confirmatory factor analysis and structural equation modelling (variance-based approach)
- Software SmartPLS 2.0 application (Ringle et al., 2005)
- Bootstrapping with 500 resamples (Chin and Newsted, 1999) to estimate significance of path coefficients and item loadings

Results: exploratory factor analysis and variables operationalization

Rennings, 2000
Horbach et al., 2012

Cheng and Shiu, 2012

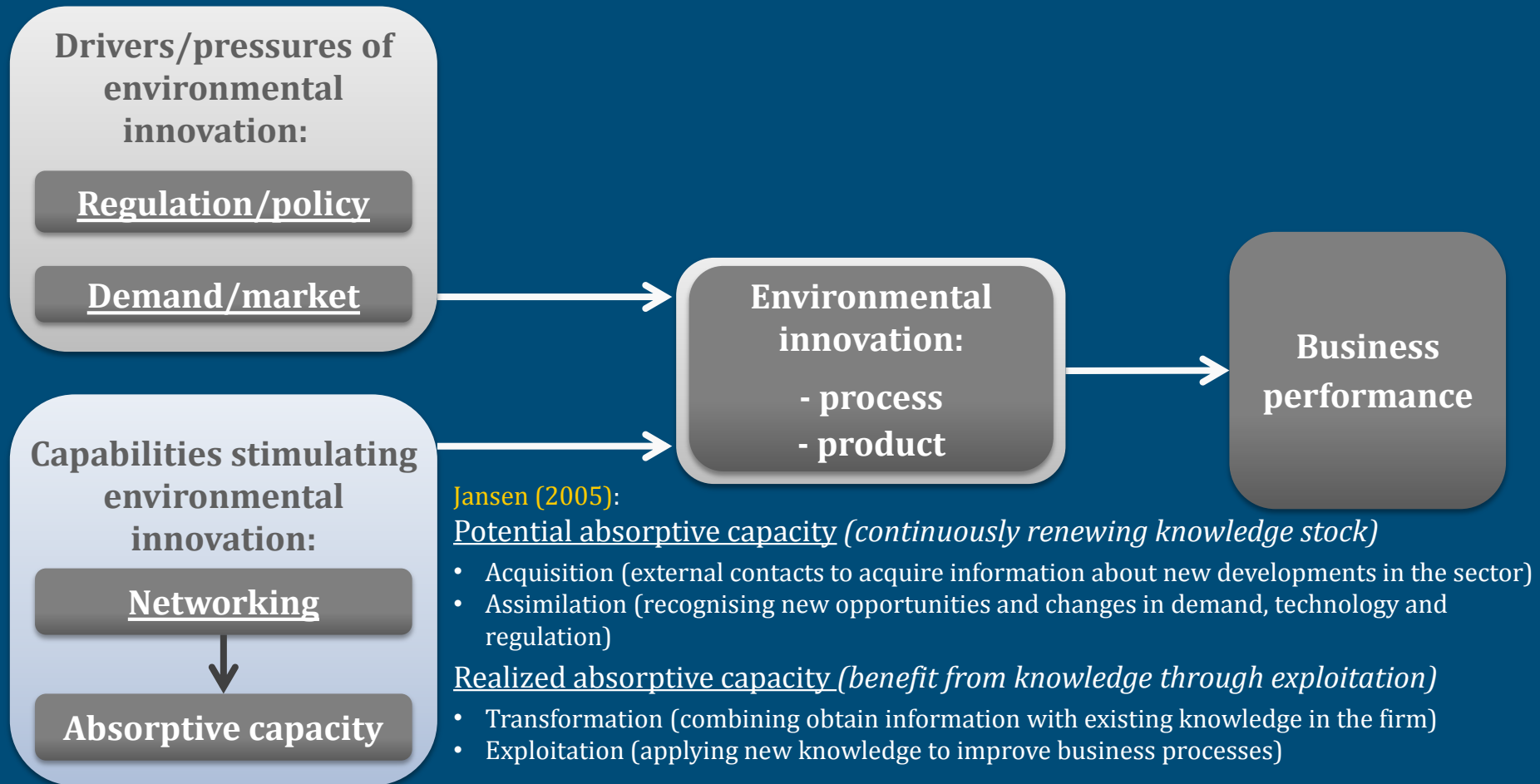


Results: exploratory factor analysis and variables operationalization

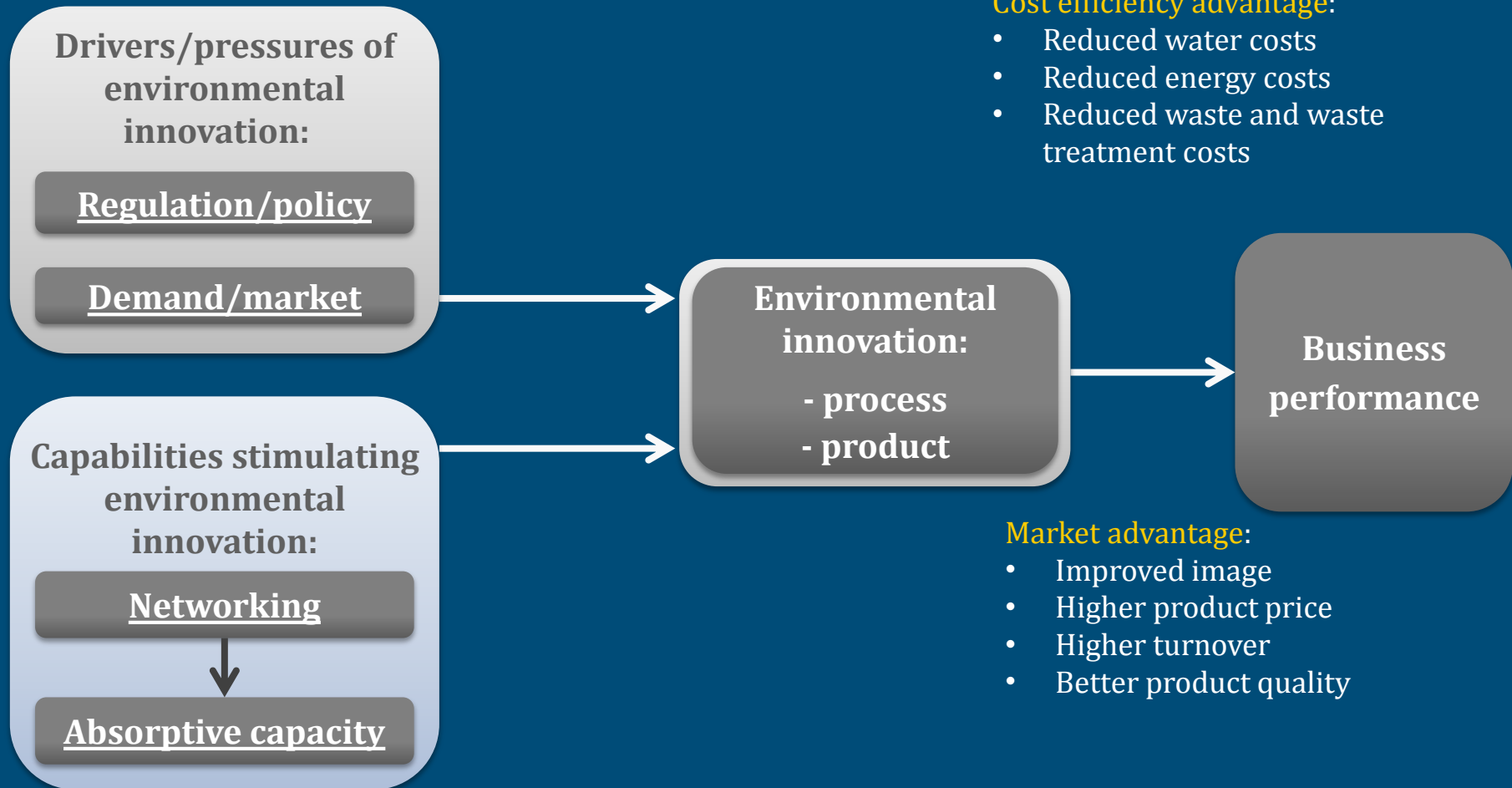
Rennings, 2000; Horbach et al., 2012



Results: exploratory factor analysis and variables operationalization



Results: exploratory factor analysis and variables operationalization



Results: confirmatory factor analysis for measurement model evaluation

- **Indicator reliability:** item loadings above 0.7 (Chin, 1998)
- **Internal consistency reliability:** measured with Composite reliability index (>0.7) (Fornell and Larcker, 1981; Bagozzi and Yi, 1998)
- **Convergent validity:** average variance extracted (AVE) is above 0.5 threshold (Fornell and Larcker, 1981; Chin, 1998)

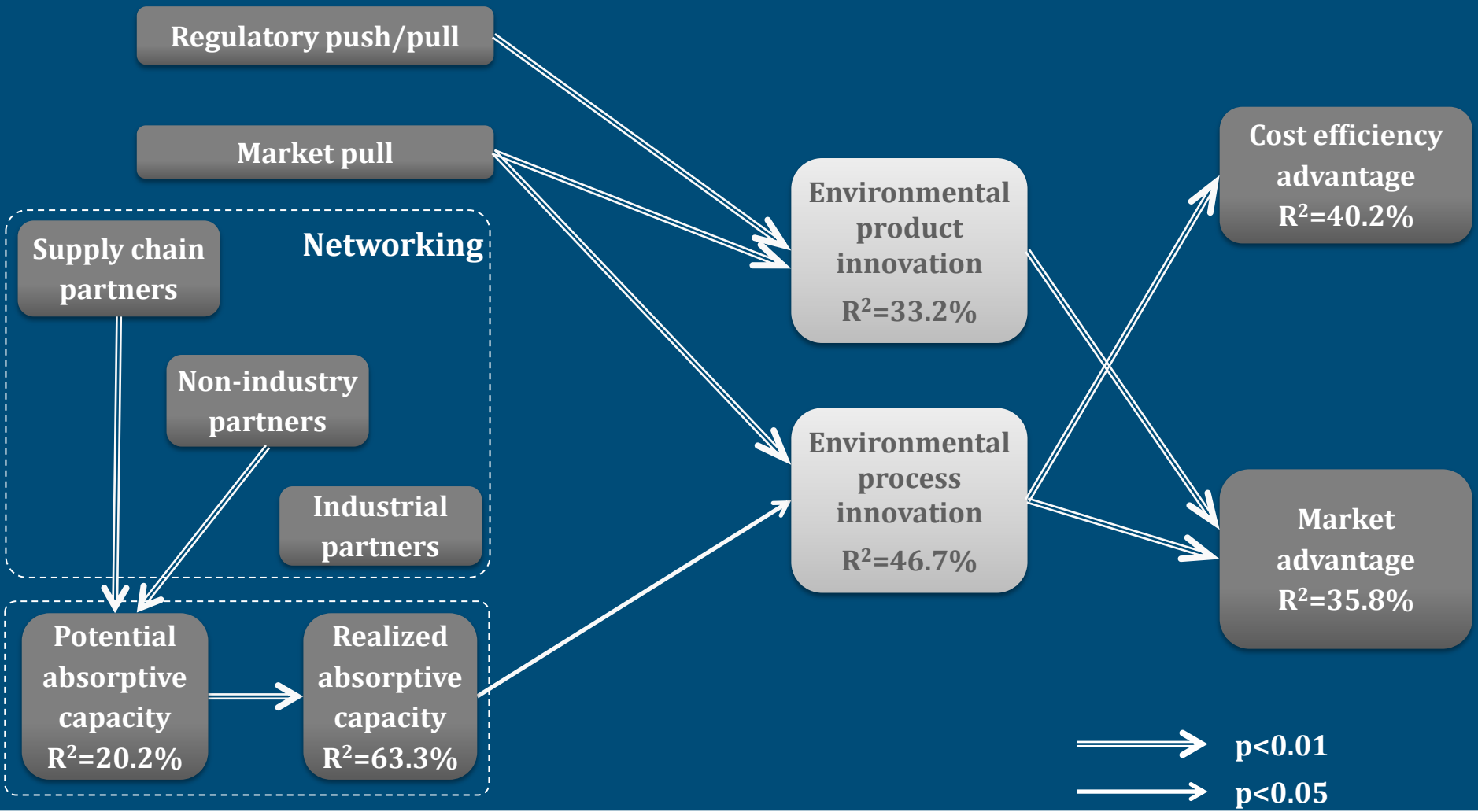
	Lowest loading	Composite Reliability	Average variance extracted
Environmental process innovation	0.73	0.88	0.64
Environmental product innovation	0.82	0.84	0.72
Regulation/policy	0.72	0.85	0.58
Demand/market	0.67	0.90	0.64
Networking: supply chain partners	0.91	0.92	0.85
Networking: industry partners	0.77	0.89	0.73
Networking: non-industry partners	0.72	0.92	0.71
Cost efficiency advantage	0.79	0.90	0.75
Market advantage	0.78	0.90	0.69

Results: confirmatory factor analysis for measurement model evaluation

- **Discriminant validity:** cross-loadings examination and Fornell-Laracker criterion (comparing AVE with construct correlation with other latent variables)

		1	2	3	4	5	6	7	8	9
1	Environmental process innovation	0.80								
2	Environmental product innovation	0.48	0.85							
3	Regulation/policy	0.42	0.43	0.76						
4	Demand/market	0.62	0.46	0.48	0.80					
5	Networking: supply chain partners	0.38	0.21	0.28	0.47	0.92				
6	Networking: industry partners	0.39	0.27	0.52	0.39	0.52	0.85			
7	Networking: non-industry partners	0.50	0.19	0.52	0.37	0.52	0.62	0.84		
8	Cost efficiency advantage	0.57	0.31	0.31	0.43	0.31	0.32	0.39	0.87	
9	Market advantage	0.49	0.52	0.40	0.60	0.30	0.37	0.27	0.46	0.83

Results: structural model estimation



Conclusions and managerial implications

Does environmental innovation pay off?

- Our results show that environmental innovation leads to business performance improvements both in terms of cost savings and market advantages.
- Environmental product innovation is recognised by customers/consumers and consequently converted into better firm image, higher quality and price, and the market share.
- Environmental process innovation is associated mostly with cost savings but also leads to market advantages .

Conclusions and managerial implications

What stimulates environmental innovation?

- We found that environmental (process) innovation is positively influenced by absorptive capacity (the firm's ability to recognise the value of new external information, assimilate it and apply to business processes).
- Absorptive capacity is stimulated by networking with supply chain partners and non-industry actors.
- The factors associated with market demand and social awareness have a strong and positive influence on both environmental process and product innovation.
- Environmental regulation and public policy strongly influence environmental product innovation, although their effect on environmental process innovation is not significant.

Theoretical contributions

- 1. The study proves evidence to the high potential of environmental innovation to contribute to firms' business performance.**
- 2. The results confirm the necessity to include the absorptive capacity and networking capabilities into analysis of determinants of environmental innovation.**

Acknowledgements

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