19. Techno-Ökonomie-Forum

Forschungskolloquium

Avoiding lock-in in technology firms – a competence based approach

Harald Wipfler

5.4.2016

Agenda

- Motivation and research objectives
- Theoretical foundation
- Research design

Motivation and Research Objectives

Problem

- Firms operate in fast changing environments and face threats associated with technological change. (e.g. D'Aveni, 1998; Teece, 2007)
- To cope with changing technologies is a key factor for organizational success. If firms are inflexible to leave an inefficient state they run the risk of a lock-in-based failure.
- Firms have to avoid lock-in situations in the context of technological change.

Relevance

- Better understanding for path dependent developments

  *„[…] there **is still a research gap regarding how to break** an already evolved path to purposefully create a new path.“*
  (Cordes-Berszinn, 2013, p.32)

  “*Unfortunately **the concept is not understood well** enough to permit meaningful progress with strategies for path creation.*”
  (Spiegel & Marxt, 2015, p.267)

- Operationalisation of dynamic capabilities

  *“Although largely discussed, the Capability Based View (CBV) related in literature **is not clear about how to define and to develop capabilities**. […] it is not yet applied either to the new technologies companies or as business model evolution tool.”*
  (Gusberti et al., 2013, p.131)

Research Questions

RQ 1: What leads to lock-in situations in the context of technology shift?

RQ 1.1: How do firms perceive lock-in situations in the context of technology shift?

RQ 1.2: Which factors cause lock-in situations in the context of technology shift?

RQ 2: How can firms avoid lock-in situations context of technology shift?

RQ 2.1: Which organizational capabilities help to prevent lock-in situations?

RQ 2.2: Which organizational capabilities help to overcome existing lock-in situations and to break existing paths?

Research Aims

- Contribute to advance theory:
  - Describe and better understand the phenomenon of lock-in in the context of technology shift
  - Identify drivers leading to path dependent developments
- Contribute to advance management practice:
  - Apply organizational capabilities in the context of technology management
  - Provide guidelines to avoid lock-in or to break existing lock-in situations

Theoretical foundation

Research Perspectives & Major Authors

Development of Technologies
- Utterback & Abernathy, 1975
- Dosi, 1982, 1997
- Anderson & Tushman, 1990

Management of Technology
- Burgelman et al., 2009
- Schuh & Klappert (eds.), 2011
- Cetindamar et al., 2016

Disruptions
- Christensen, 1997
- Danneels, 2004
- Bessant et al., 2005

Technology Management

Path Dependence Research
- David, 1985
- Liebowitz & Margolis, 1995
- Garud & Karnøe, 2001
- Sydow et al., 2009

Context of Technology
- Arthur, 1989
- Speith, 2008
- etc.

Path Dependence Research

Lock-in Management

Capability Based View

CBV
- Prahalad & Hamel, 1990
- Barney, 1991
- Leonard-Barton, 1992
- Teece et al. 1997; 2007
- Dosi, Nelson & Winter (eds.), 2000
- Schreyögg & Eberl, 2015

Absorptive Capacity
- Cohen & Levienthal, 1990

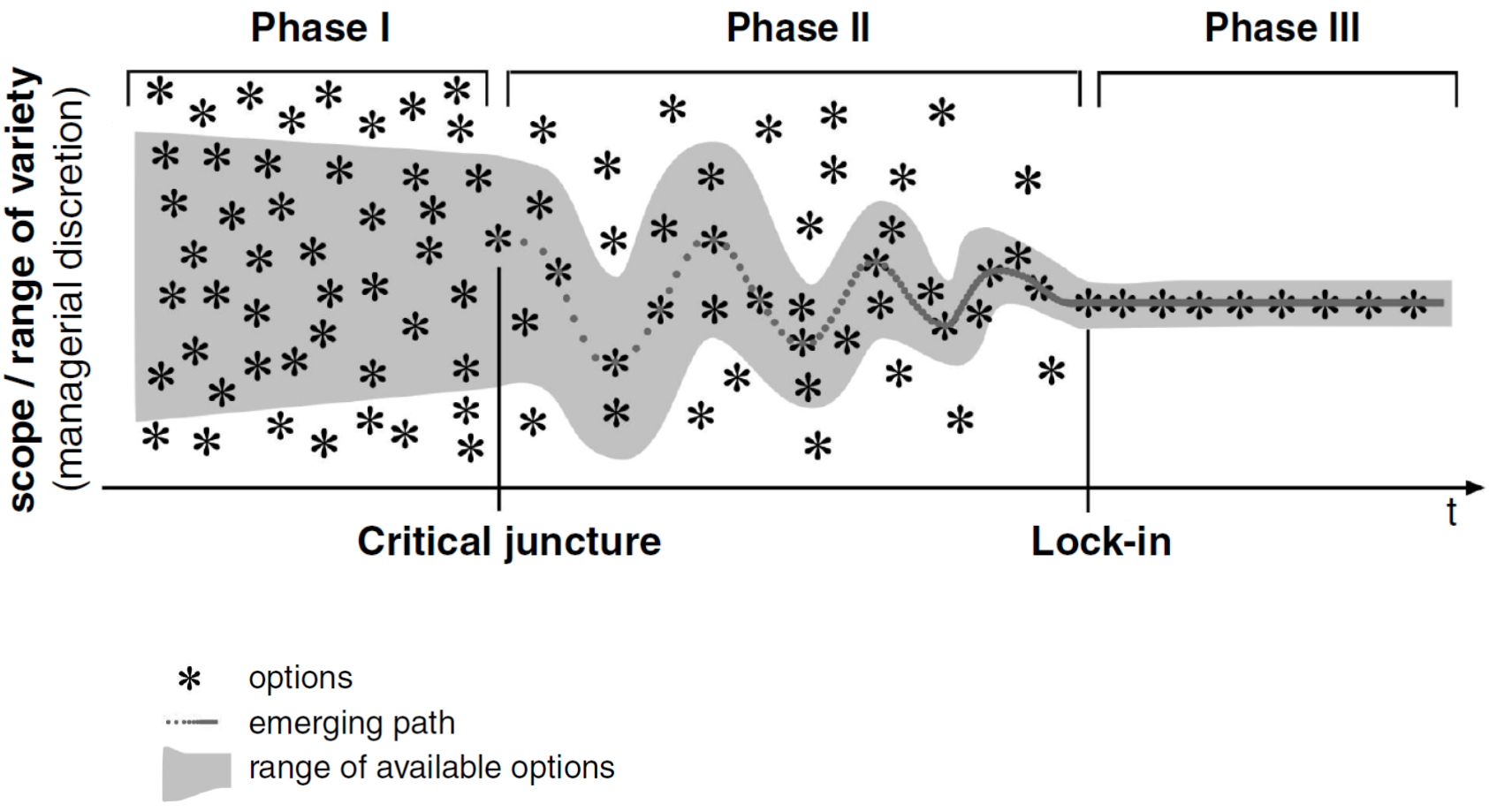
Capability Based View

- Organizational capabilities are valuable
- Reliable action patterns
- Inherent tendency to inertia
- Dynamic capabilities to explain long-term competitive advantage (e.g. Teece et al., 1997)
- No consensus on the definition and the operationalization of dynamic capabilities (e.g. Noori et al., 2012)

Path Dependence Research

- Economic historians (e.g. David, 1985; Arthur 1990)
- Question rational choice model
- Self-reinforcing, non-ergodic, history-dependent processes
- Implications: Non-predictable, inflexible, inefficient
- Path dependence occurs in various contexts:
  - Institutional/economic (North, 1990, Pierson, 2000)
  - Behavioral (Barnes, 2012)
  - Cognitive (Rothman & Koch, 2014)
  - Organizational (Sydow et al., 2009)
  - Strategic (Koch, 2007)
  - Innovation (Thrane et al., 2000)
  - Technological (Schubert et al., 2013; Greve & Seidel, 2015)

Path Dependence



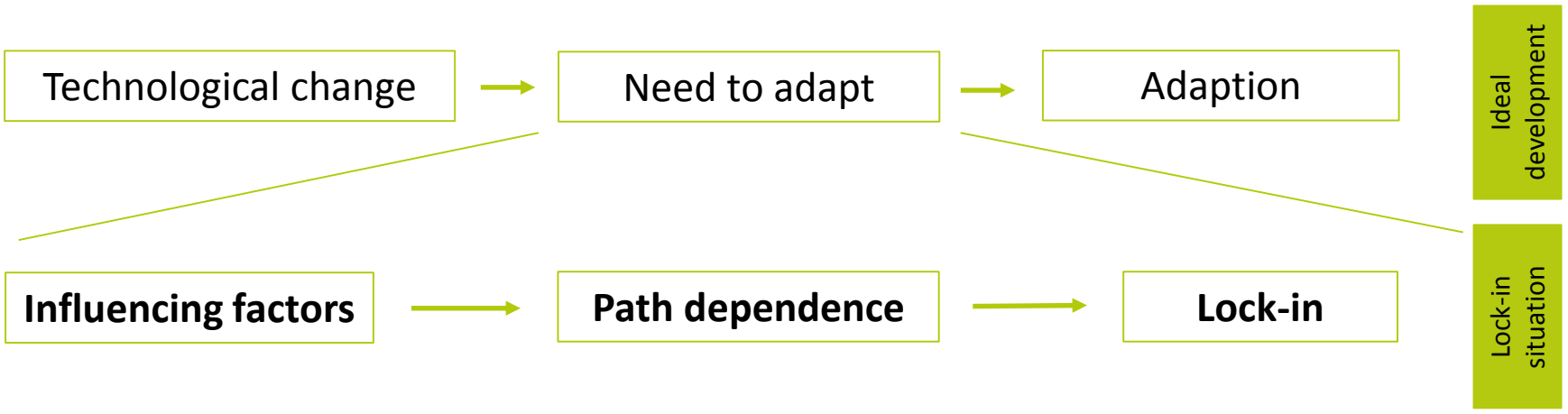
Source: Sydow et al., 2009, p. 692

Different Manifestations

	Description	Examples
Technological paths	Particular choices, events and expectations determine the development of new technological paths. Small initial differences are amplified until technologies with an early lead dominate, possibly over equally good or better technologies.	• Diffusion of wind power technology (Simmie et al., 2014) • Diffusion of innovative production technologies (Greve & Seidel, 2015) • Technological paths in semiconductor manufacturing (Schubert et al., 2013)
Technological standards	The value of a certain technology increases when conforming to widespread technological standards. Network externalities are an important source for increasing returns and a path-dependent development.	• Development of operating systems (Heinrich, 2014) • IT-Infrastructure path dependence (Fürstenau, 2014)
Innovation lock-in	Innovation lock-in effects limit the ability to innovate. Since many of the existing dominant technological trajectories have detrimental environmental effects, path dependence is critical in the context of eco-innovations.	• Path dependence in firms‘ innovation processes (Thrane et al., 2010) • Innovation path creation for hybrid-electric cars (Dijk & Yarime, 2010) • Automotive modal lock-in (Briggs, 2015) • Lock-in an path dependence in eco-innovations (Cecere et al., 2014).
Business model dilemma	Business model dilemma as a consequence of technological shifts (Tongur & Engwall, 2014)	• BM for sustainable technologies (Bohnsack et al, 2014)

Research Design

Conceptual Framework

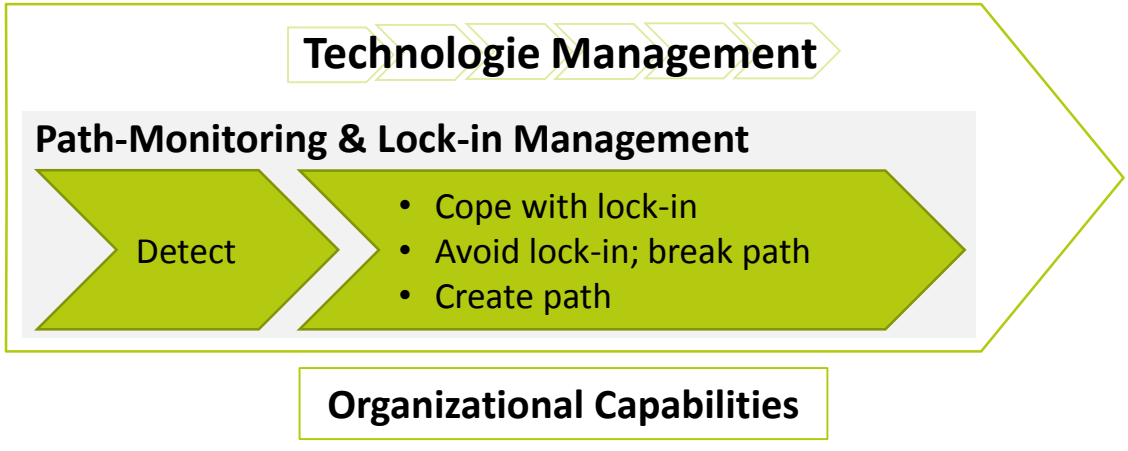


Factors influencing lock-in

- Technological interrelatedness
- Cognitive frames
- Investments

Self reinforcing processes

- Economies of scale
- Network externalities
- Learning effects
- Adaptive expectations
- Coordination effects
- Complementary effects



Sources: Spiegel & Marxt, 2015; Sydow & Schreyögg, 2013

Research Design (1/2)

Aspect	Approach
Research strategy	• Case studies: exploratory method; ensuring strong qualitative base; reducing the risk of oversimplification • Multiple case studies: clarify idiosyncratic findings; more robust
Sample and case selection	• Theoretical sampling logic • Cases chosen for replication, extension, contrary replication and elimination of alternative explanations • For higher level of generalizability: companies from different industries and value chain position
Data collection instruments	• Guided semi-structured interviews: to investigate strategic phenomena in which informants reflect on their everyday practices
Additional data sources	• Additional documents (e.g. company reports, product descriptions, articles) to illustrate/underline cases
Key informants	• Persons with expert knowledge in the field of technology management and/or strategic management

Source: Eisenhardt und Graebner, 2007, p.27; Eisenhardt, 1989, p.536

Research Design (2/2)

Aspect	Approach
Data reduction and coding	• Content analysis according to Mayring (2010) and Gioia et al. (2013)
Measures to ensure research quality	• Reliability: Precise documentation; traceability of research process; coding of transcript with MAXQDA • Construct Validity: use several informants; various data collection instruments; review processes; discussion with different researchers and experts • External Validity: companies from different industries; replication logic
Data triangulation	• Additional data sources: external perspectives of (technology) consulting

Source: Yin, 2009

Research Sequence

Literature Review

- Literature review
- Preliminary discussion with practitioners

Outcome

- Literature analysis
- Research questions
- Theoretical considerations
- Interview guide
- Case selection

- Manifestations of Path Dependent Developments in Technology and Innovation,
  Poster presentation, ISPIM 2015, Budapest
- Comparing Conceptions of Dynamic Capabilities
  Prof. Schreyögg, 2015
  35th Int. Conference on Organizational Science Development, 2016
- Avoiding Technological Lock-in
  35th Int. Conference on Organizational Science Development, 2016

Research Sequence

Literature Review → **Case Studies** (First Phase)

- Literature review
- Preliminary discussion with practitioners

Outcome

- Literature analysis
- Research questions
- Theoretical considerations
- Interview guide
- Case selection

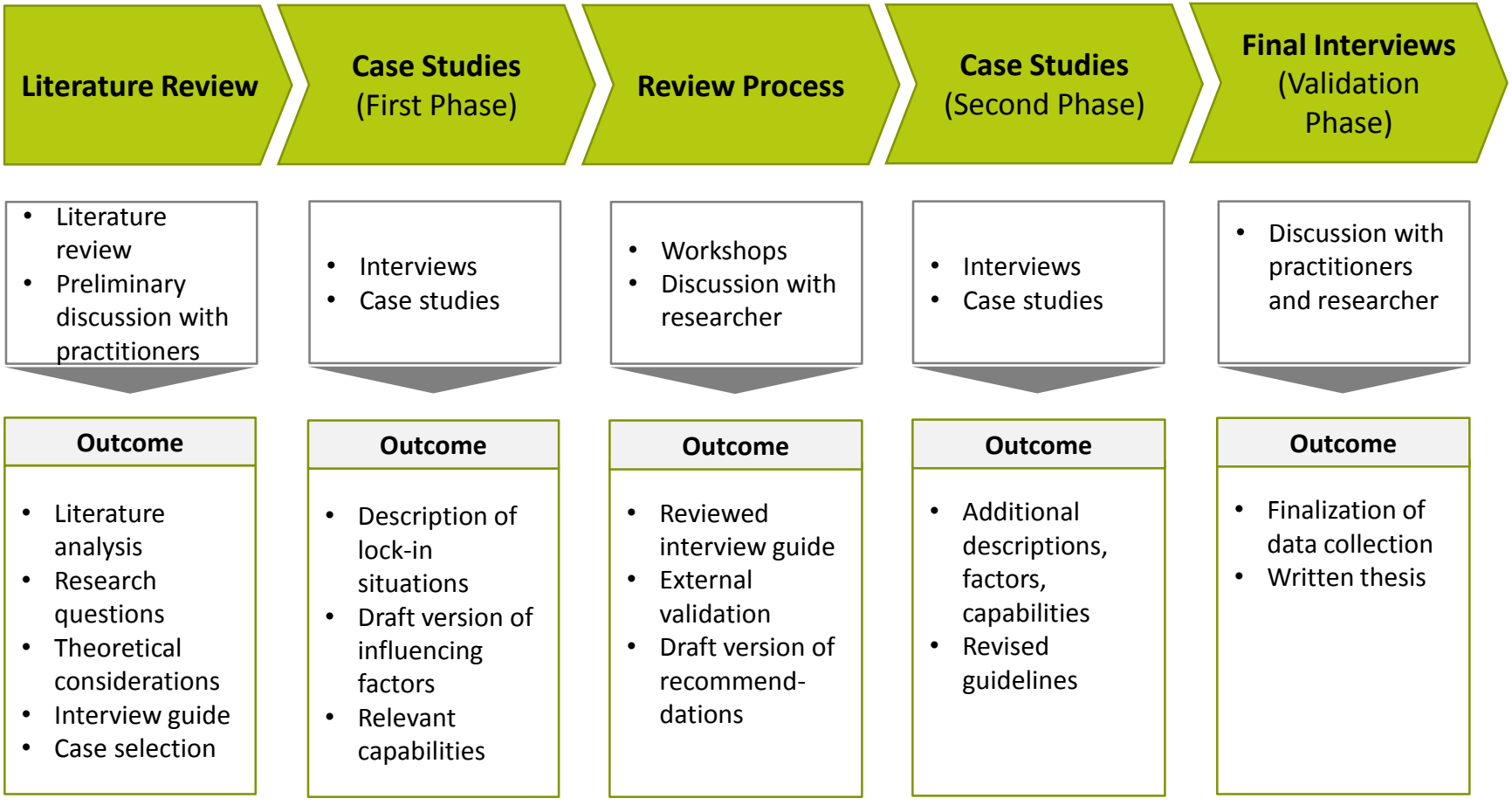
- Interviews
- Case studies

Outcome

- Description of lock-in situations
- Draft version of influencing factors
- Relevant capabilities

- Doctoral Colloquium EURAM 2016
- R&D Management Conference 2016 PhD Colloquium

Research Sequence



Next Steps

- Interviews (Phase 1)
- EURAM Doctoral Colloquium, EURAM 2016, Paris
- R&D Management Conference 2016, Cambridge
  - Participation PhD Colloquium
  - „How Path-dependent Developments Hinder Technological Change And Innovation – A Literature Review“

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Backup

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