Strategic Management in Emerging Industries: Evidence from the Renewable Energy Industry

D I S S E R T A T I O N
of the University of St. Gallen,
School of Management,
Economics, Law, Social Sciences
and International Affairs
to obtain the title of
Doctor of Philosophy in Management

submitted by

Melanie Katharina Oschlies

from

Germany

Approved on the application of

Prof. Dr. Rolf Wüstenhagen

and

Prof. Dr. Günter Müller-Stewens

Dissertation Nr. 4099

KSD Zürich, 2013
The University of St. Gallen, School of Management, Economics, Law, Social Sciences and International Affairs hereby consents to the printing of the present dissertation, without hereby expressing any opinion on the views herein expressed.

St. Gallen, October 29, 2012

The President:

Prof. Dr. Thomas Bieger
“Uncertainty is a quality to be cherished, therefore – if not for it, who would dare to undertake anything?”

Auguste de Villiers de L'Isle-Adam
Preface

Writing this dissertation was an exciting journey. It was challenging and accompanied by ups and downs, but most of all it was a rewarding adventure into the world of academia that I would not want to miss. I enjoyed (nearly) every moment of this project that means much more to me than the following pages comprise. This work could however, not have been completed without the help of several people. I would like to take the opportunity to say a big THANK YOU to all of them here.

Firstly, I would like to express my gratitude to my doctoral advisor Prof. Dr. Rolf Wüsthenhagen for his inspiring and unequaled enthusiasm. His support, input, and guidance along the way provided me in the right moments with the right ideas to complete this work. I also thank my co-advisor Prof. Dr. Günter Müller-Stewens for his instructive help and advice. Further, I would like to thank the entire team at the Chair for Management of Renewable Energies at the University of St. Gallen for their support, experience sharing, and the fun moments we had. There are moreover three close friends that encouraged me during the highs and lows of this project: thank you, Angelika, Nina, and Anja. Valerie, Friederike, and Johanna – we started as “companions in research” and became friends – thanks for inspiring me and helping me to keep up my motivation.

Moreover, I owe gratitude to Bain & Company Switzerland, for the support I received before and during this dissertation project. The same applies to the “Stiftung der deutschen Wirtschaft” which supported me throughout my studies.

Finally, I am deeply grateful for the unconditional support I received from Maximilian Brandt and my parents, Annegret and Günter Oschlies. Max, thank you for always being there for me – no matter what. Annegret und Günter, the support I have received from you throughout my life is infinitely valuable to me. You have encouraged me and helped me in every way possible. To thank you for all this, I dedicate this thesis to you.

Zurich, October 2012

Melanie Oschlies
# Table of Contents (short version)

Table of Contents (short version) .................................................................................. III
Table of Contents ............................................................................................................. V
List of Figures .................................................................................................................. VIII
List of Tables .................................................................................................................. IX
List of Abbreviations ........................................................................................................ X
Abstract ........................................................................................................................ XI
Zusammenfassung ............................................................................................................. XII

1 Introduction ................................................................................................................... 1
  1.1 Background and Problem Statement .................................................................. 2
  1.2 Theoretical Foundation and Research Framework ........................................... 6
  1.3 Objectives and Research Questions ..................................................................... 8
  1.4 Methodological Approach .................................................................................. 10
  1.5 Theoretical and Practical Contribution .............................................................. 10
  1.6 Thesis Outline ..................................................................................................... 11
  1.7 References .......................................................................................................... 15

  2.1 Introduction .......................................................................................................... 20
  2.2 Theory and Hypotheses Development ................................................................ 22
  2.3 Method .................................................................................................................. 30
  2.4 Results .................................................................................................................... 34
  2.5 Discussion ............................................................................................................. 40
  2.6 Conclusion and Implications for Further Research ............................................ 41
  2.7 References .......................................................................................................... 44
  2.8 Appendix: Profiles of Sample Companies ........................................................... 51

3 Second Paper: Performance Consequences of Fit between Financials and Strategy Descriptions in Emerging Industries: Implications for Business Model Design...... 54
  3.1 Introduction .......................................................................................................... 55
  3.2 Business Model Consistency and Firm Performance in Emerging Industries ...... 57
  3.3 Method .................................................................................................................. 61
  3.4 Results .................................................................................................................... 69
  3.5 Discussion ............................................................................................................. 73
  3.6 Conclusion ............................................................................................................. 75
  3.7 References .......................................................................................................... 77

4 Third Paper: Diversification into Emerging Industries: An Event Study on Investor Reaction .......................................................................................................................... 81
### 4.1 Introduction ................................................................. 82
### 4.2 Theoretical Background and Hypotheses Development .......... 84
### 4.3 Method ........................................................................ 89
### 4.4 Results ........................................................................ 96
### 4.5 Discussion .................................................................... 102
### 4.6 Implications and Concluding Remarks .......................... 103
### 4.7 Appendix: Market Sentiment Variable .......................... 105
### 4.8 References .................................................................... 106

### 5 Discussion and Conclusions .............................................. 111
#### 5.1 Summary of Findings and Contribution to Theory ........... 111
#### 5.2 Implications for Managers, Investors, and Policy Makers ... 115
#### 5.3 Limitations and Implications for Further Research .......... 117
#### 5.4 References .................................................................... 119

### 6 Appendix ........................................................................... 121
# Table of Contents

Table of Contents *(short version)* .......................................................... III  
Table of Contents .................................................................................. V  
List of Figures ....................................................................................... VIII  
List of Tables ......................................................................................... IX  
List of Abbreviations ........................................................................... X  
Abstract .................................................................................................. XI  
Zusammenfassung .................................................................................. XII

## 1 Introduction .................................................................................. 1

1.1 Background and Problem Statement ........................................... 2  
  1.1.1 Strategic Management in Emerging Industries .................. 2  
  1.1.2 The Research Context of the Renewable Energy Industry ... 3  
  1.1.3 Strategic Challenges in the Renewable Energy Industry ... 4  

1.2 Theoretical Foundation and Research Framework ..................... 6

1.3 Objectives and Research Questions .......................................... 8

1.4 Methodological Approach ......................................................... 10

1.5 Theoretical and Practical Contribution ..................................... 10

1.6 Thesis Outline ............................................................................. 11

1.7 References .................................................................................. 15


2.1 Introduction .................................................................................. 20

2.2 Theory and Hypotheses Development ........................................ 22
  2.2.1 Boards as Drivers and Preventing Forces for Strategic Renewal ... 23  
  2.2.2 Demographic Factors, Network Position, and Status-Quo Bias ... 23  
  2.2.3 The Reinforced Status-Quo Bias: Board Dynamics ............... 26  
  2.2.4 The Case of Swiss Electric Utility Companies and the Effect of Environmental Turbulence on Status-Quo Biases ........................................ 27  

2.3 Method ......................................................................................... 30
  2.3.1 Data Collection and Sample ............................................... 30  
  2.3.2 Dependent Variable .......................................................... 31  
  2.3.3 Independent Variables ...................................................... 32  
  2.3.4 Control Variables ............................................................ 33

2.4 Results ......................................................................................... 34

2.5 Discussion ................................................................................... 40

2.6 Conclusion and Implications for Further Research .................. 41

2.7 References .................................................................................. 44

2.8 Appendix: Profiles of Sample Companies .................................. 51
3 Second Paper: Performance Consequences of Fit between Financials and Strategy Descriptions in Emerging Industries: Implications for Business Model Design........ 54

3.1 Introduction .............................................................................................................. 55
3.2 Business Model Consistency and Firm Performance in Emerging Industries .... 57
  3.2.1 The Role of the Industry Context for Consistency-Performance Relationships .... 58
  3.2.2 The Role of Firm Growth for Consistency-Performance Relationships in Emerging Industries ................................................................. 59
  3.2.3 The Role of Business Model Theme for Consistency-Performance Relationships in Emerging Industries ................................................................. 59
3.3 Method ...................................................................................................................... 61
  3.3.1 Data Collection .................................................................................................. 61
  3.3.2 Dependent Variable .......................................................................................... 62
  3.3.3 Independent Variables ...................................................................................... 63
  3.3.4 Control Variables .............................................................................................. 65
  3.3.5 Analytic Procedure ........................................................................................... 65
3.4 Results ....................................................................................................................... 69
  3.4.1 Descriptive Statistics ....................................................................................... 69
  3.4.2 OLS Regressions ............................................................................................... 69
3.5 Discussion ................................................................................................................... 73
3.6 Conclusion ............................................................................................................... 75
3.7 References ............................................................................................................... 77

4 Third Paper: Diversification into Emerging Industries: An Event Study on Investor Reaction ........................................................................................................... 81

4.1 Introduction ............................................................................................................... 82
4.2 Theoretical Background and Hypotheses Development ......................................... 84
  4.2.1 Investor Reactions to Diversification: Do Investors Value Strategic Foresight? .... 85
  4.2.2 Diversification Mode and Timing: Do Investors Value the Potential to Create a Competitive Advantage? ................................................................. 87
  4.2.3 Decision Context: Does the Market Sentiment Reflect on Investors’ Reactions? ..... 88
4.3 Method ....................................................................................................................... 89
  4.3.1 Data Collection ................................................................................................. 90
  4.3.2 Analytic Procedure ........................................................................................... 92
4.4 Results ....................................................................................................................... 96
4.5 Discussion ................................................................................................................ 102
4.6 Implications and Concluding Remarks ..................................................................... 103
4.7 Appendix: Market Sentiment Variable .................................................................... 105
4.8 References ............................................................................................................... 106

5 Discussion and Conclusions ...................................................................................... 111

5.1 Summary of Findings and Contribution to Theory .................................................. 111
5.2 Implications for Managers, Investors, and Policy Makers ....................................... 115
List of Figures

Figure 1: Energy system value chain ................................................................. 4
Figure 2: Research framework ............................................................... 7
Figure 3: Papers located in research framework ........................................... 12
Figure 4: Board member network and ego-network of one board member 2002 .... 25
Figure 5: Hypotheses overview ............................................................... 27
Figure 6: Environmental turbulence measured by newspaper coverage ............ 29
Figure 7: Consistency-performance model .................................................. 60
Figure 8: Consistency level measurement ................................................... 65
Figure 9: Consistency-performance relationship along industry lifecycle ........... 75
Figure 10: Hypotheses overview ............................................................. 89
Figure 11: Sample distribution over time .................................................... 91
Figure 12: Market sentiment ..................................................................... 92
List of Tables

Table 1: Overview of papers ........................................................................................................... 14
Table 2: Overview of sample firms ............................................................................................... 30
Table 3: Overview of sample composition .................................................................................... 34
Table 4: Pearson’s correlation – 2002 .......................................................................................... 35
Table 5: Pearson’s correlation – 2011 .......................................................................................... 36
Table 6: Regression results – Model 1 and 2 ........................................................................... 37
Table 7: Regression results – Models 3 to 8 .............................................................................. 38
Table 8: Code definition for business model themes ................................................................. 62
Table 9: Applied financial ratios and codes for consistency assessment ................................. 64
Table 10: Pearson’s correlation table for wind sample .............................................................. 67
Table 11: Pearson’s correlation table for solar sample ............................................................... 68
Table 12: Regression results from wind sample ......................................................................... 71
Table 13: Regression results from solar sample ......................................................................... 72
Table 14: Overview of sample firms ........................................................................................... 91
Table 15: Overview of events ..................................................................................................... 96
Table 16: Results – Full sample .................................................................................................. 97
Table 17: Results – Diversification mode ..................................................................................... 97
Table 18: Results – Energy technology ....................................................................................... 98
Table 19: Results – Timing ......................................................................................................... 99
Table 20: Results – Market sentiment ......................................................................................... 100
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPM</td>
<td>Capital Asset Pricing Model</td>
</tr>
<tr>
<td>CSP</td>
<td>Concentrated Solar Power</td>
</tr>
<tr>
<td>et al.</td>
<td>et alii</td>
</tr>
<tr>
<td>etc.</td>
<td>et cetera</td>
</tr>
<tr>
<td>EVU</td>
<td>Energieversorgungsunternehmen</td>
</tr>
<tr>
<td>GE</td>
<td>General Electric</td>
</tr>
<tr>
<td>ibid.</td>
<td>Ibidem</td>
</tr>
<tr>
<td>i.e.</td>
<td>id est</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IM</td>
<td>Index Model</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>JV</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>M&amp;A</td>
<td>Mergers and Acquisitions</td>
</tr>
<tr>
<td>MAR</td>
<td>Mean Adjusted Returns Model</td>
</tr>
<tr>
<td>MM</td>
<td>Market Model</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Square (Regression)</td>
</tr>
<tr>
<td>PV</td>
<td>Photovoltaics</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RE</td>
<td>Renewable Energy/Energies</td>
</tr>
</tbody>
</table>
Abstract

The challenges that complicate strategic management in emerging industries, like the renewable energy industry, motivate this dissertation. In particular, difficulties stemming from the industrial context, from environmental uncertainty, and from manager-stakeholder interactions are discussed. The most prominent environmental hurdles are thereby to be found in the areas of regulation, technology and economics. Overall, facilitating strategic management in the renewable energy industry is crucial, because the sector’s further evolvement is essential for an effective energy system transformation.

Based on theoretical reasoning and empirical analyses I find that strategic management in emerging industries, and particularly in the renewable energy industry, requires a high awareness of contextual constraints. The main implications for managers, investors, and policy makers are the following: Strategic decisions need to be thoroughly aligned with stakeholders to ensure implementation and to create competitive advantage. In addition, this thesis helps investors in their assessment of investment targets in the renewable energy industry and helps managers to better understand investor perceptions. The findings from this dissertation should, moreover, encourage policy makers to increase their awareness for the influencing power they have in shaping the decision environment and in interacting with managers.

This thesis starts with a review of strategic management in emerging industries and develops a research framework from the ‘strategy as practice’ perspective. After the identification of current research gaps three individual papers scrutinize questions related to success factors and obstacles when operating in emerging industries. By looking at different firms along the energy system value chain, the papers discuss the following three topics in detail: The first paper assesses the role of status-quo biases of directors for strategic renewal in the Swiss utility sector. The second paper looks at performance implications of business model consistency in the wind and solar sector across the value chain. The third paper analyzes investor reactions to diversification decisions by multi-technology firms into the renewable energy industry. Within each paper implications for research and practice are identified. Aggregated conclusions are drawn at the end of this dissertation.
Abstrakt

Zusammenfassung


1 Introduction

Strategic management is defined as “deliberately choosing a different set of activities to deliver a unique mix of value” and through this gaining competitive advantage (Porter, 1996, p.64). The deliberate selection of activities, however, is bound to various internal and external influencing factors. Therefore, strategy making is being seen increasingly as a “context dependent, socially accomplished activity directed toward the achievement of strategic goals and constructed through actions and interaction of multiple actors or groups distributed throughout an organization” (Hendry et al., 2010, p.36). This ‘strategy as practice’ lens is applied in this dissertation to describe the social interactions that form strategy (Jarzabkowski, 2005; Whittington et al., 2003). The interactive part of strategy is further expanded beyond the organization and focuses on, for example, conscious and subconscious interactions with industry networks, policy makers or investors (Whittington, 2006). In addition, the external context that requires a regular alignment or adjustment of strategy is integrated from an institutional perspective (DiMaggio et al., 1983; Oliver, 1997; Scott, 1987, 1995). The aim of this thesis is thus to shed more light on the influence of context, in particular, the industrial context of emerging industries and the role of (external) social interaction in strategic decision making.

To introduce the research topic and the underlying theoretical concepts this introduction starts with a problem statement. In the first section, the particularities of emerging industries and reasons for the selection of the renewable energy industry, as research context, are illustrated as well. Based on the theoretical foundation and research framework, the dissertation's objectives and research questions are identified thereafter. Subsequently, the methodological approaches applied are outlined. An overview of the contribution to theory and practice follows. The introductory section ends with locating the three distinct papers that form this dissertation in the research framework.
1.1 Background and Problem Statement

Strategic management does not take place in an organizational vacuum. Its outcome and success depend on the environment, and in particular, the industrial context of a firm. Starting with Porter (1980) and Ansoff (1965), the industrial context was first seen as a source for opportunities and threats that need to be tackled by strategic management. Other researchers later integrated the environment as a force that actively shapes and is shaped by organizational actions (Burgelman, 2002; DiMaggio et al., 1983; Oliver, 1997; Scott, 1995). Despite the increased awareness for environmental dependency, research does not yet fully incorporate external actors and contextual dynamics into strategic management studies (Whittington, 2006). In order to incorporate contextual as well as interactive elements of strategic management, in this section the chosen industrial context for this thesis is introduced. Section 1.2 then aggregates the theoretical foundation, before Section 1.3 describes objectives and research questions.

1.1.1 Strategic Management in Emerging Industries

A highly dynamic and challenging context for strategic management is that of emerging industries (Macdonald, 1985). Aldrich et al. (1994, p.645) define an emerging industry as an “industry in its formative years” that faces several constraints. These constraints include a generally high level of uncertainty about future outcomes for managers and stakeholders alike, the absence of technological as well as performance measurement standards, and the lack of external legitimacy. Based on DiMaggio et al. (1983) they thus argue for a more profound consideration of the industrial environment (and its development stage) that closely interacts with decision makers in organizations. Porter (1980) adds customer confusion, financing constraints, and technological as well as strategic uncertainty to the challenges of emerging sectors. In terms of uncertainty, emerging industries are thus to be located between the two highest levels, that Courtney et al. (1997) call “a range of futures” and “true ambiguity”. The inherent uncertainty of emerging industries is in this regard the presumably toughest challenge.

Coping strategically with uncertainty in general has seen substantial attention over the last decades (Collis, 1992; Dill, 1958; Duncan, 1972; Engau et al., 2011b; McKelvie et al., 2011). Vecchiato et al. (Vecchiato, 2012; Vecchiato et al., 2010) add to the discussion by highlighting the relevance of strategic foresight, in particular in contexts of emerging technologies or sectors. Combining the need for strategic foresight with the finding of McKelvie et al. (2011, p. 274) that “more uncertainty leads to decreased
willingness for action”, the complexity of strategic management in emerging industries becomes apparent. Courtney et al. (1997, p. 73) summarize the managerial challenge this way: “it is critical to avoid the urge to throw one’s hands up and act purely on gut instinct”. Avoiding sheer reliance on gut instinct is particularly crucial as the unique opportunity of emerging sectors lies in the fact that “no player necessarily knows the best strategy in these environments” (p.78). Well-prepared firms can therefore shape the future industry structure and standards to their advantage.

1.1.2 The Research Context of the Renewable Energy Industry

As stated before, questions of strategic management in emerging industries are highly dependent on the respective industry context. Different industries are driven by diverse sources of uncertainty and resulting actions and interactions of participants are only to a limited extend comparable across industries. However, focusing on one industry and looking at its particularities allows for an examination of the causal relationship between drivers of uncertainty and the resulting coping mechanisms. When transferring research findings from one industry to another, one needs to be cautious and to always take into account specific sources of uncertainty and resulting challenges. Therefore, it is highly relevant to understand coping strategies in a particular setting in detail to compare and apply lessons-learned to other contexts. Industry specific findings consequently provide an ideal starting point for a transfer and comparison of findings in other circumstances, with different uncertainty drivers and resulting actions of market participants – ultimately leading to univocally applicable findings across industry settings.

This thesis hence uses the renewable energy industry as its distinct research setting. The reasons for this selection are threefold. First, the renewable energy industry is stated as context in which strategic management is particularly challenging and strongly influenced by contextual factors (Johnson et al., 2009; Meijer et al., 2007). This comes along with the second reason for the selection: the renewable energy industry’s uncertainty level is frequently stated to be high (International Energy Agency, 2012; Lewis et al., 2007; Masini et al., 2012). Sources of uncertainty include technological, regulatory, and economic hurdles. Technological challenges are the lack of dominant designs, technological diversity that complicates the reaching of grid parity, underdevelopment of electricity grids, and lack of reliable storage technologies (International Energy Agency, 2012; Jacobsson et al., 2000). In the regulatory dimension, political support and policy decisions are subject to frequent changes and are internationally diverse. Approval and planning procedures for new installments are
complicated and can be delayed due to public objections and social non-acceptance (Brandt et al., 2006; Lewis et al., 2007; Wüstenhagen et al., 2007). Economic barriers range from dependence on fossil energy prices, low investment volumes, and cost pressure from low cost country competitors, to raw material price fluctuation (Deloitte, 2010). Third, the industry is the underlying **motor for the global energy system transition**. Attracting sufficient financial means to support the industry growth is a key challenge (IPCC, 2011) that can only be mastered if the industry becomes more and more self-sufficient, and if individual firms are strategically and diligently managed. Understanding and guiding strategic management in this industry is thus crucial and promising.

Additional complexity is created through the **multiple and diverse firms** that operate in this industry. The industry value chain ranges from engineering and manufacturing of the energy technology, to project development, electricity generation, and further to transmission and distribution. Only few to no firms operate fully integrated along the entire chain. It is therefore also important to understand different challenges along the value chain. Consequently, the three papers of this thesis take a look at firms that cover different value chain steps. Figure 1 shows a generic value chain and locates the sample firms of the three chapters along the different steps.

![Figure 1: Energy system value chain](image)

**1.1.3 Strategic Challenges in the Renewable Energy Industry**

Resulting from the contextual challenges in the renewable energy industry, firms operating in as well as firms entering the industry have to cope with those issues. Three examples that illustrate the challenges managers and investors in the renewable energy industry face are described here. These examples build the foundation for the three main chapters of this dissertation.
When following the above illustrated energy system value chain, the first example concerns firms that develop and manufacture technologies for energy production. Technology suppliers on the one hand are pure play firms, such as Vestas or Solarworld, that focus on the production of renewable energy related technologies. On the other hand, there are multi-technology firms, such as Siemens or GE, that diversify with one of their business segments into the renewable energy industry. While pure play firms need to manage the technological, economic, and regulatory challenges described above as part of their core business, multi-technology firms add substantial complexity to their existing businesses by entering this industry. Besides considering the common challenges of diversification, firms entering an emerging sector therefore need to carefully weigh the sector specific advantages and disadvantages (Lee et al., 2010). Selective expert interviews showed that success factors from the perspective of multi-technology firms contain scalability, cost reduction potential, and technological standardization\(^1\). All three dimensions are not easily manageable in the renewable energy sector.

Another example that will be discussed further relates to firms already active in the renewable energy industry. The question of how they can cope with the contextual challenges is still a broad, under-studied subject. Business model design, in the light of environmental volatility, is for instance a task that is not straightforward. One case example here is Q-Cells. It used a rigid business model right from its start in the solar industry in 1999. When the environmental turbulence increased in recent years, the missing adaptive capabilities led (among other factors) to its bankruptcy in 2012 (Duerand et al., 2010).

Proceeding in the value chain, energy producers and distributors face a similarly severe challenge. Their entire strategy is turned upside down through the emergence of new energy sources. After the revision of energy policies across the world due to climate change discussions, and in particular after the Fukushima incident in 2011, utility companies need to renew their strategy. The case of the Swiss utility firm BKW demonstrates in this regard, how the consequences from the policy-induced phase-out of nuclear power necessitates the revision of the entire firm strategy (BKW, 2012). Dealing with unexpected write-offs as a consequence of the nuclear phase-out and stuck in a path-dependent environment, the hurdle for turning around their strategic path is high. Reasons for slow strategic transformations are therefore also subject of one of the papers in this dissertation.

---

\(^1\) Interviews were conducted for a diploma thesis supervised during the course of writing this dissertation. Interview protocols and the thesis can be requested from the author of this dissertation.
Before these examples are discussed in more detail, the theoretical foundations of strategic management in emerging industries are summarized in the next section and research gaps are identified.

1.2 Theoretical Foundation and Research Framework

This thesis applies the ‘strategy as practice’ perspective to integrate stakeholder interactions into strategic decision making (Burgelman, 2002; Whittington, 2006). Customers, as a core stakeholder group, have been in the focus of marketing and product-market strategies for some time (Christensen et al., 1996; Zott et al., 2008). Other stakeholders that are seeing growing, but not sufficient attention regarding their influence on strategy making are, for example, investors (Connelly et al., 2010), governments and regulatory decision makers (Carter, 1990; Hillman, 2005; Hillman et al., 2004), as well as professional service firms (Whittington et al., 2003). These external actors shape firm strategies through direct interaction with or involvement in firm management, as well as through their expected or actual reactions to strategic decisions. Due to their strong influence and high relevance for the financial and regulatory conditions of the renewable energy industry, especially investors and policy makers will be in the focus of this thesis.

Furthermore, the environmental and institutional context is a critical factor for strategic management in emerging industries as stated above. Earlier studies argue for an increased consideration of the (neo-)institutional context and environmental conditions (Aldrich et al., 1994; Burgelman, 1991; Courtney et al., 1997; DiMaggio et al., 1983; Lovas et al., 2000; Scott, 1987, 1995) in strategic decision making. Engau et al. (2011b) highlight the relevance of context-adapted strategies in light of high (regulatory) uncertainty. For future research it is thus proposed in different studies, to identify strategic reactions to environmental uncertainty, to help in the implementation, and to assess performance implications of these strategies (Collis, 1992; Engau et al., 2011a; Miller, 1992). The contextual influence is hence the second focus of this thesis. More concrete, this dissertation addresses different forms of strategic reactions to industrial challenges. For example, Chapter 2 looks at strategic renewal following changes in the institutional environment, in particular the energy policy setting. And Chapter 3 examines business model design choices in light of two different renewable energy sectors.

Figure 2 illustrates the research framework of this thesis combining industrial context and stakeholder interaction from a ‘strategy as practice’ lens as described in the introductory quote by Hendry et al. (2010). Furthermore, it measures the concrete
impact of these two factors on strategic decisions. First of all, the industrial context sets the frame on which strategic decisions depend (see I in Figure 2). It also creates the setting in which the interaction of decision makers and stakeholders, as well as stakeholder reactions, take place. Second, decision makers interact on a frequent basis with a firm’s stakeholders (see II in Figure 2). These social interactions affect both the decision making process and the outcomes of these decision. Strategic decision outcomes addressed in this thesis encompass three core dimensions: the strategic content itself, how it creates value, and how it is being assessed. The ex-post assessment also leads to the third, and again interactive, part of the framework: the (immediate) stakeholder reactions following strategic decisions (see III in Figure 2). Each chapter of this thesis addresses several aspects of the framework. Chapter 2 for instance, looks at interactions of boards of directors and political stakeholders in the setting of the Swiss utility industry and studies the question how this interaction impacts strategic decision outcomes. Chapter 3 addresses how value creation, in form of business model design, depends on industry context. Chapter 4 derives how investors react to strategic diversification decisions that constitute an entry into an emerging industry. Figure 3 indicates which topics are addressed by which chapter. The individual chapters furthermore apply additional theoretical perspectives to study their research topics. An overview can be found at the end of this chapter in Table 1. In the following sections the research questions are described, before the methodological approach and the contribution of this thesis is outlined.

Figure 2: Research framework
1.3 Objectives and Research Questions

The success factors and pitfalls of a successful energy system transition are intensely discussed. Besides scalable, cost-efficiency technologies and sufficiency investments, a sophisticated strategic management of firms operating in the renewable energy industry is necessary. The aim of this thesis is therefore, to identify success factors and pitfalls of strategic management in the renewable energy industry. These factors can then guide managers, boards of directors, policy makers, and investors in their future decision making processes. The goal is furthermore, to advance strategic management research in two ways: first, in its integration of environmental influence factors; and second, through considering interactions with market and non-market drivers (Baron, 1995).
The guiding research questions are:

*What enables successful strategic management in emerging industries and in particular in the renewable energy industry – considering environmental uncertainty, contextual dependence, and manager-stakeholder interactions?*

*How are managerial decisions influenced by or dependent on the industry context of an emerging industry?*

*Which factors drive investor reaction to strategic decisions in emerging industries?*

Each chapter of this dissertation contributes to these questions by answering its individual research question(s). First, Chapter 2 intends to contribute to the understanding of contextual dependence of decision makers (in this case, the board of directors) and their interaction with stakeholders in form of industry networks. This chapter focuses on strategic content in general and asks:

*Which role do boards of directors play for the prevention of strategic renewal?*

The objective of Chapter 3 is to identify the implications of internal and contextual constraints for value creation in form of business model design. The underlying research question is:

*What is the value of business model consistency for firm performance in emerging industries?*

Finally, Chapter 4 assesses investor reactions and contributes to a better understanding of diversification strategies by multi-technology firms into emerging industries. The research questions are:

*How do diversification strategies into an emerging industry sector impact stock market performance in the short-term?*

*How does the impact vary with the timing of strategic decisions (early vs. late adopters), diversification mode, technology, and the current market sentiment?*
1.4 Methodological Approach

This dissertation applies a plurality of methods. For each study the approach that suits best to the respective research questions was selected. The first study (Chapter 2) uses a combination of a network analysis and hierarchical regressions. The network analysis first identifies the individuals’ embeddedness in the overall industry network. The hierarchical regression analysis then tests the proposed curvilinear relationships. The second study applies an ordinary least square regression linking business model consistency with performance. The third study analyses stock market reactions to corporate diversification announcements with an event study to assess perceived future firm performance from an investor perspective. In each chapter the reasons for the method selection are described in more detail, based on references to earlier studies that apply similar approaches. Furthermore, the suitability and implementation of each approach, the utilized variables, and validity measures are discussed.

A supporting method that is used in all three studies is content analysis (Weber, 1990). It is applied in two papers to measure environmental turbulence and market sentiment (Chapter 2 and 4) and in one paper to classify business models and derive consistency levels (Chapter 3). Using publically available data from databases such as OneSource (OneSource, 2012), Worldscope (Thomson Reuters, 2012), and Factiva (Dow Jones, 2012), coding and/or word count approaches determine qualitative information that would not have been available otherwise. Environmental turbulence analyses are based on media assessments covering conventional and renewable energy sources. Similar approaches were applied for example by Jacobs et al. (2010) and Weinhofer et al. (2010).

1.5 Theoretical and Practical Contribution

The contribution of this dissertation is directed towards theory and practice. The overall theoretical contribution is located in the ‘strategy as practice’ discourse. In addition, following Whittington’s (2006) request, the intention is to create an increased attentiveness for environmental dependency and related dynamics in strategic management literature. His statement that “strategy […] is something that people do, with stuff that comes from outside as well as within organizations, and with effects that permeate through whole societies” (p.627) is substantiated in this thesis. This is done by combining the intra- and extra-organizational levels that form strategies. Thereby, this dissertation also contributes to the institutional literature stream (Burgelman, 2002; DiMaggio et al., 1983; Oliver, 1997; Scott, 1995). Moreover, each chapter identifies theoretical contributions to its individual theoretical perspective. All
theory contributions are summarized in Chapter 5. Furthermore, each chapter, as well as the concluding section of the thesis derives starting points for future research.

The contribution to practice covers the following target groups: managerial decision makers, i.e. management teams and boards of directors, investors, and policy makers. For managerial practice, the goal is to facilitate strategic management in emerging industries that are subject to high environmental uncertainty and other constraints. Managers and board members are to be guided regarding the aspects they need to consider in their decision making that are specific to emerging sectors. Chapter 3, for instance, discusses business model consistency and design, taking into account the contingencies from industrial context.

Investor related contributions have two dimensions. First, implications for investment decision making are derived. The underlying goal is to assist investors in assessing investment targets in the renewable energy industry and to reduce the perceived risk resulting from uncertainty. Second, the investor perspective is used to show managers how their decisions are perceived and how investors react to them. Chapter 4, for example, assesses how and why investors react in a certain way to diversification strategies into the renewable energy sector.

Finally, this dissertation also aims at contributing to future policy making in the area of renewable energies. As discussed earlier, regulatory uncertainty is a major hurdle for strategic management and investment decision making in the industry sector. The intention is therefore to make policy makers aware of their influence range and the options they have for uncertainty reduction. Chapter 2 illustrates in this regard the role of public ownership for strategic renewal in Swiss utility firms.

1.6 Thesis Outline

The above described research framework for strategic management in emerging industries is applied in three separate papers. Each paper covers a specific managerial decision maker-stakeholder interaction, a strategic decision, and resulting stakeholder reactions. All three studies furthermore discuss the influence of the industrial context and its particularities for the respective strategic decision. The papers are arranged based on the scope of the strategic decision they address. Starting with Chapter 2, the first paper analyzes strategic renewal in general. Chapter 3 discusses a more detailed level of strategic management: the business model as an overall activity system that is responsible for value creation (Zott et al., 2010). Chapter 4 finally looks at a specific type of strategic decision: diversification into an emerging industry. The location of
the papers in the research framework is illustrated in Figure 3. The numbered circles indicate the chapter that addresses the respective dimension. The value chain steps covered by the different sample firms are illustrated in Figure 1.

Chapter 2 ("Directors’ Status-Quo Bias and Strategic Renewal: The Role of Intra-Industry Ties, Diversity, and Firm Ownership in the Swiss Utility Sector") discusses the role of directors’ status-quo bias for the promotion or prevention of strategic renewal. The sample consists of the six largest utility firms in Switzerland. The analysis timeframe covers two years with different levels of environmental turbulence: 2002 and 2011 (Post-Fukushima). Individual as well as board-level aspects that can create a status-quo bias are assessed. Individual level aspects are tenure, intra- and extra-industry ties. Board-level aspects are diversity and public firm ownership. Using network and hierarchical regression analyses the paper identifies curvilinear relationships of tenure and industry ties with strategic renewal. Furthermore, the moderating role of diversity and firm ownership is assessed. Based on institutional and social network theory implications from path dependency and legitimizing behaviors for strategic renewal are discussed. The contextual influence in this paper is focusing on the role of embeddedness in industrial networks through ties. Furthermore, differences in environmental turbulence are assessed through a comparison of results for 2002 and 2011. The public firm ownership variable introduces the interaction of strategic decision makers, here board members, with the predominantly public owners of utility companies.
Chapter 3 ("Performance Consequences of Fit between Financials and Strategy Descriptions in Emerging Industries: Implications for Business Model Design") assesses the impact of business model consistency on firm performance. By analyzing 210 wind and solar firms over a period from 2006 to 2009 the paper derives the value of consistency depending on firm growth, business model theme, and industrial context. The different maturity levels of the wind and solar sector introduce the contextual dimension to this study. Furthermore, the investor perception is added through the firm performance measurement applied (Tobin’s q). The findings show that consistency does not create value per se, but depends on different contingencies. A model for a dynamic relationship of consistency and performance along the industry life-cycle is proposed for further research. Implications for managers include the need for a conscious weighting of the opportunity costs and benefits of consistency depending on firm specifics and context.

Chapter 4 ("Diversification into Emerging Industries: An Event Study on Investor Reaction") analyzes investor reactions to diversification decisions. 39 acquisitions by multi-technology firms from 2001 to 2011 to diversify into the renewable energy industry are studied. The industrial context is discussed here through different energy technologies and the consideration of market sentiment. Investor reactions cover the interaction-reaction dimension of the framework in this paper. Sub-sampling within the performed event study shows a generally positive reaction of investors to market entry decisions. Following a resource-based perspective argumentation the expected reactions cannot be supported in all cases. For example, investor reactions do not reflect potential first-mover advantages. Yet, there are clear results for the influence of market sentiment on stock market reaction. This supports behavioral economics arguments in investor behavior. Implications for managerial practice and theory are the need to consider market sentiment when entering new emerging markets and the underlying relevance of behavioral investment decisions.

Chapter 5 sums up the previous sections and provides implications for theory and practice. It highlights the relevance of the three studies, discusses their limitations and identifies starting points for further research. Summing up the first section, Table 1 gives an overview of the three studies that form this thesis.
<table>
<thead>
<tr>
<th>Table 1: Overview of papers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter 2: Directors’ Status-Quo Bias and Strategic Renewal: The Role of Intra-Industry Ties, Diversity, and Firm Ownership in the Swiss Utility Sector</strong></td>
</tr>
<tr>
<td><strong>Chapter 3: Performance Consequences of Fit between Financials and Strategy Descriptions in Emerging Industries: Implications for Business Model Design</strong></td>
</tr>
<tr>
<td><strong>Chapter 4: Diversification into Emerging Industries: An Event Study on Investor Reaction</strong></td>
</tr>
<tr>
<td><strong>Research question</strong></td>
</tr>
<tr>
<td><strong>Industrial context</strong></td>
</tr>
<tr>
<td><strong>Decision makers</strong></td>
</tr>
<tr>
<td><strong>Stakeholders</strong></td>
</tr>
<tr>
<td><strong>Strategic decision</strong></td>
</tr>
<tr>
<td><strong>Theoretical perspective</strong></td>
</tr>
<tr>
<td><strong>Methodology</strong></td>
</tr>
</tbody>
</table>
1.7 References


BKW. 2012. Die BKW setzt auf Effizienz, erneuerbare Energie und auf ihre Investitionen in Intelligente Netze. 


2 First Paper: Directors’ Status-Quo Bias and Strategic Renewal: The Role of Intra-Industry Ties, Diversity, and Firm Ownership in the Swiss Utility Sector

by Melanie K. Oschlies and Rolf Wüstenhagen

ABSTRACT

There is a vivid debate in strategic management literature on the role of boards of directors for strategic renewal. Two aspects that have not been assessed are the subject of this paper: first, the prevention of strategic renewal through individual directors’ status-quo bias driven by demographics and network position; second, the reinforcement of individual status-quo biases on the board level. We assess status-quo biases on both levels by combining network and regression analyses. Our findings from a sample of 140 board members in the Swiss electric utility sector pre- and post-Fukushima indicate a strong curvilinear influence of tenure and intra-industry ties. Moreover, board level dynamics resulting from diversity and firm ownership moderate these effects. Our findings contribute to the social network and institutional perspective on strategic renewal. We highlight the influence of status-quo biases that stem from path-dependent and legitimizing behaviors for the prevention of strategic renewal.

Key words: board of directors, institutional theory, network analysis, strategic renewal

2.1 Introduction

Whenever environmental turbulence occurs, uncertainty about decision outcomes and future environmental conditions prevails. As a result, corporate reactions to these unstable external conditions can vary substantially (Milliken, 1987). Faced with such turbulence, most firms are often too occupied with short-term oriented, reactive measures, and stick with a given status-quo or “industry recipe” (Samuelson et al., 1988; Westphal et al., 2000). Only few succeed in establishing new and proactive, long-term strategies. The majority misses the chance for strategic renewal that can create sustainable competitive advantages in the following years (Agarwal et al., 2009; Goodstein et al., 1994; Shropshire, 2010).

An example for an industry that suddenly faced turbulences is the Swiss electric utility sector after the Fukushima incident. When energy policy decisions changed the Swiss market conditions in late 2011, the large electric utility companies were taken by surprise and reacted quite differently. Some of them rather reluctantly and slowly dealt with the new market conditions. Others were more open to strategic renewal. The boards of the different companies played (as required by Swiss law) an active role in this phase of strategic reorientation. For example, the Chairman of the board of directors of Alpiq took over the interim-CEO role (Alpiq, 2011b) to oversee and drive the redefinition of the strategy. Nevertheless, the process for a sustainable strategic reorientation did only take off slowly. At BKW, another Swiss utility firm, the strategic changes following the Fukushima incident were driven more actively. Here the Chairman took over an active role as well. He, not the CEO, publically represented and communicated the firm’s new strategic directions (BKW, 2012a).

While decisions on strategic renewal, both in turbulent and stable times, are based on the interplay with the management team, board members are the decision makers who cannot only initiate strategic renewal, but also have a unique position to do so. Their role allows – and in many countries requires – them to review the management team’s strategic plans, support them through an outside perspective, and sometimes even to drive strategic change. Through their sought-after outside experience and interlocks board members can bring in new ideas to strategic discussions (Carpenter et al., 2001). However, they can also case-harden the existing strategy (Johnson et al., 1996). The role of boards and their interlocks for strategic renewal, especially for the diffusion and adoption of strategic practices, is hence an area of research that saw substantial

---

3 The role and influence of board members depends on the legal framework of the country in which a firm’s headquarter is located. In Switzerland – which sets the research frame of this paper – board of directors are legally obliged to set the strategy of a company (Ruigrok et al., 2006).
attention in the past. Recent studies also discuss the role of boards with regard to greening and environmental strategies (Kock et al., 2012; Ortiz-de-Mandojana et al., 2012; Post et al., 2011). But existing research falls short on two aspects. First, research so far looks at the initiation of strategic renewal with a focus on the diffusion of practices, such as acquisition practices (Haunschild, 1993), multi-divisional forms (Palmer, 1983; Palmer et al., 1993), golden parachutes and poison pills (Davis, 1991; Davis et al., 1997), board independence (Westphal et al., 1997), decision processes (Westphal et al., 2001), and diversification (Chen et al., 2009). A phenomenon disregarded in literature is the contrary effect, namely the non-diffusion of practices and strategic directions, as the example of the Swiss utility sector demonstrates. The question is therefore: which role do boards of directors play for the prevention of strategic renewal? Second, as stated earlier, times of external turbulence can create a unique window of opportunity for strategic renewal in individual companies as well as in an entire industry. Nevertheless, we frequently observe that firms and industries enter and exit turbulent times with the same strategic direction and goals (Goodstein et al., 1994; Shropshire, 2010). There thus seem to be forces at play that inhibit renewal and ultimately cause competitive disadvantages.

We analyze these forces based on findings from behavioral management and economic literature that show the general tendency of individuals and groups to stick with a given status-quo (Bardolet et al., 2011; Brooks, 2011; Samuelson et al., 1988). A related proposition, recently advanced by Shropshire (2010), suggests that boards of directors become less receptive to new practices and ideas, and stick to the status-quo when environmental turbulence is high. This proposition is based on and aligned with earlier findings from Eisenhardt (1990), Keck (1997), Wiersma and Bantel (1993), Goodstein et al. (1994), Carpenter and Westphal (2001), and Zhang and Rajagopalan (2003). Our paper takes this research a step further, as it aims to uncover underlying reasons for directors’ status-quo bias in times of environmental turbulence.

Moreover, much of the existing research on the influence of boards of directors on strategic renewal to date generally assesses the role of boards as groups. It discusses, for example, the composition, diversity, and particularly, the interlocks of boards (Haunschild, 1993, 1994; Haunschild et al., 1998; Mizruchi, 1996). The role of the individual board member has mostly been neglected (Davis et al., 2003; Kang, 2008; Shropshire, 2010). The individual, however, is the creator of the widely studied interlocks and the provider of the information that flows through them. The individual’s influence on strategic renewal is hence the focus of this research. We assess curvilinear relationships of individual characteristics and strategic renewal.
Further, we include findings from existing board of directors’ literature to assess the board level dynamics that reinforce or mitigate individual status-quo biases and ultimately lead to the decision outcome (Baysinger et al., 1990; Goodstein et al., 1994; Westphal et al., 2000).

In this paper we first discuss existing literature on strategic renewal through board interlocks with a focus on findings related to non-diffusion of practices. We then review literature on individual board member’s characteristics and network positions to derive our hypotheses on his or her status-quo bias. Afterwards, we develop hypotheses on the reinforcing power of board dynamics for the final decision outcome. This is followed by a section illustrating our research context – the electric utility industry in Switzerland – and its particularities which make it an ideal setting to address our research question. The methods section describes our data collection process, the composition of our sample, and analytic approach. Finally, we summarized our findings, discuss limitations of our study, and present implications for theory and practice.

### 2.2 Theory and Hypotheses Development

The role of boards of directors for strategy making is the subject of a large body of literature – and in particular board interlocks have received substantial attention (Haunschild, 1993, 1994; Haunschild et al., 1998; Mizruchi, 1996). Nevertheless, there is an area that is still mostly untapped: “interlock studies […] imply that directors help the firm to navigate uncertainty through their external connections, but existing literature fails to explicate individual-level factors” (Shropshire, 2010, p. 249). We therefore, firstly, review existing literature that deals with the board’s role for the diffusion and non-diffusion of practices. Secondly, we aggregate findings from prior research on individual board members’ characteristics and network positioning to derive our hypotheses.

Before we start with our review of the role of boards for strategic renewal we need to clarify the concept of “strategic renewal” that we apply. As proposed by Agarwal and Helfat (2009, p. 282) we use the following, broad definition:

> “Strategic renewal includes the process, content and outcome of refreshment or replacement of attributes of an organization that have the potential to substantially affect its long-term prospects.”
This definition comprises two aspects that are essential for our research. First, it allows for a broad, company specific variety of strategic renewal, either incremental or discontinuous that is particularly relevant in our research setting. Second, it includes the future prospects or competitive advantages that can be achieved through strategic renewal in turbulent times.

2.2.1 Boards as Drivers and Preventing Forces for Strategic Renewal

When external turbulences add complexity to strategic decision making, a firm’s likelihood to initiate renewal and adopt new practices is reduced (Carpenter et al., 2001; Goodstein et al., 1994; Zhang et al., 2003). The decision committee that was found to have considerable influencing power on decision making in different and often difficult circumstance is the board of directors (Chen et al., 2009; Davis, 1991; Davis et al., 1997; Haunschild, 1993; Palmer, 1983; Palmer et al., 1993; Westphal et al., 1997; Westphal et al., 2001). Therefore they should be considered when analyzing renewal in the context of external turbulences. The dominant theoretical perspective in existing literature is institutional theory as it explains imitation and legitimizing behavior of individuals and firms (Galbreath, 2010). The tendency to imitate and comply with a given status-quo in turbulent times – however, did not find its way into research on individual members and boards of directors as groups (Lieberman et al., 2006). Assessing the role of directors’ status-quo conformity for the non-adoption of new ideas could, however help decision makers understand why change happens only slowly in some cases, and how change could be fostered in the future. We build on the reasons for non-diffusion in unstable times identified by other researchers, namely the homogeneity or diversity of boards (Carpenter et al., 2001; Goodstein et al., 1994; Zhang et al., 2003) and board size (Goodstein et al., 1994) and add the individual level perspective. We describe existing findings on individual demographic factors in the next section and derive our first hypotheses from these findings.

2.2.2 Demographic Factors, Network Position, and Status-Quo Bias

Institutional theory provides an explanation for the prevention of strategic renewal: status-quo conformity. Brooks (2011, p. 686) defines a status-quo bias as “a preference for the situation to remain unchanged […] even when it is not the most reasonable alternative.” The intention to stick with the status-quo can have multiple origins on the individual level – from risk aversion to conflicts of interest with other (board) mandates, to path dependency following earlier decisions (Ciccone, 2004; Ortoleva, 2011; Samuelson et al., 1988). We review prior studies on board involvement in
strategy making and derive hypotheses on the individual’s prevention of strategic renewal.

The first individual dimension we assess is board tenure. Average tenure in a board was found to influence strategic outcomes, for example by Golden and Zajac (2001). When looking at average tenure for boards as a group they and Wiersema and Bantel (1992) found an inverted U-shaped relationship of average tenure and strategic change. On the individual level, Fiske and Taylor (1991) and Finkelstein (1992) argue for a positive relationship due to increasing power and experience. Katz (1982), Boeker (1997), and Chen et al. (2009) in contrast, argue for a negative relationship as a result of path-dependency and rigidity. New board members are argued to bring in fresh perspectives while directors with a higher tenure are less likely to contradict their own prior decisions which created the status-quo. We hence expect that board members with a low tenure are, on the one hand, not ‘locked-in’ due to earlier decision. On the other hand, at the beginning of their board membership they are too inexperienced and powerless to promote strategic renewal. Board members beyond a tipping point have, in contrast, a high likelihood to be path dependent and become reluctant to reverse earlier decisions. Thus, we propose an inverted-U-shaped relationship in our first hypothesis.

\[ H1: \] There is an inverted-U-shaped relationship between individual tenure and the promotion of strategic renewal

When assessing boards, existing research does not only assess individual characteristics. Network theory provides additional explanatory aspects with its concept of embeddedness. In this regard strategy making is being seen increasingly as a set of “context dependent, socially accomplished activities” (Hendry et al., 2010) that are not only influenced by the company’s context, but by the context of the individual board member as well. Embeddedness (Granovetter, 1985; Uzzi, 1996) in social context was consequently found to influence information flows between board members and ultimately strategic decision making (Carpenter et al., 2001; Haunschild et al., 1998).

One dimension of a network is an individual’s direct connection to other network participants. Previous studies found such ties to influence information flows, partner selection, reputation, and the outcomes of strategic decision making (Carpenter et al., 2001; Chen et al., 2009; Shane et al., 2002; Westphal et al., 2000). For our research we
distinguish different types of ties (Ortiz-de-Mandojana et al., 2012; Ruigrok et al., 2006), i.e. ties to firms in the same industry and extra-industry ties. See Figure 4 for an illustration of different types of ties in our research context.

We consider a board member’s ties to other firms in- and outside of the focal firm’s primary industry in form of board interlocks. These ties influence strategic outcomes as they represent the functional background of the board members and define the directors’ breadth and depth of experience. While, for the board as a whole, intra-industry ties have been found to reinforce the existing practices and the given status-quo, extra-industry ties were found to bring in new ideas and foster strategic renewal. Chen et al. (2009) and Geletkanycz and Hambrick (1997), for example, argue for a negative impact of intra-industry ties and a positive impact of extra-industry ties. Finkelstein (1992), however states that “expert power” increases with the number of contacts within an industry. Ravasi and Zanotti (2006) find a similar effect for the strategic involvement of board members who possess “relevant [functional or market] knowledge”. As a result, a tightly connected board member within an industry is expected to have deep industry knowledge. This comes along with the ability to compare strategies within the industry and apply lessons-learned from decisions in other boards. The ability to transfer knowledge and experience, as well as the
credibility among other directors, is lacking when board members are highly interconnected outside the focal industry (Carpenter et al., 2001). Consequently, we propose, contrary to these early studies, a non-linear relationship of intra- and extra-industry ties. Our next hypotheses are therefore:

\[ H2a: \text{There is a U-shaped relationship between intra-industry experience, i.e. number of intra-industry ties, and promotion of strategic renewal} \]

\[ H2b: \text{There is an inverted-U-shaped relationship between extra-industry experience, i.e. number of extra-industry ties, and promotion of strategic renewal.} \]

2.2.3 The Reinforced Status-Quo Bias: Board Dynamics

So far, we discussed aspects that influence individual board members, create a status-quo bias, and ultimately prevent strategic renewal. However, decisions on strategic renewal are taken in the board and individual opinions can drive the final decision in different ways. Moreover, there are board level dynamics that hinder or facilitate the enforcement of one’s ideas.

Since boards are composed in different ways decision outcomes on the board level are influenced by various factors. Based on existing research findings, we expect that a status-quo bias of one or several board members can be reinforced by board dynamics and lead to a status-quo bias of the board respectively. Yet, the board structure can also facilitate strategic renewal. Two aspects that we consider here are diversity and firm ownership.

Diversity is an intensely discussed facilitator of strategic renewal. For example, Westphal and Milton (2000) assessed to what extent minorities have an impact on strategy making. While board members with similar backgrounds and demographics share the same views, the individuals that differ from the majority are more likely to initiate strategic renewal. Findings by Chatman and Flynn (2001), in addition, show that potential negative effects of diversity on team outcomes (Goodstein et al., 1994) decrease over time. The hypothesis is hence that homogeneous boards prevent strategic renewal due to their intention to stick with the status-quo. Diverse boards are in contrast more likely to be open to new ideas and mitigate individual biases. Another aspect is firm ownership. Political influence on the board as a result of predominantly public firm ownership also influences decision outcomes (Hillman, 2005). According to Hillman’s findings, especially in a context of highly regulated or policy dependent
industries, political shareholders can play an important role. Links to political institutions help managing external uncertainty. Reasons are, among others, preferred access to decision makers and information (Boyd, 1990). A high share of ownership by public institutions (such as cantons in Switzerland) consequently ensures a direct connection of political and managerial decision makers. This leads to a tighter alignment of political goals and strategic outcomes, and hence promotes strategic renewal once the political agenda is set accordingly. Our last hypotheses are therefore:

**H3: Board composition mitigates individual status-quo biases**

**H3a: Diverse boards mitigate status-quo biases**

**H3b: Public ownership mitigates status-quo biases**

All hypotheses are illustrated in Figure 5 in an aggregated manner.

**2.2.4 The Case of Swiss Electric Utility Companies and the Effect of Environmental Turbulence on Status-Quo Biases**

We study the above illustrated influences on strategic decision making using the example of Swiss electric utility companies and their (non-)adoption of renewable energy sources. Swiss boards in the electric utility sector provide a fruitful context for
our topic for four reasons: First, boards in Switzerland have in general a strong position in strategy making because they are legally obliged to set the strategic direction of their focal firms (Ruigrok et al., 2006). Second, the Swiss utility companies are dominated by public ownership (BFE, 2009) and face strong influence of policy makers in the board rooms. Moreover, the Swiss directors’ network is characterized as particularly interlocked and dense (Nollert, 1998) and private, informal information flows have been shown to be as important as public information sharing (Ruigrok et al., 2006). This context hence provides an ideal frame for assessing network effects. Third, not only in Switzerland, but also globally, climate change and energy system transitions require firms in several industry segments to evaluate and adapt their strategies (Banerjee et al., 2011; Galbreath, 2010; Winn et al., 2011). Utility companies in particular currently face the decision of reviewing their portfolio regarding expansion towards renewables – a matter that is often controversially discussed. Therefore, this process builds an interesting area of research on strategic renewal and the underlying influencing factors. Switzerland provides a particularly interesting context here, because until recently, large Swiss electric utility companies have only partially and reluctantly shifted their portfolio towards new renewable sources like wind, solar and biomass. Strategic renewal was hence not a top priority on boards’ agendas until the incisive changes in the energy system in 2011 (see sample firm overview of strategic reactions in appendix). In 2009, only ~2%\(^4\) (BFE, 2010) of the Swiss electricity production came from new, non-hydro renewables. Fourth, the recent history of the Swiss electricity market provides two interesting points in time to assess strategic renewal. The first is 2002, a year in which the public debate on nuclear power and alternatives heated up due to a referendum that took place in March 2003. A popular initiative (‘MoratoriumPlus’) had been launched, which aimed at a further suspension of new nuclear power plant constructions and a transition towards electricity from non-nuclear sources. Both initiatives were rejected (Bundeskanzlei, 2003), however discussions on alternative energy sources remained on the agenda. The second point in time is 2011 when the public debate was fueled by the Fukushima nuclear accident in Japan. As a consequence, the formerly submitted building permits for new nuclear power plants were suspended. Leading utility companies faced substantial write-offs and were forced to reconsider their existing renewable energy strategies (Meier, 2011). As a result the external uncertainty surrounding strategic decisions in the utility sector increased.

\(^{4}\) New renewables excluding hydro-power.
To measure the environmental turbulence that occurred in these points of time, we collected the number of media articles that discussed renewables from the Factiva database (Dow Jones, 2012). The number increased by 26% annually between 2002 and 2011. Together with the political events, this gives us the indication that the topic’s awareness increased substantially over time (see Figure 6). While we do not propose separate hypotheses for the different environmental turbulence level here, we will assess the two points in time separately later on. This allows us to identify different effects of our individual and board level measures on strategic renewal depending on external contexts.

Figure 6: Environmental turbulence measured by newspaper coverage
2.3 Method

To test our hypotheses in the proposed research setting we collected data for the years 2002 and 2011. We ran hierarchical regressions to assess the relationships between demographics, network positions, and decision outcomes. The process and method is described in the following sections.

2.3.1 Data Collection and Sample

The sample for this research consists of the six\(^5\) largest Swiss electric utility companies as illustrated in Table 2. An advantage of concentrating the research on electric utility companies only is that firm-specific differences can be controlled for. However, this focus will also limit the external validity of our study. We chose moreover to focus only on the six largest electric utility companies since these companies produced over 90\% of the total electricity produced in Switzerland in 2009. All other companies are generally smaller, regional players that have less influence and are generally highly connected to the six main players through their networks or supplier relationships as well.

<table>
<thead>
<tr>
<th>Board members</th>
<th>Energy supply (TWh)</th>
<th>Share of public ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 2011</td>
<td>2011</td>
<td>2011</td>
</tr>
<tr>
<td>Alpiq</td>
<td>13'961 11'009</td>
<td>18 14 192</td>
</tr>
<tr>
<td>Axpo</td>
<td>6'258 4'415</td>
<td>9 14 71</td>
</tr>
<tr>
<td>BKW</td>
<td>2'633 2'880</td>
<td>17 10 21</td>
</tr>
<tr>
<td>Repower</td>
<td>2'523 1</td>
<td>12 12 19</td>
</tr>
<tr>
<td>ewz</td>
<td>733 1'080</td>
<td>9 9 5</td>
</tr>
<tr>
<td>SIG</td>
<td>513 1'654</td>
<td>19 19 3</td>
</tr>
</tbody>
</table>

Energy supply: own production, resale, and trade; limited comparability of energy supply figures due to different reporting formats

Alpiq 2002 data is based on EOS and ATEL/Motor Columbus data - who merged in 2009 to create Alpiq

Axpo emerged from NOK (Nordostschweizer Kraftwerke) in 2001; thereafter a merger with CKW and EGL followed; 2002 data is based on NOK

1 Group results

2 Data for 2010 (revenues and employees of energy, grid and telecommunications department)

3 Data for 2010 (revenues from electricity, energy production and distribution; employees from all departments of SIG)

For more information on the individual sample firms see short business descriptions.

---

\(^5\) Alpiq, Axpo, BKW, Repower, ewz (Elektrizitätswerk der Stadt Zürich), and SIG (Services Industriels de Génève).
To analyze the Swiss electric utility industry’s board members, network data as well as data for the dependent variable was collected from public sources. The advantage of analyzing secondary data that provides a complete picture of the board network was ranked higher for our purposes than an undoubtedly insightful primary data collection. We expected that insights from primary data in our setting would have been limited due to resource and participation restrictions and a limitation of the time horizon that could have been assessed. Network data was therefore collected for the selected years for all board members. The data sources for the information were the Swiss trade register’s database as well as the focus companies’ websites (Moneyhouse, 2012). For board of directors’ networks former positions in boards and management roles were documented. In total, we collected data for 140 board members for the years 2002 and 2011. Data for the dependent variable was retrieved from company websites, annual reports, and press releases.

### 2.3.2 Dependent Variable

To measure prevention of strategic renewal through status-quo biases on individual and board level we derived a proxy variable that measures the renewable energy proneness of the six electric utility companies over time. Since the Swiss electricity market is dominated by conventional energy sources, low renewable energy proneness is associated with a status-quo bias in this paper. The variable consists of two equally weighted, individual measures related to the strategic aims for renewable energy production and the attitude towards renewables of the sample firms: the first measure is strategic goals set for the renewable energy production, the second is the firm’s reasoning on the feasibility of an energy system transition in general (qualitative assessment in annual reports, coded and transformed on Likert scale 1-5). This approach is similar to measures of strategic renewal applied in prior studies (Goodstein et al., 1994; Wiersema et al., 1992). Since we assess how individual status-quo biases are reinforced through board level effects, each board member was assigned with the renewable energy proneness of his or her board to assess the individual and enforced status-quo biases on board level.

---

6 There is no industry standard for reporting investments in renewable energies, therefore no comparable quantitative figure throughout our analysis period was found.

7 1 = low renewable energy proneness, 5 = high renewable energy proneness.
2.3.3 Independent Variables

Based on our hypotheses, we included the following independent variables. Their coding is based on the criteria mentioned in the hypotheses section above in line with approaches used by other researchers before (Goodstein et al., 1994; Westphal et al., 2000). We also centered the variables to assess curvilinear effects (Cohen et al., 2003; Lechner et al., 2010).

**Tenure:** Board tenure was derived from trade register and firm sources as well and taken as absolute value.

**Intra- and extra-industry ties:** Industry ties are used as proxy for industry experience. The variable was built based on the absolute number of positions a board member holds in the non-utility sector (extra-industry ties) and on board interlocks with other electric utilities (intra-industry ties).

Besides the demographic factors we added measures for board dynamics that were entered in the regression analysis as interaction terms with the independent variables. We expect them to reinforce the underlying effects.

**Diversity:** We measure diversity with the Gibbs-Martin-Index as done before by Goodstein et al. (1994) to measure the concentration of members with different backgrounds or demographics (1 for diversity and 0 for homogeneity). The formula applied is ($P_i =$ proportion of the board with same background or demographics):

$$D = 1 - \sum_{i=1}^{n} P_i^2$$

We calculated the Index for gender and nationality, and use the average of these two values for an overall assessment of the board diversity. Our values are relatively low (max: 0.4) which indicates a generally high homogeneity across the boards of our sample. For an overview see Table 3.

**Public ownership:** We collected data on the shareholder structure of our sample firms and coded 1 for a share of public ownership (mostly state governments) above 75%.
2.3.4 Control Variables

To account for other influences on non-diffusion of practices we controlled for age (absolute number), gender (0 for male, 1 for female), and nationality (0 for domestic, 1 for foreign) of the individual board members. We also run regressions with control variables for educational background, but as they did not show any significant results we exclude them from our discussions and regression models.
2.4 Results

The sample’s composition based on a selection of the above described variables is described in Table 3.

Table 3: Overview of sample composition

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>2002</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td>140</td>
<td>85</td>
</tr>
<tr>
<td>Age (mean)</td>
<td></td>
<td>55.6</td>
<td>57.1</td>
</tr>
<tr>
<td>Tenure (mean)</td>
<td></td>
<td>4.4</td>
<td>6.5</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swiss</td>
<td>90%</td>
<td>94%</td>
<td>89%</td>
</tr>
<tr>
<td>Foreign</td>
<td>10%</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>89%</td>
<td>89%</td>
<td>90%</td>
</tr>
<tr>
<td>Female</td>
<td>11%</td>
<td>11%</td>
<td>10%</td>
</tr>
</tbody>
</table>

1 140 individuals, no double counting of board members that had mandate in both years in overall mean

To assess the above stated hypotheses we created several models that we tested in hierarchical, linear regression analyses. Besides the above stated influence of the independent variables we also included squared and interaction terms of our independent variables to measure curvilinear effects as well as the moderating role of diversity and firm ownership. We assessed the two points in time separately since we expect different turbulence levels in the environment to impact our results. We tested for multicollinearity among the independent variables and calculated the variance inflation factors (VIF) that were in all cases smaller than 10, when no squared variables were included (Kleinbaum et al., 1998). We furthermore do not interpret the coefficients, but only their sign for our curvilinear relationships. Hence, we do not see a reason for concern here in case the VIFs were inflated. A summary of our analysis is included in Tables 4 to 7.
Table 4: Pearson’s correlation – 2002

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RE proneness</td>
<td>2.635</td>
<td>1.358</td>
</tr>
<tr>
<td>2. Tenure</td>
<td>4.424</td>
<td>4.184</td>
</tr>
<tr>
<td>3. Intra-Industry Ties</td>
<td>2.576</td>
<td>3.580</td>
</tr>
<tr>
<td>4. Extra-Industry Ties</td>
<td>7.141</td>
<td>5.780</td>
</tr>
<tr>
<td>5. Diversity</td>
<td>0.167</td>
<td>0.079</td>
</tr>
<tr>
<td>6. Firm Ownership</td>
<td>0.424</td>
<td>0.497</td>
</tr>
<tr>
<td>7. Age</td>
<td>55.588</td>
<td>7.473</td>
</tr>
<tr>
<td>8. Gender</td>
<td>0.106</td>
<td>0.310</td>
</tr>
<tr>
<td>9. Nationality</td>
<td>0.059</td>
<td>0.257</td>
</tr>
</tbody>
</table>

**Independent variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RE proneness</td>
<td>2.635</td>
<td>1.358</td>
</tr>
<tr>
<td>2. Tenure</td>
<td>4.424</td>
<td>4.184</td>
</tr>
<tr>
<td>3. Intra-Industry Ties</td>
<td>2.576</td>
<td>3.580</td>
</tr>
<tr>
<td>4. Extra-Industry Ties</td>
<td>7.141</td>
<td>5.780</td>
</tr>
<tr>
<td>5. Diversity</td>
<td>0.167</td>
<td>0.079</td>
</tr>
<tr>
<td>6. Firm Ownership</td>
<td>0.424</td>
<td>0.497</td>
</tr>
<tr>
<td>7. Age</td>
<td>55.588</td>
<td>7.473</td>
</tr>
<tr>
<td>8. Gender</td>
<td>0.106</td>
<td>0.310</td>
</tr>
<tr>
<td>9. Nationality</td>
<td>0.059</td>
<td>0.257</td>
</tr>
</tbody>
</table>

**Control variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RE proneness</td>
<td>2.635</td>
<td>1.358</td>
</tr>
<tr>
<td>2. Tenure</td>
<td>4.424</td>
<td>4.184</td>
</tr>
<tr>
<td>3. Intra-Industry Ties</td>
<td>2.576</td>
<td>3.580</td>
</tr>
<tr>
<td>4. Extra-Industry Ties</td>
<td>7.141</td>
<td>5.780</td>
</tr>
<tr>
<td>5. Diversity</td>
<td>0.167</td>
<td>0.079</td>
</tr>
<tr>
<td>6. Firm Ownership</td>
<td>0.424</td>
<td>0.497</td>
</tr>
<tr>
<td>7. Age</td>
<td>55.588</td>
<td>7.473</td>
</tr>
<tr>
<td>8. Gender</td>
<td>0.106</td>
<td>0.310</td>
</tr>
<tr>
<td>9. Nationality</td>
<td>0.059</td>
<td>0.257</td>
</tr>
</tbody>
</table>

N=85; **p < 0.01, *p < 0.05**

Notes: Mean and standard deviation for Tenure, Intra-Industry Ties, and Extra-Industry Ties based on data before centralization.
### Table 5: Pearson’s correlation – 2011

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. RE proneness</td>
<td>3.856</td>
<td>1.020</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Tenure</td>
<td>6.450</td>
<td>5.686</td>
<td>0.102</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Intra-Industry Ties</td>
<td>2.625</td>
<td>4.456</td>
<td>-0.206</td>
<td>0.076</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Extra-Industry Ties</td>
<td>10.538</td>
<td>12.982</td>
<td>0.133</td>
<td>0.178</td>
<td>0.013</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Diversity</td>
<td>0.168</td>
<td>0.084</td>
<td>0.733**</td>
<td>-0.044</td>
<td>-0.282*</td>
<td>0.050</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Firm Ownership</td>
<td>0.513</td>
<td>0.503</td>
<td>0.552**</td>
<td>-0.068</td>
<td>-0.297**</td>
<td>0.072</td>
<td>0.263*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Age</td>
<td>57.113</td>
<td>7.735</td>
<td>-0.13</td>
<td>0.557**</td>
<td>0.140</td>
<td>0.211</td>
<td>-0.165</td>
<td>-0.080</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Gender</td>
<td>0.100</td>
<td>0.302</td>
<td>0.253*</td>
<td>-0.152</td>
<td>-0.188</td>
<td>-0.091</td>
<td>0.364**</td>
<td>0.075</td>
<td>-0.271*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9. Nationality</td>
<td>0.113</td>
<td>0.318</td>
<td>-0.428**</td>
<td>-0.238*</td>
<td>-0.041</td>
<td>-0.257*</td>
<td>-0.239*</td>
<td>-0.365**</td>
<td>-0.206</td>
<td>-0.119</td>
<td>1</td>
</tr>
</tbody>
</table>

N=80; **p < 0.01, *0.01 <= p < 0.05

Notes: Mean and standard deviation for Tenure, Intra-Industry Ties, and Extra-Industry Ties based on data before centralization
Table 6: Regression results – Model 1 and 2

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.68***</td>
<td>3.97***</td>
<td>2.69***</td>
<td>3.96***</td>
<td>2.44***</td>
<td>3.86***</td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.04*</td>
<td>-0.02†</td>
<td>-0.03</td>
<td>-0.03*</td>
<td>-0.03</td>
<td>-0.04*</td>
</tr>
<tr>
<td>Gender</td>
<td>0.17</td>
<td>0.51</td>
<td>-0.04</td>
<td>0.44</td>
<td>-0.16</td>
<td>0.39</td>
</tr>
<tr>
<td>Nationality</td>
<td>-1.03†</td>
<td>-1.43***</td>
<td>-0.82</td>
<td>-1.33***</td>
<td>-1.08</td>
<td>-1.24***</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenure</td>
<td>-0.04</td>
<td>0.03</td>
<td>-0.03</td>
<td>0.08**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-Industry Ties</td>
<td>-0.12*</td>
<td>-0.04†</td>
<td>-0.22**</td>
<td>-0.12**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra-Industry Ties</td>
<td>0.01</td>
<td>0.01</td>
<td>0.00</td>
<td>-0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenure squared</td>
<td>0.00</td>
<td>-0.00†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-Industry Ties squared</td>
<td>0.02†</td>
<td>0.01*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra-Industry Ties squared</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. R2</td>
<td>0.06</td>
<td>0.22</td>
<td>0.10</td>
<td>0.25</td>
<td>0.12</td>
<td>0.32</td>
</tr>
<tr>
<td>F</td>
<td>2.64†</td>
<td>8.54***</td>
<td>2.60*</td>
<td>5.39***</td>
<td>2.27*</td>
<td>5.08***</td>
</tr>
<tr>
<td>Change in Adj. R2</td>
<td>0.09</td>
<td>0.25</td>
<td>0.09</td>
<td>0.05</td>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>Change in F</td>
<td>2.64†</td>
<td>8.54***</td>
<td>2.64†</td>
<td>1.93</td>
<td>1.50</td>
<td>3.39*</td>
</tr>
</tbody>
</table>

***p <0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
### Table 7: Regression results – Models 3 to 8

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.68***</td>
<td>3.88***</td>
<td>2.53***</td>
<td>3.95***</td>
<td>2.87***</td>
<td>3.82***</td>
</tr>
</tbody>
</table>

**Control variables**

| Age                        | -0.02            | -0.02            | -0.01            | -0.02            | -0.01            | -0.02            |
| Gender                     | -0.44            | -0.07            | -0.29            | -0.03            | -0.07            | -0.03            |
| Nationality                | -0.12            | -0.28            | 0.06             | -0.38            | 0.01             | -0.32            |

**Independent variables**

| Tenure                     | 0.071            | 0.04*            | 0.05             | 0.04†            | 0.08*            | 0.04*            |
| Intra-Industry Ties        | -0.11*           | -0.12*           | 0.01             | -0.13*           | -0.1*            | -0.13*           |
| Extra-Industry Ties        | -0.02            | 0.01             | -0.02            | 0.00             | -0.02            | 0.00             |
| Tenure squared             | -0.01*           | 0.00             | 0.00             | 0.00             | -0.02**          | 0.00             |
| Intra-Industry Ties squared| 0.00†            | 0.00             | 0.00             | 0.00             | 0.01†            | 0.00             |
| Extra-Industry Ties squared| 0.00             | 0.00             | 0.00             | 0.00             | 0.00             | 0.00             |
| Diversity                  | -0.41            | 7.18***          | -4.56*           | 8.39***          | -3.37*           | 7.16***          |
| Firm Ownership             | 2.28***          | 0.75***          | 2.35***          | 0.69***          | 2.17***          | 0.73***          |

**Interactions**

| Diversity * Tenure         | 1.49**           | -0.18            |                  |                  |                  |                  |
| Diversity * Tenure squared | -0.19**          | 0.00             |                  |                  |                  |                  |
| Diversity * Intra-Industry Ties | -1.39*   | 0.36             |                  |                  |                  |                  |
| Diversity * Intra-Industry Ties squared | -0.10          | -0.05            |                  |                  |                  |                  |
| Diversity * Extra-Industry Ties | 0.08            | -0.05            |                  |                  |                  |                  |
| Diversity * Extra-Industry Ties squared | -0.04          | 0.00             |                  |                  |                  |                  |
| Firm Ownership * Tenure    | 0.38***          | -0.01            |                  |                  |                  |                  |
| Firm Ownership * Tenure squared | -0.05**          | 0.01             |                  |                  |                  |                  |
| Firm Ownership * Intra-Industry Ties | -0.11        | 0.09             |                  |                  |                  |                  |
| Firm Ownership * Intra-Industry Ties squared | 0.02         | 0.02             |                  |                  |                  |                  |
| Firm Ownership * Extra-Industry Ties | 0.09†          | -0.05**          |                  |                  |                  |                  |
| Firm Ownership * Extra-Industry Ties squared | -0.01          | 0.00**            |                  |                  |                  |                  |
| Adj R2                     | 0.68             | 0.69             | 0.67             | 0.70             | 0.63             | 0.69             |
| Change in Adj R2           | 0.05             | 0.00             | 0.04             | 0.01             | 0.00             | 0.00             |
| Change in F                | 5.90**           | 0.57             | 5.58**           | 0.89             | 0.44             | 0.23             |

***p < 0.001, **p < 0.01, *p < 0.05, †0.05 <= p <= 0.1
Our results show that individual level factors, such as intra-industry ties and tenure have a curvilinear influence on strategic renewal. The impact of extra-industry ties is not as strong. Diversity and tenure partially moderate the relationships, and the strength of our results varies between 2002 and 2011.

Firstly, we test our control variables and find a negative significant effect of age and nationality. Model 1 assesses the impact of our three individual level variables: tenure, intra-industry ties and extra-industry ties. There are no significant results for tenure and extra-industry ties, and only slightly significant, negative results for intra-industry ties. In Model 2 we test our curvilinear relationships of the three variables by adding the squared terms of tenure and ties. We can confirm the inverted-U-shaped relationship of tenure and strategic renewal in 2011 (p<0.01/p<0.1) with a significant change in R2. This effect reappears in other models (see models 3 and 6) also for 2002. Consequently, our results confirm hypothesis 1.

Model 2 also shows the expected U-shaped effect of intra-industry ties for both years: intra-industry ties has a negative sign, while the squared variable has a positive one (2002: p<0.01/p<0.1; 2011: p<0.01/p<0.05). In 2002, the change in R2 is however not significant and the results must therefore be interpreted with caution. But as the relation reappears in models with significant R2 changes for 2002 (see models 3 and 6) we confirm hypothesis 2a as well. The inverted U-shaped effect of extra-industry ties does not show in our models and extra-industry ties alone do not show any significant results as well. We thus reject hypothesis 2b.

The moderating roles of diversity and firm ownership are analyzed in models 3 to 8. The variable firm ownership alone shows a positive and significant result in all models. The variable for diversity has a negative and mostly significant impact in 2002, and a positive, significant impact in 2011. We assess the moderation by entering the interaction term of diversity and firm ownership with each of our independent variables and their squared counterparts. For diversity, we only find one significant interaction in 2002 for tenure (model 3, p<0.01). Firm ownership moderates tenure in 2002 as well (model 6, p<0.001/p<0.01). The respective changes in R2 were significant in both models. The moderating role of firm ownership on extra-industry ties is significant in 2011 in model 8. But as the individual effect of extra-industry ties did not show significant findings we treat these results cautiously and do not use them as a support for our hypothesis. Aggregating these findings we cannot confirm hypotheses 3a and 3b. If at all, there only is an interaction effect of diversity and firm ownership with tenure. Moreover, the interaction strengthens the underlying effect, rather than mitigating it.
When comparing our results for 2002 and 2011 throughout our models we see three important variances. First, the results for intra-industry ties are stronger in 2011. Second, the interaction results show only in 2002. Third, while firm ownership generally has a positive effect, diversity has a negative effect in 2002 and a positive in 2011. Summarizing our findings we can state that individual level factors matter for strategic renewal and can have a linear or curvilinear relation. Board level dynamics do not reinforce or mitigate these findings per se. We furthermore find first indications that the turbulence level matters for some of our discussed effects.

2.5 Discussion

When reviewing our empirical results we find individual status-quo biases as well as board-level dynamics to influence strategic renewal. With our confirmation of hypothesis 1 we support earlier group-level findings by Golden and Zajac (2001) and Wiersema and Bantel (1992). On the individual level there also is a positive effect of tenure up to a certain tipping point which decreases after this point is reached. While new board members bring in a fresh perspective after a time of acclimatization, more experienced board members reach a “lock-in” point and their path dependency seems to hinder strategic renewal. This effect is supported by the negative values for age that we find in some of our models. The impact of tenure does, moreover, not seem to vary with external turbulence.

Individual embeddedness is another aspect that needs to be considered for assessments of openness for strategic renewal. Contrary to earlier studies (Chen et al., 2009; Finkelstein, 1992; Geletkanycz et al., 1997) we proposed and confirmed curvilinear relationships of intra- and extra-industry ties. In our sample, board members with little or much ties to firms in the same industry have a higher likelihood to drive change. While less interlinked members are less likely to have a status-quo bias, more experienced members can use their “expert power” (Finkelstein, 1992) to drive change. This effect is stronger in turbulent times (see models for 2011). For extra-industry ties we cannot confirm the value of outside experience and knowledge transfer for strategic renewal as proposed by Carpenter and Westphal (2001).

When looking at reinforcing or mitigating board-level effects we find mixed results. Diversity is the first aspect we looked at. While the variable itself has a negative effect in less turbulent times, it has a positive effect when higher external uncertainty sets in. In addition, it does not mitigate, but reinforce the relationship of tenure. The positive influence of diversity as argued by, for example, Westphal and Milton (2000) seems to vary with external contingencies. Similar results by Filatotchev and Toms (2003) on
the value of diversity in crisis situations support our findings. Public firm ownership, in contrast, has a positive effect independent of external turbulence. It is also not moderating individual openness for strategic renewal, but creates value per se. This contradicts Filatotchev and Toms (2003) who find that the presence of institutional investors not public owners enhances survival chances in times of crisis. Although our result might be a special effect from the analyzed industry – electric utilities are highly interlinked with and managed by local governments in Switzerland – we believe that public owners can be a driver of strategic renewal. In particular if an industry is highly dependent on regulatory decisions, publically dominated firms seem to be more open for strategic renewal.

The discussion illustrates that some of the so far discussed effects in board literature need to be assessed in combination with other individual, network, and board level aspects. Institutional drivers of status-quo biases should be complemented by network aspects. Our results, lastly, do also vary across our two points in time. As discussed earlier, this can be a result of the different turbulence levels in the industry and its environment that further complicate strategy making and needs to see further attention in future research.

2.6 Conclusion and Implications for Further Research

This paper discusses the role of individual and board level factors for the prevention of strategic renewal in an established industry – i.e. the Swiss electric utility industry. We find results that are more fine-grained than earlier research; in particular, the curvilinear relationship of tenure and intra-industry ties with strategic renewal. Another new finding of our research is the influence of external turbulence levels on strategic renewal. The role of either low or high intra-industry experience seems to be particularly relevant in turbulent times. Moreover, the value of diversity for strategic renewal also depends on turbulence levels and is generally higher in less turbulent times. These findings provide interesting starting points for future research. After describing the limitations of our study we end this paper by deriving implications for theory and practice.

As stated above a limitation of our study is the focus in terms of industry sector and country. On the one hand, it provides an ideal research context for our purpose: an industry segment that is facing substantial environmental uncertainty with a large board member network. And we cover more than 90% of the Swiss electricity production with our sample. On the other hand, one needs to be careful when generalizing our results to other industry or regional contexts. We therefore see our
results as a starting point for further research that can test the applicability of our findings to other settings.

Moreover, we collected data from secondary sources. This leads to a complete picture of the entire board network of our six firms. A disadvantage of this method is that it cannot capture informal information, for example on the quality of interpersonal relationships. Future studies could add to this by assessing the information flows in intra- and extra-industry ties and the role of these information flows. In particular, at low and high levels of embeddedness, as indicated in our curvilinear findings, the significance of information exchange could vary substantially. In addition, a procedural analysis of the dynamics that lead to or prevent strategic renewal would be particularly insightful from our perspective (Parker, 2007; Samra-Fredericks, 2000; Soderholm, 2009).

We, lastly, provide only initial indications for variations in our results, depending on external turbulences because we assess two points in time. As decision making is particularly difficult in unstable times (Milliken, 1987) we suggest that further research should incorporate the external decision making context more frequently into analyses like, for example done by Goodstein et al. (1994).

For further research we provide several additional starting points. First, the question is, if our findings do only show in boards of directors or if they also become apparent in other strategically relevant decision groups (such as management teams or corporate development departments). Second, our results on firm ownership resonate with research on corporate political activity (Hillman, 2005; Lux et al., 2011). Our findings on the role of public ownership can build the ground for further investigations on their strategic decision making influence, especially in highly regulated and policy dependent industries. The last, and potentially most fruitful area for research, concerns a further combined assessment of effects such as status-quo biases as illustrated in the behavioral management literature with a network analysis lens. This can be done, for example, by analyzing how common beliefs or heuristics of individuals spread through industry networks and thereby shape the outcome of strategic decisions. Such an approach can uncover new behavioral drivers and barriers in managerial decision making (Granovetter, 1985; Hambrick et al., 2008; Harris et al., 2007; Jack, 2005).

We believe that our research and findings have implications for social network and institutional theory. Our empirical results show that – while individual level aspects are relevant drivers or obstacles for strategic renewal – network connections and board level aspects are important influencing factors as well. Moreover, these effects depend on environmental turbulences. Our findings moreover have implications for
managerial practice. The awareness for the composition – on the individual as well as the team level – of strategy making committees should increase and should incorporate environmental conditions. Board or team-level dynamics should be monitored carefully and status-quo biases on all levels should be scrutinized to avoid strategic halt.
2.7 References


Palmer DA, Jennings PD, Zhou XG. 1993. Late adoption of the multidivisional form by large United-States corporations - institutional, political and economic accounts. *Administrative Science Quarterly* 38(1): 100-131


2.8 Appendix: Profiles of Sample Companies

Alpiq:

Alpiq is the largest utility in Switzerland, but operates in 33 countries in total. 36% of its energy sales are made in Switzerland, 44% in Europe. Approximately 20% of its energy supply is traded. 27% of its energy production in 2011 originated from hydro and new renewable sources. Moreover, Alpiq is the major shareholder of the Swiss nuclear power plants Gösgen and Leibstadt. 28% of Alpiq’s shares are held publically (predominantly by smaller Swiss utilities), 31% are held by EOS, 25% by Electricité de France.

Following the Fukushima incident and the resulting changes for the Swiss utility sector Alpiq had to realize substantial write-offs. This led to a loss of 1.3 bn CHF for 2011. Consequently, a broad restructuring program was launched. The former Chairman of the board of directors also took over the CEO position to drive the strategic changes and their implementation (Alpiq, 2011a, 2011c).

Axpo:

Axpo is active in energy production and distribution. It delivers energy to local utilities and does not sell energy to private households. Axpo is the major shareholder (>80%) of Centralschweizerische Kraftwerke (CKW) and Energiegesellschaft Laufenburg (EGL) and can thereby influence the Swiss energy supply far beyond its own production. Of its most recent Swiss energy production 40% came from hydro energy and new renewables. Axpo furthermore operates two nuclear power plants (Beznau 1 and 2) and has shares of 23-25% in two others (Gösgen and Leibstadt). 100% of Axpo’s shares are in public ownership (by among others, canton Zurich 18%, Elektrizitätswerk des Kantons Zürich 18%, canton Aargau 14%).

Axpo’s EBIT in 2011 was 400 m CHF lower than in 2010 as a result of the changes in the energy market. As a consequence, Axpo did not only initiate strategic and organizational changes, it also raised its target for renewable energy production until 2030 from 2.2 bn kWh to 5 bn kWh (Axpo, 2011, 2012).
BKW:

BKW is active in all steps of the energy supply value chain – from production to distribution. In 2011, 18% of its energy production came from renewable sources (hydro and new renewables). BKW has a participation in the nuclear power plant Leibstadt and operates the nuclear power plant Mühleberg (the most intensely questioned nuclear power plant in Switzerland with a limited operating approval until 2013). 53% of BKWs shares are held by public institutions (canton Berne), 10% are held by Groupe E (Switzerland) and 7% by E.On Energie AG (Germany).

In 2011, BKW realized a loss of 66 m CHF, in particular due to write-offs and provisions for the nuclear power plant phase-out. Since its nuclear power plant is most likely the first one that will be shut-down in Switzerland, BKW developed a new strategic concept for its energy production till 2030 with a focus on energy efficiency and renewables. To drive this strategic change the former CEO took over a position in the board of directors and one board member was added (BKW, 2011, 2012a, 2012b).

Repower:

Repower operates in energy production, distribution, carrying and trade. 44% of its energy production in 2011 came from hydro, wind, and solar power. Furthermore, Repower holds participations in four nuclear power plants (in France and Switzerland). Its core markets are Switzerland, Germany, Italy and Rumania. Major shareholders are the canton of Graubünden (public, 46%), Alpiq (25%) and EGL (21%).

As a result of the changes in the Swiss electricity market in 2011 Repower faced an 18% decrease in its EBIT. Strategic changes were initiated thereafter; however, no substantial changes regarding Repower’s share of renewable energy production were communicated (Repower, 2011, 2012).
**Elektrizitätswerk der Stadt Zürich – ewz:**

ewz produces, trades, transports, and distributes energy predominantly in the city of Zurich. ewz is a public utility (100% public ownership) and monitored by the city council of Zurich. In 2008, a referendum in the city determined that ewz has to exit all nuclear power related activities by 2039. Currently (in 2010), ewz produces 57% of its energy from renewable sources (incl. hydro and thermal).

ewz has a detailed strategy “Stromzukunft” that illustrates different scenarios for its future energy production till 2060. For 2018, 310 GWh production capacities of renewable energies are planned (ewz, 2010, 2011).

**Services Industriels de Genève – SIG:**

SIG is the public utility company of the city and canton of Geneva. It is fully in public ownership. The company is not only in charge of the electricity production and supply, but also responsible for waste and water management, heating and telecommunication. 88% of its own energy production came from renewable sources (incl. hydro and thermal) in 2010. No strategic changes were communicated as a consequence of the energy system and policy changes in 2011. However, SIG set targets for its renewable energy production capacities until 2015 (380 GWh) (Services Industriels de Genève, 2010, 2012).
3 Second Paper: Performance Consequences of Fit between Financials and Strategy Descriptions in Emerging Industries: Implications for Business Model Design

by Moritz Loock and Melanie K. Oschlies

Abstract

Performance implications of different business-model themes have been studied broadly (Zott et al., 2007, 2008). However, a dimension that received little attention in business model-performance assessments is consistency or “configuration as a quality” (Miller, 1996). Business model consistency in this regard indicates the degree of fit of different business model elements. Generally, it is implicitly argued that a high degree of consistency, in which all business model activities best fit to each other, would be beneficial. However, when considering opportunity costs within emerging industries we also find arguments for benefits of a low degree of consistency. Thus, we argue for an optimal degree of consistency in emerging industries depending on contingencies such as business model, firm growth, and industry specifics. As a proxy for measuring consistency we look at the fit between financials and business descriptions of 210 firms in the renewable energy industry. We find that the analyzed contingencies can impact the consistency-performance relationship positively as well as negatively. We also propose a dynamic relationship along the industry lifecycle. The results question an uncritical appreciation of consistency and have implications, in particular, for managers and investors of growing firms in emerging industries.

Key words: fit, firm performance, business model, contingency theory, emerging industry

---

3.1 Introduction

Research reports empirical evidence that business models impact firm performance (Zott et al., 2007, 2008). The literature on business models offers different explanations for this relationship: business models appear as a “mediator between a technology and economic value creation” (Chesbrough et al., 2002), create value for investors (Doganova et al., 2009; Shanley, 2004) and translate a technology into value for customers (Chesbrough et al., 2002; Johnson et al., 2009; Lee et al., 2012; Morris et al., 2005). In more recent studies, scholars defined a business model as “activity system” (Zott et al., 2010), which creates value externally (for example, for customers and investors) and internally for the firm itself. Such an understanding implicitly features the assumption that the different activities should be consistent, and fit to each other as best as possible. For instance Johnson et al. claim that business model elements should “bond to one another in consistent and complementary ways“ (Johnson et al., 2008, p.53) and Morris et al. (2005, p.732) elaborate on the importance of business model consistency which “can be described in terms of both internal and external ‘fit’ where the former is concerned with a coherent configuration of key activities within the firm and the latter addresses the appropriateness of the configuration given external environmental conditions.”

The basic assumption that consistency positively drives firm performance is hardly questioned in literature. We see three reasons for that. First, psychologically, consistency and coherence were found to impact or rather facilitate decision making (Morewedje et al., 2010). Second, various studies in organization science inform us about the value of consistency. The analogical concept of fit for example was from the early beginnings seen as “primary determinant of success” (Galbraith, 1977, p.6). It has been an inherent argument for typologies such as the pattern applied by Miles and Snow (1984), for discussions on configurations (Miller, 1996), and it is one of the building blocks of the contingency theory perspective (Drazin et al., 1985). Especially Miller, to whom business model research has a close link (see Zott et al., 2007, 2008), offers a detailed discussion on the value of different “degrees of configuration” and the impact on firm performance (Miller, 1996). Third, empirical evidence from various industries supports the overall value of consistency. Roca-Puig and Bou-Llusar (2007), for example, find evidence for the value of consistency in the hotel, dealership and transport sector.

While there is research on the positive impact of high degrees of consistency, little research exists on configurations that might require or reward less consistent set-ups. Miller’s statement (1996, p.511) that “the more changing and uncertain the
Second Paper: Business Model Consistency

environment, the more loosely coupled the elements of an organization may have to be” gives an indication of the importance of differentiated discussions on the value of consistency. The need for reinvestigating consistency is especially apparent when studying firms in emerging industries. A comparison of firms in the renewable energy sector such as Solarworld and Q-Cells reveals differences in business model consistency and performance of both firms. Q-Cells operated with a highly consistent business model that made fast adaptations to changes in the regulatory and competitive environment difficult. The slow adaptation is supposedly one reason why it had to file bankruptcy in the beginning of 2012. Solarworld, in contrast, is also struggling with the volatile industry context, yet it is currently managing the transition from pure cell production to system integration and trading. One origin of Solarworld’s better adaptability is its less consistent business model set-up in the past.

The renewable energy industry is only one emerging sector characterized by high volatility, in which consistency is associated with substantial opportunity costs that can impact performance: i.e., being less flexible once changes in the industry context come up. Deciding on the right level of consistency is therefore a challenge for managers as well as investors who assess potential investment targets. Thus, the question we address in this paper is: what is the value of business model consistency for firm performance in emerging industries? We argue that while there generally is a benefit from consistency for performance this varies depending on the contingency factors firm growth, business model theme, and industry. We study our question within the context of two entrepreneurial and fast growing renewable energy industries: wind and solar. The rationale for choosing these industries is twofold. First, the renewable energy industry is at the dawn of leading one of the most expansive economic transitions in near future. The International Energy Agency states that investment in low-carbon electricity generating technologies such as wind and solar must be heavily increased in order to reduce energy related CO2 emissions (International Energy Agency, 2010). In this context especially matters of firm performance and investor attractiveness are important enablers of the proposed fundamental change in energy production (International Energy Agency, 2012). Given that, it is a timely issue for research to better understand drivers of firm performance in the renewable energy industry. Second, due to their emerging stage, findings from the renewable energy industry are also transferable to other young industry sectors that face similar external contingencies, ranging from political support changes to technological challenges to investment allocation quests.
To assess our research question we introduce the concept of consistency from a contingency perspective. In this regard, we mainly draw on discussions on degree of configuration and fit. Thereafter, we introduce our model of how consistency impacts firm performance and discuss firm growth and business model theme as moderating factors. Based on this model, hypotheses are developed, new consistency measures are created, and hierarchical OLS regressions are performed. A discussion of our results follows. Finally, implications from our findings for management and investors of firms in emerging industries as well as limitations of our study, and implications for future research are discussed. Overall, we intend to contribute to the literature on consistency and firm performance in emerging industries. For management and investors, we aim at shedding light on the question of when a consistent business model set-up is beneficial for firm performance and when opportunity costs outweigh consistency considerations.

3.2 Business Model Consistency and Firm Performance in Emerging Industries

We define consistency as the internal fit of business model activities with an overarching theme. Our understanding of business model consistency is informed mainly by two different streams of organization theory: discussions of fit on the one hand, and discussions of configurations which have later been adopted from the business model literature on the other hand. Thus, the concept of fit is mostly associated with a contingency theory perspective (Drazin et al., 1985). Nevertheless, the question of whether a high degree of fit is beneficial for firm performance has ever since been of interest for management scholars. Fit, moreover, has been an important aspect in strategy research within debates of strategy and structure dominated by Chandler (1962), Miles and Snow (1978) and others. While Drazin and Van den Ven (1985, p.535) find that “fit is a significant predictor of [unit] performance”, Miles and Snow (1984, p.10) claim that “tight fit, both internally and externally, is associated with excellence”, and Galbraith (1977, p.6) even argues that coherence or fit “is the primary determinant of success”.

It was Danny Miller who further developed ideas of consistent organizational forms and introduced the concept of configurations. He presented a logic of grouping firms and discussed three distinct criteria to classify configurations (Miller, 1986, 1996): typology, taxonomy and configuration as a quality (Miller, 1996). Especially the third approach with configuration as a quality is of interest for us, as it outlines that firms actually differ in their degree of configuration (ibid.). Based on the idea of fit the
explanation for “degree of configurations”, for the first time, points to the fact that firms actually can vary according to how close their elements fit together; hence, how consistent organizations are. This notion in a first step argues for a variance within this dimension without indicating that highly consistent firms are superior to others. Miller mainly outlines positive aspects of consistency, such that it helps creating synergies and coordinating stakeholder activities (Miller, 1996, p.6). At the same time it becomes clear, that consistency requires costs to be established. Management needs to allocate time to establish, monitor and maintain consistency. Markets may reward inconsistent business models over consistent business models, when uncertain environments require an equally flux organizational design. Given these two contradicting lines of argumentation we propose two opposing hypotheses. Thus, in following arguments of advocates of consistency (Drazin et al., 1985; Galbraith, 1977; Miles et al., 1984), we first submit:

\[ H1a: \text{Consistency is positively associated with firm performance} \]

Contrary to the advantages of a high degree of consistency the opportunity costs that come along with it can be a burden – depending on internal and external contingencies. Threats of high consistency include, for example, over-simplicity and too monolithic world-views (Miller, 1993, 1994; Miller et al., 1996) and can ultimately result in a fate similar to Q-Cells as described in the introduction of this paper. Thus,  

\[ H1b: \text{Consistency is negatively associated with firm performance} \]

3.2.1 The Role of the Industry Context for Consistency-Performance Relationships

The first determinants of the consistency-performance relationship we discuss are external contingencies. In contrast to the arguments that point to a benefit of high consistency, for emerging industries we also find arguments that point to negative aspects of a too high degree of consistency. As Miller (1996, p.511) argued, an appropriate level of configuration needs to be in line with the environmental conditions of an organization – especially in uncertain and volatile contexts. The higher the external uncertainty, the more flexibility is required. Investigating distinct contingencies is beyond the scope of our paper; however, we assume that different industries (with different contingency settings) lead to a different value of business
model consistency. In particular, when assessing industries in different development stages, we assume that within separate emerging industry stages different business model configurations would impact firm performance differently (Phaal et al., 2011). While emerging industry segments require a lower degree of consistency due to faster changes, the value of consistency is expected to be higher within more mature industries (Sabatier et al., 2012). Our second hypothesis is therefore:

**H2: The value of business model consistency is higher in more mature industries**

### 3.2.2 The Role of Firm Growth for Consistency-Performance Relationships in Emerging Industries

We further expect consistency-performance relationships to be moderated by firm growth. From an investor perspective firm growth sends positive signals (Davidsson et al., 2009) as it is often seen as a sign for successful future performance. Therefore, growth should reinforce positive effects of consistency on performance and outbalance negative effects. In addition, to further fuel growth prospects and gain scale, a minimum degree of consistency is a prerequisite that further directs towards a positive impact of growth on the consistency-performance relationship. Firm growth is consequently used as our first moderator and the following hypothesis is proposed.

**H3: Firm growth moderates the consistency-performance relationship positively**

### 3.2.3 The Role of Business Model Theme for Consistency-Performance Relationships in Emerging Industries

The business model classifies a firm’s activities for value creation (Sabatier et al., 2012) and is often used as a communication device to investors and other stakeholders (Doganova et al., 2009). In addition, through their contribution to customer value creation and competitive positioning, business models have an effect on firm performance. This effect has been studied for instance by Zott and Amit (2007), who assess the performance impact of business model designs in entrepreneurial firms. Patzelt et al. (2008) elaborate on the moderating effect of business models on the relationship between top management team composition and firm performance. In addition, Zott and Amit (2008) highlight the moderating effect of business models on
the relationship between product market strategy and firm performance. Within their assessments of business models and firm performance Zott and Amit (2007, 2008) selected in reference to Miller (1996) innovation- and efficiency-driven business models as contrary, yet encompassing and complementary themes. As main source of value creation innovation-driven business models focus on novelty and the creation of new goods, technologies or services. While efficiency-driven business models encompass (transaction) cost reduction through, for example, improvement of information transparency and information flows or process optimization (ibid.).

We follow their approach when comparing efficiency- and innovation-driven business models because we expect those two business model themes to moderate the consistency-performance relationship differently. While in efficiency-driven business models a high degree of consistency is expected to be especially beneficial as it allows, for example specialization, cost reduction or optimization this is not the case in innovation-driven business models. Innovation assumedly requires less standardized structures and can be established within organizations of lower levels of consistency. Lee at al. (2012, p.832), for example, define innovativeness as “ever changing environment-responsive strategies […]” – a definition that inherently argues against consistency. Our last hypotheses are therefore:

\[ H4: \text{Business model theme moderates the consistency-performance relationship} \]

\[ H4a: \text{Efficiency-driven business models moderate the consistency-performance relationship positively} \]

\[ H4b: \text{Innovation-driven business models moderate the consistency-performance negatively} \]

![Figure 7: Consistency-performance model](image-url)
3.3 Method

To test our hypotheses we first created a dataset for wind and solar companies from Worldscope (Thomson Reuters, 2012) and OneSource databases (OneSource, 2012). Based on this dataset we conducted content analyses. In the content analyses we identify necessary information from business descriptions for business model classifications and independent variables. We are confident with this approach since the use of coded textual and/or survey information for a representation of business models has been applied earlier, for example by Zott et al. (2007, 2008) and Casadesus-Masanell et al. (2010). Second, we derived a set of independent variables based on our theoretical discussions to measure consistency of business models. Third, we ran – together with a set of control variables – a hierarchical OLS regression analysis as applied by Zott et al. (2007, 2008) to assess the relationship between consistency and firm performance.

3.3.1 Data Collection

We produced an expansive list of wind and solar companies from Worldscope and OneSource. This approach is widely applied for aggregating larger, multi-year datasets (see for example Laamanen et al., 2008; Wan et al., 2003). Our data covers the period from 2006 to 2009. For this dataset we identified all publicly listed companies that comprised “solar” or “wind” in their business description and derived an initial list of 1,144 companies (624 wind and 522 solar). Afterwards, we excluded entries due to data availability issues or misleading business descriptions and arrived at a final sample size of 210 firms (93 wind; 117 solar).

After aggregating this cross-sectional dataset we conducted a two-step content analysis of the Worldscope business description. We categorized the firms according to their business model theme (innovation-driven or efficiency-driven) (Loock, 2011). The codes for the business model themes were based on items suggested by Zott et al. (2008, p.23-26) with adoptions due to the particularities of the renewable energy sector (for example, we added “turnkey” and “patent” which are particularly relevant in technology driven industries).
Table 8: Code definition for business model themes

<table>
<thead>
<tr>
<th>Business description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation-driven</td>
</tr>
<tr>
<td>(innovation, invent, novel, patent, design, research, development, exploration)</td>
</tr>
<tr>
<td>Efficiency-driven</td>
</tr>
<tr>
<td>(marketing, brand, selling, sale, promotion, service, support, turnkey, large scale, low cost)</td>
</tr>
<tr>
<td>Not-clear</td>
</tr>
<tr>
<td>(innovation, invent, novel, patent, design, research, development, exploration, marketing, brand, selling, sale, promotion, service, support, turnkey, large scale, low cost)</td>
</tr>
</tbody>
</table>

We then performed a computer-aided word count of the respective codes and clustered the companies based on the frequency of the respective codes into three categories of business model themes: innovation-driven or efficiency-driven. If themes were mentioned equally frequently or if neither theme was mentioned, the business model was classified as “not clear”. This procedure resulted in 28 innovation-driven and 24 efficiency-driven firms in the wind and 29 innovation-driven and 51 efficiency-driven firms in the solar sector.

3.3.2 Dependent Variable

To measure firm performance we selected – congruent with prior management and organizational research (see Chung et al., 1994; Dowell et al., 2000; Lindenberg et al., 1981; Villalonga, 2004) – Tobin’s q defined as a company’s market value over replacement cost of its tangible assets. Tobin’s q is widely used as a measure of expected returns (Villalonga, 2004, p.211). A value greater than 1 indicates high expectations of future performance, while a value smaller than 1 indicates low expectations by investors.

We collected all necessary information from Worldscope and calculated the market value from the sum of market capitalization, long-term debt, and current liabilities (Dowell et al., 2000). Finally, we derived the mean over the time period from 2006 to 2009 following the proposition by Dowell et al. (2000) to account for possible extreme values over the time period.
3.3.3 Independent Variables

To assess the consistency of business models we created two proxy variables that were aggregated into the overall consistency measure of our analysis. The two proxy variables are financial and descriptive consistency. They allow us to measure the alignment of publically available quantitative and qualitative data with the respective business model theme of the firms.

**Financial consistency:** Financial consistency was measured by two separate financial ratios that should show characteristic levels for the respective business model theme. A selection criteria for the ratios was furthermore data availability for all firms in our sample on a comparable basis (R&D expenses, for example, are not reported in a standardized form). We always compared the ratio achieved by an individual firm (over our time period from 2006 to 2009) to its industry cluster peers\(^9\) and used a 3-point-Likert scale to assign the consistency values. 3 points were assigned for more than 20% deviation from the industry mean, 2 points for more than 10% deviation from the industry mean, 1 point for less than 10% deviation.

The ratio used for innovation-driven business models is intangibles/ total assets. The share of intangibles in total assets is a suitable variable to assess consistency in an innovation-driven business model from our perspective because intangibles comprise intellectual property created by a company itself. Intangibles can include, for instance, patents, copyrights, and trademarks. A high share of capitalized intangibles in a firm’s balance sheet indicates thus a strong innovative performance that can only be achieved through an internal, consistent alignment of research and development activities (Canibano et al., 2000; Fernandez et al., 2000).

The ratio used for efficiency-driven business models is inventory turnover. Inventory turnover is defined as cost of goods sold over the mean of the current and last year’s inventory, and can be interpreted as the number of times a company’s inventory is sold over a period of 12 months. A high turnover stands for high efficiency levels in terms of optimized internal production, purchasing, and logistics processes and is therefore characteristic for efficiency-driven firms (Jahnukainen et al., 1999).

**Descriptive consistency:** Based on Doganova et al.’s line of argumentation (2009) business models operate also as narrative devices that help outsiders understand the business activities of a firm. We therefore incorporated also a qualitative measure in our analysis to assess consistency in this dimension. The descriptive proxy variable

---

\(^9\) We calculated the mean per ratio within the industry clusters from Worldscope (see section on control variables) to account for potential differences in cost structures, raw material prices, etc. within our sample.
was derived through a content analysis of the individual OneSource (OneSource, 2012) strategy reports. We developed the same number of codes per business model theme (see Table 9 for an overview), again based on the concepts used by Zott et al. (2007, 2008, 2010), that describe structural and procedural dimensions of the firm’s business activity. In a next step, we assigned consistency if a firm had an above average word count compared to its industry cluster peers.

Table 9: Applied financial ratios and codes for consistency assessment

<table>
<thead>
<tr>
<th>Financials</th>
<th>Strategy descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation-driven</td>
<td>Intangibles/ total assets flexible, innovative, invention, innovation process, freedom, creativity, vision, inspiration, knowledge, patent, design, concept, pioneer, R&amp;D</td>
</tr>
<tr>
<td>Efficiency-driven</td>
<td>Inventory turnover specialization, formalization, control, reduction, rule, procedure, coordination, efficient, effective, optimization, transaction cost, systematic, plan, complexity</td>
</tr>
</tbody>
</table>

After we aggregated the individual consistency measures we summed them up to an overall proxy variable. The respective values were measured on a 5-point-Likert scale with 1 representing low consistency and 5 representing high consistency.

Business Model Consistency = Financial Consistency + Descriptive Consistency

This approach results in the highest consistency levels only for those firms that have highest consistency level in the financial dimension and are consistent in the descriptive dimension as well. See Figure 8 for an overview of the procedure.
### 3.3.4 Control Variables

We included several control variables in our analysis (Zott et al., 2008) that were in previous studies shown to influence Tobin’s q: company size, measured by the normalized mean of revenues from 2006 to 2009, profitability, measured by the normalized mean of return on sales from 2006 to 2009, and growth, measured by compounded annual sales growth from 2006 to 2009. In addition, we included region and industry cluster, based on the classification from Worldscope (Thomson Reuters, 2012).

### 3.3.5 Analytic Procedure

To test our hypotheses we analyzed our data using multivariate regression techniques. We analyzed the wind and the solar sample separately since we assume that different industry stages and business activities in these industries lead to different revenue models, accounting procedures and cost structures which would limit the comparability of the applied financial measures in a joint regression. Furthermore, as stated in our fourth hypothesis, we expect the industry context to have an influence on the consistency-performance-relationship. The moderating effects in hypotheses 2 and 3 were assessed by addition of interaction terms. We furthermore validated our models in a two step process. First, to fulfill the conventional requirement of normally distributed variables we conducted a logarithmic transformation of the dependent as well as two independent variables (sales and profitability). Second, we tested for
multicollinearity among the independent variables (see Table 10 and 11 for Pearson’s correlations). The variance inflation factors (VIF) were calculated among first-order terms as well as among first- and second-order terms when interaction terms were introduced. In all cases the VIF levels were smaller than the threshold level 10 (Kleinbaum et al., 1998).
### Table 10: Pearson’s correlation table for wind sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business model gestalt themes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Efficiency</td>
<td>0.26</td>
<td>0.44</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Innovation</td>
<td>0.30</td>
<td>0.46</td>
<td>-0.39***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. In (Tobin’s Q average 2006-2009)</td>
<td>1.74</td>
<td>1.32</td>
<td>-0.06</td>
<td>-0.03</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Consistency</td>
<td>1.33</td>
<td>1.57</td>
<td>0.47***</td>
<td>0.37***</td>
<td>-0.05</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Consistency_Efficiency</td>
<td>2.61</td>
<td>1.29</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.12</td>
<td>0.12</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Consistency_Innovation</td>
<td>1.98</td>
<td>1.34</td>
<td>0.05</td>
<td>0.12</td>
<td>0.26*</td>
<td>0.42***</td>
<td>-0.05</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Growth (revenue CAGR 2006-2009)</td>
<td>0.28</td>
<td>0.43</td>
<td>0.01</td>
<td>0.09</td>
<td>0.47***</td>
<td>0.12</td>
<td>-0.08</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Region</td>
<td>2.19</td>
<td>0.63</td>
<td>-0.06</td>
<td>0.06</td>
<td>0.02</td>
<td>0.12</td>
<td>-0.08</td>
<td>0.30**</td>
<td>-0.17</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Age</td>
<td>35.81</td>
<td>33.95</td>
<td>-0.06</td>
<td>-0.05</td>
<td>-0.30**</td>
<td>-0.01</td>
<td>0.04</td>
<td>0.14</td>
<td>-0.30**</td>
<td>0.21*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Industrycluster</td>
<td>3.10</td>
<td>1.56</td>
<td>0.01</td>
<td>-0.06</td>
<td>0.00</td>
<td>-0.05</td>
<td>-0.03</td>
<td>-0.05</td>
<td>0.15</td>
<td>-0.12</td>
<td>-0.01</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. In (average revenues 2006-2009)</td>
<td>2120.24</td>
<td>4913.24</td>
<td>0.11</td>
<td>-0.14</td>
<td>-0.29**</td>
<td>0.12</td>
<td>0.07</td>
<td>-0.09</td>
<td>-0.26*</td>
<td>-0.02</td>
<td>0.17</td>
<td>0.06</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>12. In (average return on sales 2006-2009)</td>
<td>0.07</td>
<td>0.15</td>
<td>0.06</td>
<td>-0.11</td>
<td>-0.09</td>
<td>0.02</td>
<td>0.06</td>
<td>-0.04</td>
<td>-0.40***</td>
<td>0.00</td>
<td>0.03</td>
<td>-0.12</td>
<td>0.34**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Note on descriptive statistics:**
Mean of Tobin’s q, revenues and return on sales in USD millions (not normalized)

***p <0.001, **p < 0.01, *p < 0.05, †0.05 <= p <= 0.1
<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business model gestalt themes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Efficiency</td>
<td>0.44</td>
<td>0.50</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Innovation</td>
<td>0.25</td>
<td>0.43</td>
<td>-0.51***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ln (Tobin's Q average 2006-2009)</td>
<td>1.61</td>
<td>0.95</td>
<td>-0.18</td>
<td>0.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Consistency</td>
<td>1.62</td>
<td>1.57</td>
<td>0.57***</td>
<td>0.10</td>
<td>-0.13</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Consistency_Efficiency</td>
<td>2.45</td>
<td>1.28</td>
<td>0.13</td>
<td>-0.08</td>
<td>0.03</td>
<td>0.42***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Consistency_Innovation</td>
<td>2.12</td>
<td>1.43</td>
<td>0.10</td>
<td>-0.09</td>
<td>0.05</td>
<td>0.15</td>
<td>-0.09</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Growth (revenue CAGR 2006-2009)</td>
<td>0.10</td>
<td>0.26</td>
<td>0.06</td>
<td>-0.11</td>
<td>0.17</td>
<td>0.02</td>
<td>0.18*</td>
<td>0.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Region</td>
<td>2.06</td>
<td>0.67</td>
<td>0.23*</td>
<td>-0.02</td>
<td>-0.19*</td>
<td>0.18*</td>
<td>0.11</td>
<td>0.06</td>
<td>0.16</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Age</td>
<td>32.02</td>
<td>25.90</td>
<td>0.20*</td>
<td>-0.27**</td>
<td>0.02</td>
<td>0.05</td>
<td>0.08</td>
<td>0.09</td>
<td>-0.07</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Industry cluster</td>
<td>2.55</td>
<td>1.44</td>
<td>0.21*</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.33***</td>
<td>0.18*</td>
<td>0.25**</td>
<td>0.07</td>
<td>0.09</td>
<td>0.19*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. ln(average revenues 2006-2009)</td>
<td>1463.97</td>
<td>4871.80</td>
<td>0.20*</td>
<td>-0.11</td>
<td>-0.19*</td>
<td>0.18</td>
<td>0.08</td>
<td>0.15</td>
<td>-0.02</td>
<td>0.10</td>
<td>0.26**</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>12. ln(average return on sales 2006-2009)</td>
<td>-0.01</td>
<td>0.32</td>
<td>0.20*</td>
<td>-0.04</td>
<td>-0.01</td>
<td>0.06</td>
<td>-0.08</td>
<td>0.02</td>
<td>0.25**</td>
<td>0.25**</td>
<td>0.09</td>
<td>-0.01</td>
<td>0.28**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note on descriptive statistics:
Mean of Tobin's q, revenues and return on sales in USD millions (not normalized)

***p <0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
3.4 Results

Our results show no consistency-performance relationship per se. However, there are differences in the consistency-performance relationship in the wind and solar industry. Efficiency- and innovation-driven business models were found to have an impact on the relationship as well. Furthermore, we find instances in which growth moderates the relationship.

3.4.1 Descriptive Statistics

In our sample the average size of firms in the wind sector is USD 2,120 million, in the solar sector USD 1,463 million (mean over the period from 2006 to 2009). Moreover, the wind firms in our sample are more profitable (mean return on sales 0.07, s.d. 0.10) than the solar firms (mean return on sales -0.01, s.d. 0.17). Compounded annual growth is 10% for solar and 28% for wind firms over our analysis timeframe.

3.4.2 OLS Regressions

In model 1a we test the influence of consistency on firm performance by only including these variables, along with growth and our controls, into the regression. We are not able to measure a significant result for a consistency-performance relationship per se – as we should have if H1a or H1b were true. Thus, former statements or findings in other studies that consistency is directly linked to performance cannot be supported by our analysis. We find, however, a significant relationship of consistency and performance that is negatively moderated by growth in model 1b (addition of interaction term ‘consistency*growth’; p<0.01). This effect only shows in the solar sector. With these results we cannot confirm hypothesis 3, but we find a first indication that results vary among our two industry sectors as stated in hypothesis 2.

To test the impact of business model theme, we analyze three different models per theme in a next step. First, we only add consistency and business model (models 2a and 3a), then we add the interaction term ‘business model theme*consistency’ (models 2b and 3b), lastly we add the interaction with growth (interaction term ‘business model theme*consistency*growth’, models 2c and 3c). When looking at differences for business models and consistency, we only find a positive effect of consistency in innovation-driven business models in the wind sector (models 3a to 3c, p<0.01). The interaction effects of consistency and business model as tested in models 2b and 3b are not significant. We therefore reject hypothesis 4.
Hypothesis 3 is further tested in models 2c and 3c by adding the interaction terms with growth. In the wind sector, we find a slightly significant, positive moderation for efficiency business models (model 2c, p<0.1) and a negative moderation for innovation business models (model 3c, p<0.01). We do not find any significant results linked to business models and growth in the solar sector. We can therefore, combined with the negative moderation by growth in model 1b, only confirm hypothesis 3 in one model: for growing wind firms with efficiency business models.

To test hypothesis 2 we analyze our samples in two different regressions. As the results vary between our two sectors, and because we find a stronger impact of consistency in the wind than in the solar sector, we see support for hypothesis 2. The consistency-performance relationship therefore depends on industry contingencies and industry maturity could be an explanatory factor. We discuss this question in more detail below.
Table 12: Regression results from wind sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Consistency</th>
<th>Efficiency</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1a</td>
<td>Model 1b</td>
<td>Model 2a</td>
</tr>
<tr>
<td>Constant</td>
<td>0.44</td>
<td>0.41</td>
<td>0.54†</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistency</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.03</td>
</tr>
<tr>
<td>Consistency_Efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistency_Innovation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency</td>
<td>-0.07</td>
<td>-0.18</td>
<td>-0.15</td>
</tr>
<tr>
<td>Innovation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth (revenue CAGR 2006-2009)</td>
<td>0.56***</td>
<td>0.68**</td>
<td>0.54***</td>
</tr>
<tr>
<td><strong>Interaction terms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistency*Growth</td>
<td>-0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation*Consistency_Efficiency</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation*Consistency_Innovation</td>
<td>0.10†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation<em>Consistency_Innovation</em>Growth</td>
<td>-0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td>0.11</td>
<td>0.11</td>
<td>0.09</td>
</tr>
<tr>
<td>Industry cluster</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>Age</td>
<td>-0.00†</td>
<td>-0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ln (average revenues 2006-2009)</td>
<td>-0.05†</td>
<td>-0.05</td>
<td>-0.05†</td>
</tr>
<tr>
<td>ln (average return on sales 2006-2009)</td>
<td>0.37</td>
<td>0.39</td>
<td>0.37</td>
</tr>
<tr>
<td>R2</td>
<td>0.32</td>
<td>0.32</td>
<td>0.31</td>
</tr>
<tr>
<td>Adj. R2</td>
<td>0.26</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>F</td>
<td>5.58***</td>
<td>4.93***</td>
<td>4.75***</td>
</tr>
<tr>
<td>N</td>
<td>93</td>
<td>93</td>
<td>93</td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
### Table 13: Regression results from solar sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Consistency</th>
<th>Efficiency</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1a</strong></td>
<td>0.84***</td>
<td>0.79***</td>
<td>0.81***</td>
</tr>
<tr>
<td><strong>Model 1b</strong></td>
<td>0.81***</td>
<td>0.71**</td>
<td>0.79***</td>
</tr>
<tr>
<td><strong>Model 2a</strong></td>
<td>0.81***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
<tr>
<td><strong>Model 2b</strong></td>
<td>0.83***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
<tr>
<td><strong>Model 2c</strong></td>
<td>0.83***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
<tr>
<td><strong>Model 3a</strong></td>
<td>0.83***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
<tr>
<td><strong>Model 3b</strong></td>
<td>0.83***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
<tr>
<td><strong>Model 3c</strong></td>
<td>0.83***</td>
<td>0.83***</td>
<td>0.77***</td>
</tr>
</tbody>
</table>

**Independent variables**

- **Consistency**: -0.02
- **Consistency_Efficiency**: 0.02
- **Consistency_Innovation**: 0.03
- **Efficiency**: -0.15
- **Innovation**: -0.12
- **Growth (revenue CAGR 2006-2009)**: 0.34*
- **Interaction terms**
  - **Consistency*Growth**: -0.14†
  - **Innovation*Consistency_Efficiency**: -0.07
  - **Innovation*Consistency_Efficiency* Growth**: -0.08
  - **Innovation*Consistency_Innovation**: 0.06
  - **Innovation*Consistency_Innovation* Growth**: -0.17

**Control variables**

- **Region**: -0.14*
- **Industry cluster**: 0.02
- **Age**: 0.00
- **ln (average revenues 2006-2009)**: -0.05*
- **ln (average return on sales 2006-2009)**: 0.15
- **R2**: 2.18*
- **Adj. R2**: 0.07
- **F**: 117

***p < 0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
3.5 Discussion

Our first hypothesis was double edged because prior literature is not fully consistent in its discussion on the positive or negative effect of consistency on firm performance. Hypothesis 1a proposed a positive association of consistency and performance, hypothesis 1b a negative association. Based on our findings we can neither confirm 1a nor 1b. We do not find a repeatedly positive or negative relationship of consistency and performance throughout our sample.

The first instance in which we find significant results is when looking at the moderating role of growth. Hypothesis 3 proposed a positive moderating role of growth as it signals bright future prospects to investor. We are, however, only in one instance able to confirm this hypothesis: We find a positive moderating effect for efficiency business models in the wind sector. In more established sectors, like the wind industry, for firms that follow an efficiency paradigm and are growing, consistency shows to be valuable as it leads to a comparably higher performance. Contrary to our expectations of an unrestrained positive influence of growth, we find two cases of a negative moderation. The first is found in the solar sector, independently of the business model. In the wind sector, we find a negative effect of firm growth for innovation-driven business models. For fast growing firms we thus argue that, in emerging sectors, the opportunity costs outweigh the benefits of consistency. The same applies to innovation-driven, fast growing businesses in a more established sector. Investors hence seem to expect fast growing firms to maintain a higher degree of flexibility under these two conditions.

The negative moderation of growth for only one business model theme leads us to the discussion on our fourth hypothesis. We argued that consistency is positively associated with efficiency-driven business models and negatively with innovation-driven models. However, looking at business model-consistency-performance relationships, we need to reject our hypotheses. For efficiency-driven business models we find only one positive effect in connection with growth in the wind sector. In all other models there are no significant results. For innovation-driven business modes we find the contrary effect to our hypothesis: In the wind sector only, we find a positive effect of consistency. This indicates towards a value of consistency in business models that carry uncertainty regarding their performance outcome themselves, as innovation-driven business models do. Our findings challenge discussions on innovativeness that argue for a high degree of flexibility and slag resources to reach optimal performance (Lee et al., 2012). As this finding only appears in the more mature wind industry we propose the following explanation: when industry maturity increases and innovations
become more incremental rather than disruptive, the value of consistency in innovation-driven firms outweighs its opportunity costs. In other cases as well as up to this stage ambidextrous (Sanchez et al., 1996; Tushman et al., 2010) or paradox-mirroring organizational designs (Smith et al., 2011; Smith et al., 2010), especially for fast growing, innovative firms, might be the right choice.

Finally, when comparing our industry settings as done in hypothesis 2, we find support for a higher value of consistency in more mature industries. We show for the solar industry that growth negatively moderates the consistency-performance relationship - regardless of the business model. Thus, we assume that within early-stage industries with high volatility consistency does not have a value per se. In fact, for fast growing firms an adaptive set-up seems to be more advisable to be able react to industry changes. More granular results can be seen in the more established wind sector, where the industry’s less inherent volatility results in different impacts of consistency depending on business model theme and firm growth. These results add to the discussion by Phaal et al. (2011) on industrial emergence and related success factors.

We summarize our findings related to industry evolution in Figure 9. In young, emerging sectors such as the solar industry there is no, or even a negative value of performance (moderation by growth illustrated with arrow 1). In more established industries, we find the value of consistency to be increasing, however depending on business model and growth (moderation effects in both directions, arrows 2a and 2b). As the industry lifecycle continues we expect the earlier discussed advantages of consistency to become more apparent (Drazin et al., 1985; Galbraith, 1977; Miles et al., 1984) – illustrated by a steeper curve. In younger industries than the solar sector, we suppose the findings from the solar industry to be more pronounced. Both proposed extrapolations of our findings can be starting points for further research and will be discussed further in the next section.
3.6 Conclusion

With an empirical investigation of renewable energy firm performance we found that firms differ according to the fit of business descriptions with financial measures and thus their business model consistency. For the first time we were able to measure the variance of business model consistency for firms in emerging industries. We tested this variance of consistency for implications on financial performance as measured in Tobin’s Q with a sample of 210 firms in the renewable energy industry and investigated the impact of different degrees of consistency on firm performance. As fit is, according to contingency theory, usually associated with superior firm performance we expected a positive impact of consistency and renewable energy firm performance. However, our regression models do not identify a plain consistency-performance relationship.

These results have implications for managers as well as investors and bear potential for further research in different areas. When considering business model design managers should weight the costs and benefits and need to be aware of the circumstances that drive the value of consistency. First, the business model theme itself has implications for the value of consistency and therefore needs attention when allocating financial means or deciding on activities to achieve consistency. Second, our findings show that it is important to consider the industry’s evolutionary stage.
As we measure firm performance with Tobin’s q this reflects the stock market and investors’ perception of a firm’s strategy. Our results therefore also have implications for investors. Investors should consider including business model consistency as a performance indicator into their investment analysis and actively monitor it. But they need to be cautious regarding the value they assign to consistency. Four aspects need to be considered, in particular: growth, industry stage, business model, and consistency. If consistency is used as a performance indicator, it is necessary to assess the fit between consistency level and a given contingency combination of industry stage, business model, and growth scenario. The application of consistency as a performance indicator has in return an additional implication for managers. They should be aware of their investors’ preferences in regard to consistency. It is crucial to actively monitor and communicate consistency levels, opportunity costs, and underlying decisions.

Naturally our work comes with some limitations that result from the scope and method of our study. First of all, there are limitations resulting from our sample. Because we focus on renewable energy companies with two types of business models the generalizability to other industries is limited. We also restricted our timeframe to a four year period that included a financial crisis. Despite the analysis of means across that timeframe, this short time period could have influenced our results. From our methodological approach there stem limitations inherent in the way we built our independent variables. They are subject to an outsider’s perspective only since we derived all our information from publically available sources. Moreover, despite the fact that the creation of our financial measures is based on prior academic results, investors might either use different or a broader set of variables to assess financial consistency.

Drawing on our findings and limitations we see different avenues for further research. First, we encourage research that investigates whether similar results apply to other emerging industries, different economic contexts, and other timeframes. Second, since our study is an ex-post study it can be interesting to elaborate on the impact of consistency within further settings. For that we propose a real-time investigation of the impact of consistency on investment preferences (for example, within a conjoint experiment or a qualitative assessment). Third, we expect interesting insights from research that assesses other orchestrating themes than business models and other moderating effects beyond firm growth and business models. Finally, as illustrated in Figure 3, we suggest analyses that extrapolate our findings to more emerging and/or
established industries and potentially identify a continued consistency-performance dynamic along the industry lifecycle.

3.7 References


Galbraith JR. 1977. *Organization design*. Addison-Wesley: Reading, MA


4 Third Paper: Diversification into Emerging Industries: An Event Study on Investor Reaction

by Melanie K. Oschlies

Abstract

Substantial investment in the renewable energy industry is needed in the coming years to drive the global energy system transition. However, investment decisions in emerging industries, like the renewable energy industry, are often associated with high uncertainty. This paper assesses stock market reactions to diversification decisions of established multi-technology players into the renewable energy sector. It analyzes investor reactions depending on diversification mode, timing, energy technology, and market sentiment. The tested hypotheses are routed in resource-based and behavioral economics literature. The empirical assessment is an event study of 37 diversification decisions into the renewable energy industry between 2001 and 2011. Results indicate positive investor reactions to entries into the renewable energy sector and suggest a dependence on heuristics to reduce uncertainty. These findings contribute to the diversification-performance literature and highlight the relevance of market sentiment for managers and investors.

Key words: behavioral economics, diversification, emerging industries, event study, renewable energies, resource-based view

4.1 Introduction

A transition in the global energy system from fossil fuels to renewable sources to mitigate climate change ranks high on the global political agenda. However, not only political measures are needed to achieve this transition. To further drive the emergence of the renewable energy sector substantial public and private investments are necessary. In the most recent IPCC report, a total sum of 2,900 to 12,300bn USD is stated as the required sum of investment from 2011 to 2030 to achieve a share of 77% renewables in 2050 (IPCC, 2011). These investment volumes need to be generated from multiple sources, and especially the request for increased investment activities by private companies is emphasized (IEA, 2012; Wüstenhagen et al., 2012). Large multi-technology firms are one group of private actors that have a leading role in this transition due to their investment capacities and technological know-how (Lewis et al., 2007). Publically traded companies, however, need to assess their investment decisions in line with the requirements of their own financiers. Decisions investors approve or disapprove are rewarded or penalized with immediate stock market reactions.

Diversification decisions into emerging industry segments furthermore require strategic foresight since uncertainty about future market outcomes is higher than in established markets. Despite a long history of research on diversification with numerous suggestions for the best form and timing of successful diversification moves, there is no one precise answer for the right timing and diversification mode. This becomes evident when market reactions to diversification strategies of large multi-tech firms into the renewable energy sector are assessed. Looking at the wind turbine and systems industry, GE was the first multi-tech player that entered the sector, through an acquisition, in 2002. Until then the sector was dominated by pure play actors such as Vestas. Since its market entry, GE managed to become the third largest player after Vestas and Gamesa. Siemens and Alstom followed GE in 2004 and 2007, again both through acquisitions. However, Siemens today only ranks sixth in terms of market share and Alstom did not make it to the top 10 (BTM Consult, 2009). Moreover, short-term stock market reactions to the announcements of the respective market entries varied. While the abnormal return of GE was slightly positive after the announcement, Siemens and Alstom saw mixed share price reactions.

The effects of market entry timing on market shares have been studied (Kerin et al., 1992; Urban et al., 1991) with findings that are in line with the market outcome in the wind segment (i.e. GE having the highest and Alstom having the lowest market share). In contrast, the assessment of investor reactions to strategic decisions was focusing,
among others, on product innovation, leadership turnover, and marketing activities (Agarwal et al., 2002; Gilley et al., 2000; Mathur et al., 2000; Seelhofer, 2010; Worrell et al., 1986). The underlying assumption in these analyses is that investors assign a cash flow projection to new strategies and these strategic decisions hence affect market performance (in form of share prices). But especially emerging industries, like the renewable energy industry, face high uncertainties resulting from varying market forecasts and changes in political regulation. The development of cash flow projections is hence not straightforward (Lee et al., 2010b). Moreover, there are diverse entry options to choose from: being a first-mover or early entrant, a close follower or a laggard is one dimension (Finney et al., 2008; Lieberman et al., 1998b; Lilien et al., 1990). Investing in own R&D, cooperating or acquiring a firm that is already active in the market is another option (Lee et al., 2010a). Previous research argues hence, based on industrial organization and resource-based perspectives, for different ways to gain competitive advantage through diversification. Yet empirical results on performance implications vary substantially (Palich et al., 2000). Assessing diversification decisions and their potential performance impact is thus challenging for investors.

This paper’s goal is therefore to analyze investors’ reactions to decisions of established multi-tech companies that enter the renewable energy sector through acquisitions, both as early mover or close follower, for three reasons. Firstly, diversification has been studied predominantly in emerging markets and not in emerging industries, so far (Meyer et al., 2009). Yet, diversification into emerging industries is a key driver of a firm’s future success and competitive advantage. Secondly, the performance impact (based mostly on accounting measures) of diversification decision and not investor reactions were studied (Barreto et al., 2006). And thirdly, a behavioral perspective on investor reactions to diversification is missing as well. This perspective is particularly interesting, because uncertainty in the decision context can lead to the application of cognitive heuristics and influence decision outcomes as well as investor reactions (Kahneman et al., 1998). Based on findings on investor under- and overreactions (Kadiyala et al., 2004), I therefore expect that not only potential sources for competitive advantage are drivers for investor reactions. The research questions that this paper will address are hence: How do diversification strategies into an emerging industry sector impact stock market performance in the short-term? How does the impact vary with the timing of strategic decisions (early vs. late adopters), diversification mode, technology, and the current market sentiment?
By answering these questions the intention is to contribute to the ongoing discussion on diversification strategies (Palich et al., 2000). The aim is to further enhance the understanding of investor perceptions of entry decision in emerging industries. Moreover, I contribute to the resource-based perspective on diversification by discussing investor perspectives on different sources for competitive advantage. Beyond the classic strategic management literature, I add the behavioral economics view to analyze potential heuristics in investor behavior. The combination of these two lines of argumentation provides starting points for future research on investors’ assessment of strategic decisions intended to create competitive advantages. For managerial practice, implications contain insights on influence factors for diversification strategies and investor preferences. For investors, the results indicate towards irrational decision making when rewarding decisions based on market sentiment. Overall, the paper sheds light on investor behavior in emerging industries and helps understanding the complexity of decision making in uncertain industrial contexts.

To fulfill its aims this paper first describes existing literature on corporate diversification and links it to investor perceptions. Based on prior research findings hypotheses are developed. To test the hypotheses an event study of 37 diversification moves into the renewable energy industry is conducted. After aggregating the results, implications for theory, management practice, and investors are described. This paper ends with a discussion on its limitations and on potential areas for further research.

### 4.2 Theoretical Background and Hypotheses Development

Theory on success and failure of diversification moves is broad. Its main dimensions concern the mode of diversification (Carow et al., 2004; Lee et al., 2010a), the timing (Finney et al., 2008; Lieberman et al., 1998a; Lieberman et al., 1998b; Robinson, 1988; Robinson et al., 1985), and the relatedness of new business activities with existing ones (Christensen et al., 1981; Montgomery, 1982, 1985; Palepu, 1985; Palich et al., 2000; Rumelt, 1982; Steinemann et al., 2004). Earlier literature, as broad as it is, however is equally discordant on the success factors and performance impacts of diversification decisions (Amit et al., 1988; Palich et al., 2000). It is thus neither a simple task for managers to decide on the right diversification move and timing, nor for investors to evaluate these moves. Furthermore, the decision context that was found to impact investors’ assessments by behavioral economics researchers (Barberis et al., 1998; Rosen, 2006), did not yet see much attention in diversification studies. In particular, when decision contexts are associated with a higher degree of uncertainty,
the role of contextual effects is not to be neglected (Courtney et al., 1997; DiMaggio et al., 1983; Mayer et al., 2003). Managers moreover, have to not only deal with operational alignment of the different diversification dimensions. They also need to consider their investors’ judgment of strategic decisions. For diversification decisions into emerging industries it is thus crucial to understand which role different internal and external dimensions play for investors’ assessment, and consequently for stock market reactions.

In this paper, I look at diversified, multi-technology firms in the industrial machinery and electronic equipment industry. In particular, I assess their decisions to enter the renewable energy industry. The market reactions following these diversification announcements are analyzed regarding their diversification mode, timing, and decision context. Relatedness is not considered further, as there is agreement on the advantages of relatedness in literature (Pandya et al., 1998; Very, 1993; Zook et al., 2003). Moreover, all firms in the sample have prior activities in electricity-generation related businesses and the analyzed diversification moves thus assumed to have a similar degree of relatedness.

4.2.1 Investor Reactions to Diversification: Do Investors Value Strategic Foresight?

The performance impact of diversification has, so far, been assessed predominantly based on accounting measures (Dubofsky et al., 1987; Palich et al., 2000). An aspect that is equally important, in particular when considering the tentative involvement of private investors in the energy system transition (IEA, 2012), is their assessment of diversification strategies into the renewable energy sector. Based on the assumption of efficient capital markets and perfect information, share prices react to previously unanticipated, relevant events with abnormal positive or negative returns (Fama et al., 1969). Thus, a positive evaluation of a diversification move in terms of expected risk and return would be reflected in a positive abnormal return. In the next paragraphs I describe different dimensions of diversification and assess the underlying advantages and disadvantages for firm performance. Based on a comparison of risk and return, expected stock market reactions are described as hypothesis. Figure 1 at the end of this section summarizes the analyzed relationships.

Before looking at individual dimensions of diversification, the first hypothesis addresses the diversification into an emerging industry in general. Literature does not agree on the impact of a diversification move per se (Palich et al., 2000), hence I cannot propose an expected positive or negative reaction. Yet, as this study deals with
emerging industries there are other particularities to be considered. Positive reactions can result from the assessment that an entry into an emerging industry, here the renewable energy industry, creates competitive advantages and is a sign of strategic foresight of the management team (Barney, 1986, 1991; Lieberman et al., 1998b). Negative reactions, on the other hand, can stem from the high uncertainty and risk associated with an emerging industry. In the example of the renewable energy industry, aspects such as policy and regulatory dependence, technological immaturity, and social acceptance are sources for a high risk perception (Lewis et al., 2007; Masini et al., 2012). Because private and institutional investors move only reluctantly into the renewable energy sector (IEA, 2012), I assume that their expected risk exceeds the expected return, and therefore they react negatively to a diversification decision into this sector. I further separate this effect depending on the uncertainty of the renewable energy technology involved. The first hypotheses are therefore:

*H1: Investors react negatively to diversification moves into the renewable energy industry*

*H2: Investors react less negatively when moves are associated with less uncertain technologies*
4.2.2 Diversification Mode and Timing: Do Investors Value the Potential to Create a Competitive Advantage?

Two intensely discussed aspects of diversification are diversification mode and timing. A diversification into a new segment can be done by own or joint R&D or a full or partial acquisition of another firm or technology. Both modes have advantages and disadvantages. While, on the one hand, own R&D creates a know-how advance and competitive advantage, it is associated with high risk regarding the final outcome (Lee et al., 2010a). An acquisition of a firm or technology, on the other hand, is less risky in terms of R&D outcome and it is seen as a rapid way to enter a market (Finkelstein, 1997; Simmonds, 1990). But it bears the risk of post-acquisition integration problems and overpayment (Chatterjee, 1992; Lee et al., 2010a). Moreover, existing research did at best find neutral firm performance impacts of acquisitions (Carow et al., 2004). As R&D investments are a rather incremental than one-time process (Lee et al., 2010a) immediate investor reactions are difficult to assess. Therefore, there is no hypothesis proposed here. However, for acquisitions, a separation between full takeovers and stake acquisitions is made, to differentiate between underlying risk levels. While in a partial acquisition the full benefits cannot be enjoyed, the risk is shared as well. Moreover, joint R&D and market entry efforts have been found to create a positive market reaction (Park et al., 1997). The second hypothesis is therefore:

\[ H3: \text{Investors react negatively to full takeovers, and positively to stake acquisitions into the renewable energy industry} \]

Similar effects apply for the decision timing. The first-mover phenomenon is deeply rooted in strategy research from a resource-based perspective and has been studied regarding its advantages and disadvantages (Finney et al., 2008; Jakopin et al., 2012; Lieberman et al., 1998b; Robinson, 1988). Research shows, predominantly from a resource-based perspective, positive profitability, technological leadership, creation of buyer lock-in effects, and favorable market share developments for first-movers (Carow et al., 2004; Frynas et al., 2006; Kerin et al., 1992; Usero et al., 2009). Yet, early moves into new industries are also more risky as there is less market, technology, and in the case of the renewable energy industry, also regulatory certainty (Fuentelsaz et al., 2002; Lilien et al., 1990). In contrast, second or close followers can to a certain degree ‘free-ride’ on early entrants investments and face less market uncertainty (Gilbert et al., 1996; Lilien et al., 1990). Late entrants finally can imitate early movers
and build on the existing technological and market circumstances if they are able to overcome market entry barriers. Research however found, that substantial market share gains are less likely for them (Lilien et al., 1990; Ulhoi, 2012; Urban et al., 1991). Consequently, I expect a negative investor reaction for the earliest market entries. This effect turns around with increased market maturity and correspondingly higher industry knowledge of investors. Once the advantages of being an early mover decrease, I expect late followers to face negative investor reactions.

*H4a: Investors react negatively to early diversification decisions into the renewable energy industry
H4b: Investors react positively to close follower diversification decisions into the renewable energy industry
H4c: Investors react negatively to late follower diversification decisions into the renewable energy industry

### 4.2.3 Decision Context: Does the Market Sentiment Reflect on Investors’ Reactions?

Beyond the described effects of timing and diversification mode I expect that the success of these strategies depends on the current market sentiment. When borrowing lines of argumentation from behavioral economics, investor reactions are not always as rational as traditional finance theory proposes. Rosen (2006), for example, found that investor reactions to mergers depend on recent merger successes by other firms and the overall market development. Kadiyala and Rau (2004) identify behavioral reasons such as conservatism and representativeness for investor under- or overreactions. Furthermore, Wüstenhagen and Menichetti (2012) propose cognitive aspects to influence perceived risk and return and ultimately investor reactions. I therefore propose in my last hypothesis that investor reactions depend on the current market sentiment, public debate and recent energy-related events, such as climate negotiations or environmental disasters (for example, oil spills or the Fukushima incident).

*H5: Investors react positively to diversification decisions in an environment of a favorable market sentiment and negatively in times of an adverse market sentiment for renewable energies*
4.3 Method

For this paper the event-study methodology is used to assess stock market reactions to diversification decisions into the renewable energy sector. Event studies have so far been used to assess, for example, the effect of leadership changes, product announcements, strategic cooperation, and marketing strategies on share price (Agarwal et al., 2002; Agrawal et al., 1995; Clement et al., 2007; Kang et al., 2010; Keele et al., 2011; Mathur et al., 2000; Sorescu et al., 2007; Worrell et al., 1986). The methodology is based on the efficient market hypothesis by Fama et al. (1969) who argue that stock markets incorporate all publicly available information promptly. Investors’ perceptions are consequently represented in form of share price reactions. The direct link of a strategic decision announcement to its stock market outcome – the expected future cash flows reflected in share price – is thus a key advantage of this method. A reaction of share prices following a diversification announcement can be interpreted as a change in the evaluation of future profits and consequently the firm value by investors. This reaction is measured by comparing a stock’s abnormal return compared to a market portfolio. Key requirements are that an announcement was not anticipated by the market and can be univocally defined (Bromiley et al., 1988; Brown et al., 1985; Fama et al., 1969; Klassen et al., 1996; McWilliams et al., 1997). An additional reason for selecting an event study for testing the proposed hypotheses is that the data and results allow clear-cut interpretation. The results give direct insights on investors’ perception of risks and return of a focal firm’s decision announcement (McWilliams et al., 1997; Wells, 2004).
4.3.1 Data Collection

In a first step, I selected the sample firms and defined the events that are part of the analysis. I downloaded a list of all M&A activities (acquisition of stake or full takeover) between 2001 and 2011 that contained “wind” or “solar” in the target’s business description from Thomson OneBanker (Thomson Reuters, 2012). Thereafter, I selected all M&A activities in which the acquiring firm’s was publically listed and its primary industry classification was SIC Code 35 or 36\(^{11}\) to exclude cross-sectional effects. Furthermore, two additional selection criteria were applied: the acquirer needed to be a diversified, multi-technology firm with prior activities in electricity-generation related businesses. The sample was reduced to ensure comparability of events and exclude market reactions that resulted, for example, from a low degree of relatedness. After further eliminating events due to misleading or missing data, the final list contained 49 activities or events. Before starting the analysis I consulted the firm’s media releases and conducted research in the news database Factiva (Dow Jones, 2012) to identify potential confounding events\(^{12}\) that might have influenced the share price in addition to or stronger than the focal event. Due to confounding events in a window of +/- 5 days\(^{13}\) around the event date 12 events were excluded. Table 14 shows an overview of all sample firms and Table 15 all 37 events (acquisitions by 18 companies) that build the sample of this study. In the final step, I collected daily share price data per firm as well as daily stock index prices from Bloomberg.

---

11 SIC Code 35: Industrial Machinery & Equipment; SIC Code 36: Electronic & Other Electric Equipment
12 Confounding events were for example, other M&A or JV activities, major new contracts, earnings and dividend announcements or executive changes (McWilliams et al., 1997)
13 The window was defined in line with the analyzed event windows (see below)
To analyze the hypotheses additional data for subsampling was needed. First, the diversification mode, full takeover (n=15) or stake acquisition (n=22), was collected from the Thomson One Banker database. Second, the event dates were clustered into three periods within the analysis timeframe: early entrants (2001 to 2005; n=4), close followers (2006-2009; n=14), and late entrants (2010 and 2011; n=19). See Figure 11 for an illustration of the sample distribution along these three periods.

![Figure 11: Sample distribution over time]

Table 14: Overview of sample firms

<table>
<thead>
<tr>
<th>Company</th>
<th>Ticker</th>
<th>Main Industry</th>
<th>Sales (USD m)</th>
<th>Number of events</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB</td>
<td>ABBN</td>
<td>Industrials</td>
<td>37990</td>
<td>3</td>
<td>CH</td>
</tr>
<tr>
<td>Actuant</td>
<td>ATU</td>
<td>Industrials</td>
<td>1445</td>
<td>1</td>
<td>USA</td>
</tr>
<tr>
<td>Alstom</td>
<td>ALO</td>
<td>Industrials</td>
<td>29149</td>
<td>1</td>
<td>FR</td>
</tr>
<tr>
<td>Areva</td>
<td>AREVA</td>
<td>Industrials</td>
<td>12416</td>
<td>4</td>
<td>FR</td>
</tr>
<tr>
<td>Cie de Saint-Gobain</td>
<td>SGO</td>
<td>High Technology</td>
<td>58674</td>
<td>1</td>
<td>FR</td>
</tr>
<tr>
<td>GE</td>
<td>GE</td>
<td>Industrials</td>
<td>147300</td>
<td>7</td>
<td>USA</td>
</tr>
<tr>
<td>Ishii Hyoki</td>
<td>6336</td>
<td>High Technology</td>
<td>158</td>
<td>1</td>
<td>JP</td>
</tr>
<tr>
<td>Itochu</td>
<td>8001</td>
<td>High Technology</td>
<td>45799</td>
<td>1</td>
<td>JP</td>
</tr>
<tr>
<td>ITW</td>
<td>ITW</td>
<td>Industrials</td>
<td>17787</td>
<td>1</td>
<td>USA</td>
</tr>
<tr>
<td>KSB</td>
<td>KSB</td>
<td>Industrials</td>
<td>2959</td>
<td>1</td>
<td>GER</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>6503</td>
<td>High Technology</td>
<td>45721</td>
<td>2</td>
<td>JAP</td>
</tr>
<tr>
<td>Moog</td>
<td>MOG</td>
<td>Industrials</td>
<td>2331</td>
<td>3</td>
<td>USA</td>
</tr>
<tr>
<td>Orkla</td>
<td>ORK</td>
<td>High Technology</td>
<td>10914</td>
<td>2</td>
<td>NOR</td>
</tr>
<tr>
<td>SGL Carbon</td>
<td>SGL</td>
<td>Industrials</td>
<td>2145</td>
<td>1</td>
<td>GER</td>
</tr>
<tr>
<td>Siemens</td>
<td>SIE</td>
<td>Industrials</td>
<td>103810</td>
<td>4</td>
<td>GER</td>
</tr>
<tr>
<td>Sumitomo Heavy Industries</td>
<td>6302</td>
<td>Industrials</td>
<td>6873</td>
<td>1</td>
<td>JAP</td>
</tr>
<tr>
<td>United Technologies</td>
<td>UTX</td>
<td>Industrials</td>
<td>58190</td>
<td>2</td>
<td>USA</td>
</tr>
<tr>
<td>Vacon</td>
<td>VAC1V</td>
<td>High Technology</td>
<td>531</td>
<td>1</td>
<td>FIN</td>
</tr>
</tbody>
</table>

Source: OneSource
Third, the sample was clustered based on the technology of the target firm: Wind (n=15), photovoltaic (n=16) and CSP (concentrated solar power; n=6). This helps to assess potential differences in reaction due to different uncertainty levels associated with the three technologies. Especially CSP is seen as technologically risky. And forth, a proxy variable was created that aggregates the market sentiment in the quarter surrounding an investment date. It consists of three components: media discussion, energy related events (such as climate conferences or Fukushima), and oil price development. Figure 12 illustrates the variable over time and explains the calculation procedure.

![Market sentiment chart](chart12.png)

**Figure 12:** Market sentiment (see Appendix for further information)

### 4.3.2 Analytic Procedure

Before starting the analysis, event windows need to be selected. As information might become publically available before a formal press announcement or because stock markets do not react immediately, it is suggested to analyze and compare event study results across different event windows (McWilliams et al., 1997). It is furthermore suggested to reduce the length of event windows to a range of one to five trading days, because the potential impact of other effects increases with the length of the window assessed (Brown et al., 1985; Dyckman et al., 1984; Khotari et al., 2006). I chose to analyze four event windows: A five-day window (+/- 2 days) and two two-day windows (-1, +0 days; +1,+2 days) as done by Keele and DeHart (2011) and, in addition, another two-day window (0, +1 day). The five days were furthermore analyzed individually.

When comparing studies that use an event study approach one can find different estimation models for abnormal returns: the capital asset pricing model (CAPM), the market model (MM, for example used by Mathur and Mathur (2000) and Keele and
DeHart (2011)), the mean adjusted returns model (MAR), and the market adjusted or index model (IM). The market model (MM) is based on the CAPM and uses an OLS regression to determine abnormal returns. The mean-adjusted as well as the market adjusted model are simpler and both do not incorporate volatility adjustments (Brown et al., 1980). Based on the comparative tests on event-study models applied by Cable and Holland (1999) for the purposes of this paper the MM was selected. The formula for deriving normal returns in the MM is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + E_{it}$$

- \(R_{it}\) = stock market return of firm i on day t
- \(\alpha_i\) and \(\beta_i\) = regression parameters; \(\alpha_i\) = intercept; \(\beta_i\) = systematic risk of stock
- \(R_{mt}\) = market index return on day t
- \(E_{it}\) = residual term

Through an ordinary least square (OLS) regression the values for \(\alpha_i\), \(\beta_i\), and \(E_{it}\) are derived. I used an estimation period prior to the events of 180 trading days (starting at day t-15, ending at day t-194) to estimate the normal returns for the stocks. Thereafter the abnormal returns for each day were calculated within the selected event windows. Based on McWilliams and Siegel (1997) I applied the following formula:

$$AR_{it} = R_{it} - (\alpha_i + b_i R_{mt})$$

- \(AR_{it}\) = abnormal stock return of firm i on day t
- \(R_{it}\) = actual stock market return of firm i on day t; the value is zero in case investors do not assess an announcement to be relevant
- \((\alpha_i + b_i R_{mt})\) = expected stock return for firm i on day t
- \(\alpha_i\) and \(b_i\) = regression parameters from OLS procedure in estimation period

To account for heteroscedasticity issues that might arise from error term variances I followed the frequently applied approach (Keele et al., 2011; Mathur et al., 1995, 1996, 2000) suggested by Dodd and Warner (1983). The standardized abnormal returns were derived based on this formula:

---

14 To account for different market movements and regional particularities the respective home country market index was applied for each share, for example, S&P500 for US firms, or DAX for German firms
\[ SAR_{it} = \frac{AR_{it}}{SD_{it}} \]

\( SAR_{it} \) = standardized abnormal stock return of firm i on day t  
\( SD_{it} \) = standard deviation of \( AR_{it} \)

Afterwards I accumulated the standardized abnormal return over the four event windows for each firm separately (McWilliams et al., 1997).

\[ CAR_i(t_1, t_k) = \sum_{t=t_1}^{t_k} SAR_{it} \]

\( CAR_i(t_1, t_k) \) = cumulative abnormal stock return of firm i over event window \( t_1 \) to \( t_k \)

To finally derive the average cumulative abnormal stock return over the entire sample or a sub-sample I further followed the approach by McWilliams and Siegel (1997) and divided the CARs by their standard deviation.

\[ \overline{CAR}(t_1, t_k) = \frac{1}{N} \frac{1}{\sqrt{(T-2)/(T-4)}} \sum_{i=1}^{N} CAR(t_1, t_k)_i \]

\( \overline{CAR}(t_1, t_k) \) = average standardized cumulative abnormal stock return across N firms over event window \( t_1 \) to \( t_k \)  
N= number of stocks in sample  
T= number of trading days in estimation period (here: 180)

As I intent to derive explanations for variations in market reactions to diversification announcements I sub-sampled the data based on energy technology (wind, PV, and CSP, H2), entry mode (acquisition of stake or full takeover, H3), entry timing (before 2005, 2006 to 2009, or 2010/2011, H4), and external environment (RE-adverse, neutral, RE-friendly, H5). I each time averaged the abnormal returns across all events that shared the same characteristics (Mathur et al., 2000).
To test the significance of individual and aggregated events a parametric and a non-parametric test was used. The Patell Z was used as parametric test, the generalized sign test as non-parametric test (Brown et al., 1985; Cowan, 1992; Keele et al., 2011). Patell’s Z is defined as:

\[ Z = \overline{CAR}(t_1, t_k) \sqrt{N} \]

The generalized sign test assesses if the share of positive abnormal returns in an event window is larger than expected based on positive returns in the estimation period that was not affected by the event. The following formulas were used (Cowan, 1992):

\[ Z = \frac{w - N\hat{p}}{\sqrt{N\hat{p}(1 - \hat{p})}} \]

\[ \hat{p} = \frac{1}{N} \sum_{i=1}^{N} \frac{1}{T} \sum_{t_1}^{t_k} W \]

\( w \) = number of stocks with positive (cumulative) abnormal returns on event day (in event window)
\( \hat{p} \) = the share of expected positive abnormal returns (across estimation period)
\( W \) = number positive abnormal returns (across estimation period)
### Table 15: Overview of events

<table>
<thead>
<tr>
<th>Acquiror</th>
<th>Target</th>
<th>Event Date</th>
<th>Diversification Mode</th>
<th>Energy Type</th>
<th>Return on Event Date (t=0)</th>
<th>Abnormal Return on Event Date (t=0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB</td>
<td>GreenVolts</td>
<td>14.12.2011</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>-0.021</td>
<td>-0.011</td>
</tr>
<tr>
<td>ABB</td>
<td>Novatec Solar</td>
<td>16.03.2011</td>
<td>Stake Acquisition</td>
<td>CSP</td>
<td>-0.016</td>
<td>-0.003</td>
</tr>
<tr>
<td>ABB</td>
<td>Pentulum Technologies</td>
<td>20.12.2010</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>0.005</td>
<td>0.008</td>
</tr>
<tr>
<td>Actuant</td>
<td>Mastervolt International</td>
<td>30.11.2010</td>
<td>Full Takeover</td>
<td>PV</td>
<td>0.015</td>
<td>0.023</td>
</tr>
<tr>
<td>ABB</td>
<td>BrightSource Energy</td>
<td>20.05.2010</td>
<td>Stake Acquisition</td>
<td>CSP</td>
<td>-0.019</td>
<td>0.006</td>
</tr>
<tr>
<td>ABB</td>
<td>Multibríd</td>
<td>01.06.2010</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>-0.012</td>
<td>-0.011</td>
</tr>
<tr>
<td>ABB</td>
<td>Austra</td>
<td>08.02.2010</td>
<td>Full Takeover</td>
<td>CSP</td>
<td>0.004</td>
<td>-0.003</td>
</tr>
<tr>
<td>ABB</td>
<td>PN Rotor</td>
<td>08.12.2009</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>0.038</td>
<td>0.051</td>
</tr>
<tr>
<td>ABB</td>
<td>Repower</td>
<td>27.09.2005</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>-0.009</td>
<td>-0.006</td>
</tr>
<tr>
<td>Cie de Saint-Gobain</td>
<td>SolarWood Technologies</td>
<td>02.02.2010</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.026</td>
<td>0.003</td>
</tr>
<tr>
<td>GE</td>
<td>Beteiligung eSolar</td>
<td>06.06.2011</td>
<td>Stake Acquisition</td>
<td>CSP</td>
<td>-0.019</td>
<td>-0.006</td>
</tr>
<tr>
<td>GE</td>
<td>Primestar Solar</td>
<td>07.04.2011</td>
<td>Full Takeover</td>
<td>PV</td>
<td>-0.010</td>
<td>-0.008</td>
</tr>
<tr>
<td>GE</td>
<td>Scan-Wind</td>
<td>12.08.2009</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>0.010</td>
<td>-0.004</td>
</tr>
<tr>
<td>GE</td>
<td>Fotowatio Renewable Ventures</td>
<td>01.08.2008</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>-0.003</td>
<td>0.004</td>
</tr>
<tr>
<td>GE</td>
<td>PrimeStar Solar</td>
<td>11.06.2008</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>-0.016</td>
<td>0.002</td>
</tr>
<tr>
<td>GE</td>
<td>Astro Power</td>
<td>02.02.2004</td>
<td>Full Takeover</td>
<td>PV</td>
<td>0.000</td>
<td>-0.003</td>
</tr>
<tr>
<td>GE</td>
<td>Enron</td>
<td>20.02.2002</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>0.032</td>
<td>0.012</td>
</tr>
<tr>
<td>Ishii Hyoki</td>
<td>EXCEL Inc-Solar Battery Wafer</td>
<td>05.02.2010</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>-0.019</td>
<td>-0.002</td>
</tr>
<tr>
<td>Itochu</td>
<td>Solar Net</td>
<td>13.04.2009</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.057</td>
<td>0.063</td>
</tr>
<tr>
<td>ITW</td>
<td>Despatch Industries</td>
<td>25.07.2011</td>
<td>Full Takeover</td>
<td>PV</td>
<td>0.001</td>
<td>0.007</td>
</tr>
<tr>
<td>KSB</td>
<td>Gear-Tec</td>
<td>01.12.2010</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>0.002</td>
<td>-0.015</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>Utech Solar</td>
<td>26.04.2011</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.002</td>
<td>0.004</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>Auria Solar</td>
<td>30.03.2011</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.112</td>
<td>0.112</td>
</tr>
<tr>
<td>Moog</td>
<td>LTI REEnergy</td>
<td>01.06.2009</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>0.046</td>
<td>0.015</td>
</tr>
<tr>
<td>Moog</td>
<td>Ensensys</td>
<td>30.01.2009</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>-0.022</td>
<td>0.004</td>
</tr>
<tr>
<td>Moog</td>
<td>LTI REEnergy</td>
<td>13.06.2008</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>0.029</td>
<td>0.009</td>
</tr>
<tr>
<td>Orkla</td>
<td>Renewable Energy Corp</td>
<td>29.06.2009</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.017</td>
<td>0.005</td>
</tr>
<tr>
<td>Orkla</td>
<td>Renewable Energy Corp</td>
<td>05.02.2007</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.036</td>
<td>0.035</td>
</tr>
<tr>
<td>SGL Carbon</td>
<td>Abecking &amp; Rasmussen Rotec</td>
<td>06.08.2008</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>0.029</td>
<td>0.017</td>
</tr>
<tr>
<td>Siemens</td>
<td>Sempris</td>
<td>17.06.2011</td>
<td>Stake Acquisition</td>
<td>PV</td>
<td>0.013</td>
<td>0.004</td>
</tr>
<tr>
<td>Siemens</td>
<td>Archimede Solar Energy</td>
<td>17.05.2010</td>
<td>Stake Acquisition</td>
<td>CSP</td>
<td>0.002</td>
<td>0.000</td>
</tr>
<tr>
<td>Siemens</td>
<td>Solel Solar</td>
<td>15.10.2009</td>
<td>Full Takeover</td>
<td>CSP</td>
<td>-0.008</td>
<td>-0.003</td>
</tr>
<tr>
<td>Siemens</td>
<td>Bonus Energy</td>
<td>20.10.2004</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>-0.021</td>
<td>-0.005</td>
</tr>
<tr>
<td>Sumitomo Heavy Industries</td>
<td>Hansen Transmissions Intl</td>
<td>13.04.2009</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>0.023</td>
<td>0.029</td>
</tr>
<tr>
<td>UTX</td>
<td>Clipper Windpower</td>
<td>20.09.2010</td>
<td>Full Takeover</td>
<td>Wind</td>
<td>0.012</td>
<td>-0.003</td>
</tr>
<tr>
<td>UTX</td>
<td>Clipper Windpower</td>
<td>09.12.2009</td>
<td>Stake Acquisition</td>
<td>Wind</td>
<td>-0.012</td>
<td>-0.017</td>
</tr>
<tr>
<td>Vacon</td>
<td>Undisclosed Solar Energy</td>
<td>25.05.2010</td>
<td>Full Takeover</td>
<td>PV</td>
<td>0.000</td>
<td>0.006</td>
</tr>
</tbody>
</table>

### 4.4 Results

Table 15 shows an overview of the results for all 37 events. Tables 16 to 20 show the mean abnormal returns overall and for each sub-sample, including their Z and generalized sign test statistics.
Table 16: Results – Full sample

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>0.13%</td>
<td>22 : 15</td>
<td>0.747</td>
<td>0.456</td>
<td>1.386</td>
<td>0.168</td>
</tr>
<tr>
<td>-1</td>
<td>-0.59%</td>
<td>17 : 20</td>
<td>-1.431</td>
<td>0.154</td>
<td>0.795</td>
<td>0.292</td>
</tr>
<tr>
<td>0</td>
<td>0.86%</td>
<td>21 : 16</td>
<td>2.558</td>
<td>0.011*</td>
<td>1.057</td>
<td>0.456</td>
</tr>
<tr>
<td>+1</td>
<td>-0.07%</td>
<td>17 : 20</td>
<td>-1.318</td>
<td>0.189</td>
<td>0.795</td>
<td>0.292</td>
</tr>
<tr>
<td>+2</td>
<td>0.43%</td>
<td>26 : 11</td>
<td>1.698</td>
<td>0.091†</td>
<td>2.702</td>
<td>0.008**</td>
</tr>
<tr>
<td>(0; +1)</td>
<td>0.80%</td>
<td>19 : 18</td>
<td>1.240</td>
<td>0.217</td>
<td>0.399</td>
<td>0.691</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>0.20%</td>
<td>19 : 18</td>
<td>-0.191</td>
<td>0.849</td>
<td>0.399</td>
<td>0.691</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>0.76%</td>
<td>21 : 16</td>
<td>2.254</td>
<td>0.025*</td>
<td>1.057</td>
<td>0.292</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>0.27%</td>
<td>18 : 19</td>
<td>1.128</td>
<td>0.261</td>
<td>0.069</td>
<td>0.945</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.36%</td>
<td>20 : 17</td>
<td>0.379</td>
<td>0.705</td>
<td>0.728</td>
<td>0.468</td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1

Table 17: Results – Diversification mode

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-0.26%</td>
<td>7 : 8</td>
<td>-0.527</td>
<td>0.599</td>
<td>-0.106</td>
<td>0.916</td>
</tr>
<tr>
<td>-1</td>
<td>0.00%</td>
<td>8 : 7</td>
<td>0.663</td>
<td>0.508</td>
<td>0.411</td>
<td>0.682</td>
</tr>
<tr>
<td>0</td>
<td>0.47%</td>
<td>6 : 9</td>
<td>0.771</td>
<td>0.442</td>
<td>-0.623</td>
<td>0.534</td>
</tr>
<tr>
<td>+1</td>
<td>-0.58%</td>
<td>5 : 10</td>
<td>-2.816</td>
<td>0.005**</td>
<td>-1.140</td>
<td>0.256</td>
</tr>
<tr>
<td>+2</td>
<td>0.78%</td>
<td>12 : 3</td>
<td>1.629</td>
<td>0.105</td>
<td>2.478</td>
<td>0.014*</td>
</tr>
<tr>
<td>(0; +1)</td>
<td>-0.11%</td>
<td>5 : 10</td>
<td>-2.046</td>
<td>0.042*</td>
<td>-1.140</td>
<td>0.256</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>-0.10%</td>
<td>7 : 8</td>
<td>-1.382</td>
<td>0.169</td>
<td>-0.106</td>
<td>0.916</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>0.42%</td>
<td>8 : 7</td>
<td>-0.280</td>
<td>0.779</td>
<td>0.411</td>
<td>0.682</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>0.48%</td>
<td>7 : 8</td>
<td>1.434</td>
<td>0.153</td>
<td>-0.106</td>
<td>0.916</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.20%</td>
<td>7 : 8</td>
<td>-1.187</td>
<td>0.237</td>
<td>-0.106</td>
<td>0.916</td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
### Table 18: Results – Energy technology

<table>
<thead>
<tr>
<th>Wind</th>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>8 : 7</td>
<td>-0.08%</td>
<td>0.169</td>
<td>0.866</td>
<td>0.359</td>
<td>0.720</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>7 : 8</td>
<td>-0.80%</td>
<td>-0.831</td>
<td>0.407</td>
<td>-0.158</td>
<td>0.875</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8 : 7</td>
<td>0.57%</td>
<td>0.640</td>
<td>0.523</td>
<td>0.359</td>
<td>0.720</td>
<td></td>
</tr>
<tr>
<td>+1</td>
<td>9 : 6</td>
<td>0.67%</td>
<td>0.937</td>
<td>0.350</td>
<td>0.875</td>
<td>0.383</td>
<td></td>
</tr>
<tr>
<td>+2</td>
<td>11 : 4</td>
<td>0.35%</td>
<td>1.067</td>
<td>0.287</td>
<td>1.908</td>
<td>0.058†</td>
<td></td>
</tr>
<tr>
<td>(0;+1)</td>
<td>9 : 6</td>
<td>1.25%</td>
<td>1.578</td>
<td>0.116</td>
<td>0.875</td>
<td>0.383</td>
<td></td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>8 : 7</td>
<td>0.45%</td>
<td>0.746</td>
<td>0.457</td>
<td>0.359</td>
<td>0.720</td>
<td></td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>9 : 6</td>
<td>0.72%</td>
<td>1.982</td>
<td>0.049*</td>
<td>0.875</td>
<td>0.383</td>
<td></td>
</tr>
<tr>
<td>(-1;0)</td>
<td>7 : 8</td>
<td>-0.22%</td>
<td>-0.191</td>
<td>0.849</td>
<td>-0.158</td>
<td>0.875</td>
<td></td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>10 : 5</td>
<td>1.02%</td>
<td>2.004</td>
<td>0.047*</td>
<td>1.392</td>
<td>0.166</td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>11 : 5</td>
<td>0.38%</td>
<td>0.913</td>
<td>0.362</td>
<td>1.736</td>
<td>0.084†</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>6 : 10</td>
<td>-0.69%</td>
<td>-1.445</td>
<td>0.150</td>
<td>-0.768</td>
<td>0.444</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>12 : 4</td>
<td>1.52%</td>
<td>3.457</td>
<td>0.000***</td>
<td>2.237</td>
<td>0.027*</td>
<td></td>
</tr>
<tr>
<td>+1</td>
<td>5 : 11</td>
<td>-0.85%</td>
<td>-3.254</td>
<td>0.001**</td>
<td>-1.269</td>
<td>0.206</td>
<td></td>
</tr>
<tr>
<td>+2</td>
<td>11 : 5</td>
<td>0.35%</td>
<td>0.735</td>
<td>0.463</td>
<td>1.736</td>
<td>0.084†</td>
<td></td>
</tr>
<tr>
<td>(0;+1)</td>
<td>7 : 9</td>
<td>0.67%</td>
<td>0.203</td>
<td>0.840</td>
<td>-0.267</td>
<td>0.790</td>
<td></td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>7 : 9</td>
<td>-0.02%</td>
<td>-1.243</td>
<td>0.216</td>
<td>-0.267</td>
<td>0.790</td>
<td></td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>8 : 8</td>
<td>0.71%</td>
<td>0.406</td>
<td>0.685</td>
<td>0.234</td>
<td>0.815</td>
<td></td>
</tr>
<tr>
<td>(-1;0)</td>
<td>9 : 7</td>
<td>0.83%</td>
<td>2.012</td>
<td>0.046*</td>
<td>0.735</td>
<td>0.464</td>
<td></td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>6 : 10</td>
<td>-0.50%</td>
<td>-2.519</td>
<td>0.013*</td>
<td>-0.768</td>
<td>0.444</td>
<td></td>
</tr>
</tbody>
</table>

***p <0.001, **p < 0.01, *p <= 0.05, †0.05 < p <= 0.1
Table 19: Results – Timing

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>till 2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>-0.19%</td>
<td>2 : 2</td>
<td>-0.032</td>
<td>0.974</td>
<td>-0.017</td>
<td>0.987</td>
</tr>
<tr>
<td>-1</td>
<td>-0.89%</td>
<td>2 : 2</td>
<td>-0.960</td>
<td>0.338</td>
<td>-0.017</td>
<td>0.987</td>
</tr>
<tr>
<td>0</td>
<td>-0.05%</td>
<td>1 : 3</td>
<td>-0.302</td>
<td>0.763</td>
<td>-1.017</td>
<td>0.311</td>
</tr>
<tr>
<td>+1</td>
<td>-0.44%</td>
<td>2 : 2</td>
<td>-0.605</td>
<td>0.546</td>
<td>-0.017</td>
<td>0.987</td>
</tr>
<tr>
<td>+2</td>
<td>0.71%</td>
<td>4 : 0</td>
<td>1.023</td>
<td>0.308</td>
<td>1.983</td>
<td>0.049*</td>
</tr>
<tr>
<td>(0;+1)</td>
<td>-0.49%</td>
<td>1 : 3</td>
<td>-0.907</td>
<td>0.365</td>
<td>-1.017</td>
<td>0.311</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>-1.38%</td>
<td>1 : 3</td>
<td>-1.868</td>
<td>0.063†</td>
<td>-1.017</td>
<td>0.311</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>-0.86%</td>
<td>2 : 2</td>
<td>-0.878</td>
<td>0.381</td>
<td>-0.017</td>
<td>0.987</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>-0.93%</td>
<td>1 : 3</td>
<td>-1.262</td>
<td>0.208</td>
<td>-1.017</td>
<td>0.311</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.27%</td>
<td>2 : 2</td>
<td>0.417</td>
<td>0.677</td>
<td>-0.017</td>
<td>0.987</td>
</tr>
<tr>
<td><strong>2006-2009</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>-0.08%</td>
<td>8 : 6</td>
<td>-0.017</td>
<td>0.986</td>
<td>0.573</td>
<td>0.567</td>
</tr>
<tr>
<td>-1</td>
<td>-0.19%</td>
<td>6 : 8</td>
<td>-0.513</td>
<td>0.608</td>
<td>-0.496</td>
<td>0.621</td>
</tr>
<tr>
<td>0</td>
<td>1.51%</td>
<td>11 : 3</td>
<td>-0.161</td>
<td>0.872</td>
<td>2.177</td>
<td>0.031*</td>
</tr>
<tr>
<td>+1</td>
<td>0.77%</td>
<td>8 : 6</td>
<td>-0.324</td>
<td>0.747</td>
<td>0.573</td>
<td>0.567</td>
</tr>
<tr>
<td>+2</td>
<td>-0.07%</td>
<td>7 : 7</td>
<td>0.547</td>
<td>0.585</td>
<td>0.039</td>
<td>0.969</td>
</tr>
<tr>
<td>(0;+1)</td>
<td>2.28%</td>
<td>9 : 5</td>
<td>-0.485</td>
<td>0.628</td>
<td>1.108</td>
<td>0.269</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>2.09%</td>
<td>9 : 5</td>
<td>-0.998</td>
<td>0.319</td>
<td>1.108</td>
<td>0.269</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>1.93%</td>
<td>10 : 4</td>
<td>-0.469</td>
<td>0.640</td>
<td>1.642</td>
<td>0.102</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>1.31%</td>
<td>9 : 5</td>
<td>-0.675</td>
<td>0.501</td>
<td>1.108</td>
<td>0.269</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.70%</td>
<td>7 : 7</td>
<td>0.223</td>
<td>0.824</td>
<td>0.039</td>
<td>0.969</td>
</tr>
<tr>
<td><strong>2010-2011</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>0.35%</td>
<td>12 : 7</td>
<td>-0.015</td>
<td>0.988</td>
<td>1.451</td>
<td>0.148</td>
</tr>
<tr>
<td>-1</td>
<td>-0.83%</td>
<td>9 : 10</td>
<td>-0.441</td>
<td>0.660</td>
<td>0.072</td>
<td>0.943</td>
</tr>
<tr>
<td>0</td>
<td>0.58%</td>
<td>9 : 10</td>
<td>-0.139</td>
<td>0.890</td>
<td>0.072</td>
<td>0.943</td>
</tr>
<tr>
<td>+1</td>
<td>-0.60%</td>
<td>7 : 12</td>
<td>-0.278</td>
<td>0.782</td>
<td>-0.848</td>
<td>0.397</td>
</tr>
<tr>
<td>+2</td>
<td>0.74%</td>
<td>15 : 4</td>
<td>0.469</td>
<td>0.640</td>
<td>2.831</td>
<td>0.005**</td>
</tr>
<tr>
<td>(0;+1)</td>
<td>-0.02%</td>
<td>9 : 10</td>
<td>-0.416</td>
<td>0.678</td>
<td>0.072</td>
<td>0.943</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>-0.85%</td>
<td>9 : 10</td>
<td>-0.857</td>
<td>0.393</td>
<td>0.072</td>
<td>0.943</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>0.23%</td>
<td>9 : 10</td>
<td>-0.403</td>
<td>0.688</td>
<td>0.072</td>
<td>0.943</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>-0.25%</td>
<td>8 : 11</td>
<td>-0.579</td>
<td>0.563</td>
<td>-0.388</td>
<td>0.698</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.14%</td>
<td>11 : 8</td>
<td>0.191</td>
<td>0.848</td>
<td>0.991</td>
<td>0.323</td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *p < 0.05, †0.05 <= p <= 0.1
### Table 20: Results – Market sentiment

#### RE adverse

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-0.09%</td>
<td>2 : 3</td>
<td>-0.191</td>
<td>0.849</td>
<td>-0.348</td>
<td>0.728</td>
</tr>
<tr>
<td>-1</td>
<td>0.14%</td>
<td>3 : 2</td>
<td>-0.003</td>
<td>0.998</td>
<td>0.547</td>
<td>0.585</td>
</tr>
<tr>
<td>0</td>
<td>0.16%</td>
<td>3 : 2</td>
<td>0.460</td>
<td>0.646</td>
<td>0.547</td>
<td>0.585</td>
</tr>
<tr>
<td>+1</td>
<td>-1.86%</td>
<td>1 : 4</td>
<td>-4.279</td>
<td>0.000***</td>
<td>-1.243</td>
<td>0.215</td>
</tr>
<tr>
<td>+2</td>
<td>0.01%</td>
<td>3 : 2</td>
<td>-0.128</td>
<td>0.899</td>
<td>0.547</td>
<td>0.585</td>
</tr>
<tr>
<td>(0; +1)</td>
<td>-0.09%</td>
<td>2 : 3</td>
<td>-0.191</td>
<td>0.849</td>
<td>-0.348</td>
<td>0.728</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>-1.55%</td>
<td>3 : 2</td>
<td>-3.821</td>
<td>0.000***</td>
<td>0.547</td>
<td>0.585</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>-1.63%</td>
<td>1 : 4</td>
<td>-4.140</td>
<td>0.000***</td>
<td>-1.243</td>
<td>0.215</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>0.30%</td>
<td>3 : 2</td>
<td>0.458</td>
<td>0.648</td>
<td>0.547</td>
<td>0.585</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>-1.84%</td>
<td>2 : 3</td>
<td>-4.406</td>
<td>0.000***</td>
<td>-0.348</td>
<td>0.728</td>
</tr>
</tbody>
</table>

#### Neutral

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>0.28%</td>
<td>11 : 5</td>
<td>0.854</td>
<td>0.394</td>
<td>1.719</td>
<td>0.087†</td>
</tr>
<tr>
<td>-1</td>
<td>-1.62%</td>
<td>5 : 11</td>
<td>-2.896</td>
<td>0.004**</td>
<td>-1.285</td>
<td>0.200</td>
</tr>
<tr>
<td>0</td>
<td>0.87%</td>
<td>9 : 7</td>
<td>1.924</td>
<td>0.056†</td>
<td>0.718</td>
<td>0.474</td>
</tr>
<tr>
<td>+1</td>
<td>-0.25%</td>
<td>8 : 8</td>
<td>-0.446</td>
<td>0.656</td>
<td>0.217</td>
<td>0.828</td>
</tr>
<tr>
<td>+2</td>
<td>0.46%</td>
<td>11 : 5</td>
<td>1.294</td>
<td>0.197</td>
<td>1.719</td>
<td>0.087†</td>
</tr>
<tr>
<td>(0; +1)</td>
<td>0.62%</td>
<td>10 : 6</td>
<td>1.478</td>
<td>0.141</td>
<td>1.218</td>
<td>0.225</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>-1.00%</td>
<td>8 : 8</td>
<td>-1.418</td>
<td>0.158</td>
<td>0.217</td>
<td>0.828</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>-0.25%</td>
<td>9 : 7</td>
<td>0.730</td>
<td>0.466</td>
<td>0.718</td>
<td>0.474</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>-0.75%</td>
<td>7 : 9</td>
<td>-0.972</td>
<td>0.332</td>
<td>-0.284</td>
<td>0.777</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>0.22%</td>
<td>10 : 6</td>
<td>0.848</td>
<td>0.397</td>
<td>1.218</td>
<td>0.225</td>
</tr>
</tbody>
</table>

#### RE friendly

<table>
<thead>
<tr>
<th>Event day/Window</th>
<th>Mean Abnormal Return</th>
<th>Positive : Negative</th>
<th>Patell Z</th>
<th>p</th>
<th>Generalized Sign Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>0.04%</td>
<td>9 : 7</td>
<td>0.389</td>
<td>0.698</td>
<td>0.583</td>
<td>0.560</td>
</tr>
<tr>
<td>-1</td>
<td>0.20%</td>
<td>9 : 7</td>
<td>0.723</td>
<td>0.471</td>
<td>0.583</td>
<td>0.560</td>
</tr>
<tr>
<td>0</td>
<td>1.08%</td>
<td>9 : 7</td>
<td>1.709</td>
<td>0.089†</td>
<td>0.583</td>
<td>0.560</td>
</tr>
<tr>
<td>+1</td>
<td>0.68%</td>
<td>8 : 8</td>
<td>0.832</td>
<td>0.406</td>
<td>0.083</td>
<td>0.934</td>
</tr>
<tr>
<td>+2</td>
<td>0.53%</td>
<td>12 : 4</td>
<td>1.359</td>
<td>0.176</td>
<td>2.084</td>
<td>0.039*</td>
</tr>
<tr>
<td>(0; +1)</td>
<td>1.75%</td>
<td>7 : 9</td>
<td>2.542</td>
<td>0.012*</td>
<td>0.417</td>
<td>0.677</td>
</tr>
<tr>
<td>(-1;+1)</td>
<td>1.95%</td>
<td>8 : 8</td>
<td>3.264</td>
<td>0.001**</td>
<td>0.083</td>
<td>0.934</td>
</tr>
<tr>
<td>(-2;+2)</td>
<td>2.52%</td>
<td>11 : 5</td>
<td>5.012</td>
<td>0.000***</td>
<td>1.584</td>
<td>0.115</td>
</tr>
<tr>
<td>(-1;0)</td>
<td>1.28%</td>
<td>8 : 8</td>
<td>2.432</td>
<td>0.016*</td>
<td>0.083</td>
<td>0.934</td>
</tr>
<tr>
<td>(+1;+2)</td>
<td>1.20%</td>
<td>8 : 8</td>
<td>2.191</td>
<td>0.030*</td>
<td>0.083</td>
<td>0.934</td>
</tr>
</tbody>
</table>

***p <0.001, **p < 0.01, *0.01 <= p < 0.05, †0.05 <= p <= 0.1
Overall, I find that investors react positively to diversification moves of diversified multi-tech firms into the renewable energy industry. On the day of the announcement there was 0.86% abnormal return achieved on average. This result is statistically significant (p<0.05) in the Patell Z test. I find further positive reactions on day t: +2 (p<0.01) and for the event window t: +2/-2 (p<0.05). With these results I reject hypothesis 1 in which I proposed negative investor reactions.

When comparing the different technologies, wind is assumed to be least uncertain, while CSP is assumed to be associated with the highest uncertainty from an investor perspective. This, however, does not seem to have an influence on stock market reaction. I find significant, positive reactions for the wind subsample (p<0.05). The same is true for the CSP sample. For the PV sample the results are mixed: There are positive as well as negative, statistically significant results to be found (+1.52%, p<0.001 on t:0; -0.85%, p<0.01 on t:+1). I hence do not find consistent support for hypothesis 2.

Regarding the diversification mode hypothesis 3 is confirmed. There are mostly negative, statistically significant reactions for full takeovers (-0.58%, p<0.001 on t: +1). For stake acquisitions 3 out of 4 statistically significant results are positive at the p<0.001 level (t:0; t: +2/-2; t: 0/+1). When looking at timing of the diversification, hypothesis 4a is confirmed. I find one statistically significant reaction which is negative for the earliest market entries (-1.38%, p<0.1 in t: -1/+1). Hypothesis 4b and 4c on close and distant followers cannot be confirmed since the market reactions vary among individual days and across the different event windows.

The strongest results were found for hypothesis 5. In times of a renewable energy adverse market sentiment there are statistically significant, negative market reactions (p<0.001). In “neutral” phases, the reactions are mixed, while in times of a renewable energy favoring market sentiment the reactions are positive (above 1% in all five event windows as well as on the announcement day, p<0.01).

To further validate these findings they were also tested across other, longer event windows based on Mathur and Mathur (2000). Moreover, the abnormal returns calculation was in a second analysis derived based on other market indices than the ones applied here. No substantially different findings were found in both analyses.
4.5 Discussion

The analyses in this study assessed stock market reactions following diversification announcements of multi-tech firms into the renewable energy sector. Despite the high degree of uncertainty in this market in general and regarding its core energy sources – i.e. wind and solar – (Lewis et al., 2007; Masini et al., 2012) investors react positively to diversification announcements. This is surprising as diversification and acquisitions were shown by previous studies to not create positive value per se (Palich et al., 2000). Hence the expected return could at best be moderate. However, the movement into the renewable energy industry seems to create a competitive advantage (Barney, 1986, 1991; Finney et al., 2008; Lieberman et al., 1998b) in the eyes of investors and the strategic foresight of the management team is rewarded with positive market reactions. In light of these findings it is surprising that the results for hypotheses 4a to 4c are not as strong. There are negative reactions to the earliest diversification moves, but neither are close followers consistently rewarded nor late followers consistently penalized. Investors thus do not value the positive effects early mover advantages could create (Gilbert et al., 1996; Lilien et al., 1990). Another explanation for these findings could stem from the limited analysis timeframe. As only a ten year period could be studied due to data availability the three windows are potentially too short to show significant, consistent investor reactions. The same is a possible explanation for the generally positive reactions to the wind and CSP sample, despite the differences in technological uncertainty. This could be a result from the comparatively small sample size, especially for the CSP subsample. An explanation for the mixed reactions in the PV sample can be that investors closely assess the technological advantages and disadvantages in a diversification move. And they therefore do not reward or penalize a technology in general.

A dimension that shows the impact of risk assessments by investors is the diversification mode. Investors clearly prefer acquisitions of stakes over full takeovers in the sample. Incremental market entries through stakes rather than acquiring a whole firm bear the advantage of risk sharing and reduce potential pitfalls from post-merger integration issues (Carow et al., 2004; Lee et al., 2010a). These benefits of stake acquisitions are thus favored by investors.

The findings on the relation of market sentiment and investor reaction support earlier findings from behavioral finance studies (Kadiyala et al., 2004; Rosen, 2006). A favorable or unfavorable market sentiment clearly impacts market reactions. Despite the apparently moderate risk assessment of the overall renewable energy industry by
investors, as can be reasoned from the positive reactions overall, investors still seem to be influenced by the market environment (Mayer et al., 2003).

Summing up the findings, there are two main conclusions. On the one hand, investors value strategic foresight by management and expect entries into the renewable energy industry to have a positive value. This is, however, only the case as long as there is a moderate degree of risk taking involved (i.e. stake acquisitions are preferred over full takeovers). On the other hand, the overall knowledge base of investors for the renewable energy industry does not seem to be very distinct yet, because investors’ reactions appear to be highly linked with the overall market sentiment.

4.6 Implications and Concluding Remarks

As substantial investment in the renewable energy sector is needed to drive the energy system transition, this paper is to provide insights on diversification strategies from an investor perspective. Insights can help managers and investors in allocating their future investments. The contribution to theory is twofold. First of all, the diversification-performance literature is enhanced by findings on investor reactions to different dimensions of diversification. This stock market perspective provides a new angle to the assessment of diversification and shows that investors do not necessarily react according to resource-based theory’s expected competitive advantages. Second, the illustrated findings show that behavioral economics arguments can help to understand investor reactions that are not in line with purely rational, resource-based view driven reasoning.

Some of the mixed findings may be a result of the limitations of this study. The limited sample size and the limited timeframe can have had an impact – in particular on the sub-sample analyses. As the focus is on the renewable energy industry, one needs to be careful when extrapolating the findings to other emerging industries. Differences in uncertainty levels, industry maturity, and investor knowledge might lead to different results. A cross-sectional set-up, comparing the results across emerging industry segments, hence can be a first starting point for additional research. Further the assessment of investor reactions is based on stock market data. This does indeed reflect the overall investor perception, but individual investors or different investor groups can show different reactions due to different risk-return expectations. Another interesting follow-up research could thus be the assessment of individual or investor group preferences for renewable energy investments. Lastly, this study assesses short-term market reactions. An insightful new analysis can be the assessment of long-term effects of diversification into emerging industry segments. Additional research topics
result from the findings of this study. For example, the mixed results on entry timing could be verified in other industry settings and across longer timeframes.

For managerial practice, the success factors and pitfalls on the when and how to enter into emerging industries were illustrated from an investor perspective. In particular, in firms with high shareholder dependence, not only potential competitive advantages, but also investors’ reaction to diversification decision should be considered. Moreover, managers need also take into account that negative or positive investor reactions do not necessarily stem from a pure risk-return assessment, but also depend on market sentiment. Finally, for investors, guidance on how to assess diversification strategies in emerging industries is provided. A dependence on market sentiment is uncovered that should lead investors to rethink their investment decisions when assessing relatively new market segments.
4.7 Appendix: Market Sentiment Variable

The market sentiment variable is constructed based on a combination of oil price development (curve in chart), climate change related political events and ecological disaster dates, and public debate. This resulted in three types of periods: renewable energy favoring, neutral, and renewable energy adverse market sentiment (as highlighted in Figure 12).

*Oil price:* >10% increase: assumed to lead to RE favoring sentiment; <10% decrease: assumed to lead to RE adverse sentiment; between +/-10%: neutral.

*Event dates:* Identification of relevant dates regarding climate negotiations, IPCC reports, and Kyoto protocol as well as ecological disasters – assuming that these events trigger favorable discussions on renewable energy

*Media analysis:* Comparison of wordcount for “renewable energy” and “green energy” versus “nuclear energy” and “fossil energy” in major, global business press (from Factiva database).
4.8 References


Dow Jones. 2012. Factiva:


Gilley KM, Worrell DL, Davidson WN, El-Jelly A. 2000. Corporate environmental initiatives and anticipated firm performances: The differential effects of process-


Thomson Reuters. 2012. Thomson One Banker:
5 Discussion and Conclusions

Strategy making is being seen increasingly as a “context dependent, socially accomplished activity directed toward the achievement of strategic goals and constructed through actions and interaction of multiple actors or groups distributed throughout an organization” (Hendry et al., 2010, p.36). This is one of the first sentences of this dissertation and it also is the one that leads towards its final remarks. Identifying success factors and pitfalls of “context dependent, socially accomplished” strategic management in emerging industries is consequently stated as the main goal of my research. This thesis discusses therefore three different aspects of strategic management in the renewable energy industry. The implications of the industrial context and the interaction between decision makers and stakeholders for strategic outcomes were illustrated. The particular role of environmental uncertainty or turbulence is thereby considered in all three chapters.

This section sums up the previous chapters, aggregates their findings, and provides implications for theory and practice. Sources for success and failure of firms in the renewable energy industry and other emerging industries are highlighted. Finally, this chapter describes the relevance of the three studies, discusses their limitations, and identifies starting points for further research.

5.1 Summary of Findings and Contribution to Theory

Chapter 2 assesses the role of boards of directors – and in particular their status-quo biases – for the prevention of strategic renewal. Based on an assessment of 140 board members of the six largest utility firms in Switzerland the role of the individual level factors tenure and industry ties is studied. This is complemented by board-level dynamics stemming from diversity and public firm ownership. The most meaningful findings concern the curvilinear relationships of tenure and intra-industry experience with strategic renewal. Missing “expert power” (Finkelstein, 1992) and path dependency can hinder strategic renewal; an outsider perspective or high industry insider knowledge can promote change. We further find first indications that a fresh view or deep industry expertise are especially relevant in turbulent conditions. With these findings this chapter contributes above all to the social network and institutional perspective on strategic renewal. It argues for a stronger and more fine-grained consideration of individual connectedness, tenure, and industry context.

Chapter 3 focuses on the value of business model consistency for firm performance in emerging industries. By analyzing 210 wind and solar firms regarding the fit of their
financials and their strategy descriptions we identify three important learnings for business model design. First, **consistency does not create value per se**. Opportunity costs associated with consistency should therefore not be neglected. Second, the consistency-firm performance relationship **depends on industry context**. And third, the relationship **varies with firm growth and business model theme**. Based on these findings we propose a dynamic consideration of consistency along the industry life cycle in the future and thereby contribute to contingency theory.

Chapter 4 answers the question how **diversification strategies into an emerging industry sector** impact **stock market performance** in the short-term. Special attention is paid to the influence of timing, diversification mode, technology, and market sentiment in this regard. In an event study of 37 diversification decisions into the renewable energy industry by multi-technology firms the individual sources for positive and negative stock market reactions are analyzed. The generally **positive investor reactions** to entries into the renewable energy sector need to be balanced against the sub-sampling results. Resource-based view arguments for first-mover advantages cannot be supported by the findings, neither are uncertainty considerations of different energy types. Stake acquisitions are furthermore preferred to full takeovers as shown in previous studies (Carow et al., 2004; Lee et al., 2010). The most insightful finding is, however, **the impact of market sentiment on investor reactions**: in times of favorable market sentiment investors react positively, in adverse environments they react negatively. These results advance the diversification-performance literature by adding a stakeholder perspective and introducing behavioral decision making aspects.

In combination these three chapters and their findings contribute to the overall research question:

> What enables successful strategic management in emerging industries and in particular in the renewable energy industry – considering environmental uncertainty, contextual dependence, and manager-stakeholder interactions?

This question is assessed from a theoretical as well as a practical perspective. Within the theoretical part the impact of contextual dependence and manager-stakeholder interaction receives particular attention. Aggregating the findings from both perspectives the following critical **success factors** can be stated:
• Strategic management in the renewable energy industry and other emerging industries is **highly dependent on context.** Therefore turbulence levels, industry settings, and firm context need to be considered by practitioners as well as in future research. A more detailed discussion on the relevance of context follows below.

• The **social, interactive dimension** of strategic management is particularly relevant in emerging industries. Policy makers and investors are only two groups of stakeholders that have a strong influence on the renewable energy industry and the firms operating in it. A well-prepared interaction-approach with stakeholders, for example through investor communication (Doganova et al., 2009) or corporate political activity (Hillman et al., 2004), is thus a fundamental success factor for strategic management.

• Strategic management needs to take into account firm specifics. There is no **“one-size-fits-all” strategic recipe** for emerging industries. For example, in business model design individual firm growth and the business model theme need to be factored in. And strategic renewal is shown to also depend on a firm’s ownership structure.

Besides these drivers of success, there are also **pitfalls** that need to be avoided:

• A method for **dealing with uncertainty** is crucial. In various instances of this thesis different uncertainty levels appeared and dealing with them concerns both managers and stakeholders. However, as prior research stated acting on “gut-instinct” (Courtney et al., 1997) or “muddling-through” (Lindblom, 1959) is no valid option.

• **Path dependency of decision makers** shows to be a reason for delayed strategic renewal. As the future success of emerging industries, however, depends on strategic foresight and the pursuing of new tracks, sources of path dependency need to be identified and overcome.

• **Heuristics and biases** influence decision making. While there is nothing wrong with applying these to overcome uncertainty and achieve faster decisions, it is essential to be aware of potential underlying behavioral reasons for decision making – both for managers and future research.
A core aspect of this dissertation is the role of context. The answer this dissertation
gives to the second overarching research question on how managerial decisions are
influenced by or dependent on the industry context is the following. The findings show
that the consideration of environmental influences and contingencies in managerial
practice and future research is nonnegotiable. Chapter 2 shows that an individual’s
embeddedness in his or her professional network can be a source of a status-quo bias.
It further identifies the changing role of expert power with environmental turbulence.
Chapter 3 illustrates the varying value of business model consistency with industry
maturity – even within an emerging industry. Chapter 4 furthermore points towards a
context dependence of stakeholders. Investors seem to be influenced by the overall
market sentiment when reacting to diversification decisions. These findings can only
be a starting point for future research on the role of industry context in emerging
industries. Resulting research implications are described in section 5.3.

Another aim of this thesis was to shed light on interactions with stakeholders in
strategy making from a ‘strategy as practice’ lens. When discussing interactions with
different stakeholder groups, investors receive the highest attention in this thesis,
because their role for the future of the renewable energy industry is crucial
(International Energy Agency, 2012). The question of how investors react to strategic
decisions in emerging industries is thus the last research question that is answered in
an aggregated manner here. In Chapter 3 findings on consistency show that investors
reward or penalize consistency depending on external contingencies. Chapter 4 finds
behavioral investor reactions that can potentially impact strategic management. And
Chapter 2 states the relevance of firm ownership for strategic renewal. Furthermore,
Chapter 4 also identifies that investors reward strategic foresight with positive stock
market reactions. As stated above, a close consideration of investor preferences and a
sophisticated investor relations approach is therefore highly relevant.

The last two paragraphs summarize not only the answers to the first two research
questions, they also are the basis for the main theoretical contribution of this
dissertation. While each individual paper contributes to the literature stream it is based
on, the thesis as a whole aims at advancing the ‘strategy as practice’ perspective
and the (neo-) institutional stream of strategy research. The findings on the role of
the industrial environment and its institutional forces advance (neo-)institutional
theory and argue for a stronger integration of context into management research
on emerging industries. Therewith this dissertation joins prior requests on a

15 Chapter 2 contributes to social network and institutional theory as well as to board of directors literature
Chapter 3 contributes to contingency and organization theory as well as to business model literature
Chapter 4 contributes to resource-based and behavioral theory as well as to diversification literature
continuous integration of the institutional context in strategic management literature (Aldrich et al., 1994; Burgelman, 1991; Courtney et al., 1997; DiMaggio et al., 1983; Lovas et al., 2000; Scott, 1987, 1995). It, moreover, follows propositions for an intensified assessment of strategic reactions to environmental uncertainty and resulting performance implications (Collis, 1992; Engau et al., 2011; Miller, 1992); particularly, when the origin of managerial ‘inaction’ as a consequence of institutional influences is described further (see Chapter 2). Aspects of legitimizing and adaptive behavior to react to contextual changes are uncovered in all three papers.

The contribution to the ‘strategy as practice’ lens (Burgelman, 2002; Kock et al., 2012; Whittington, 2006) stems from the assessment of different manager-stakeholder interactions. Observable as well as latent dynamics are described. While the role of public firm owners shows their direct influence on strategy making, the influence of embeddedness is not easily observable in everyday life. Managers moreover, consider and anticipate potential investor reactions to their strategies, but these dynamics are hardly ever pronounced or discussed. This research, however shows, that investor reactions can depend on aspects within and outside the reach of management teams. I therefore propose a stronger focus on latent, voluntary and involuntary interactions when assessing strategic practices in future.

5.2 Implications for Managers, Investors, and Policy Makers

The practical relevance of this dissertation was already touched upon in the success factors and pitfalls discussion. Hence, in the following, concrete implications for the three dominant groups of actors of this thesis – managers, investors, and policy makers – are described.

Managers and members of the board of directors can integrate the identified success factors and pitfalls into their strategic management practices – either when operating in or when considering entering an emerging industry. First of all, they should be aware of the relevance of context for their decision making as well as for the reactions their investors do or might show. Their context assessment thereby needs to range from political conditions, to industry maturity, market sentiment, and further sources of uncertainty or turbulence. A thorough understanding of the “range of futures” (Courtney et al., 1997) they are facing can help in gaining competitive advantage. Well-designed adaptation strategies that create legitimacy, for example through business model set-up or team compositions, are one pillar of success. Equally important is taking an active role in shaping the industrial context to ones advantage where possible, for example by applying networking strategies (Hillman et al., 2004).
Finally, a proactive dialogue with investors on their considerations and preferences can reduce uncertainty and help funneling sufficient means into the (renewable energy) industry to ensure future growth.

Investors can use the findings of this thesis for their assessment of investment targets in the renewable energy industry as well as other emerging industries. Consistency between financials and strategy descriptions is found to be a potential performance measure that investors can use in their analysis. A thorough understanding of the industrial peculiarities is advisable for investors as well. To engage in an active discussion with firms in the industry could be one way to enhance industry knowledge and reduce uncertainty. Regarding the perceived uncertainty of emerging industries, investors should furthermore be aware of the heuristics they might (consciously and subconsciously) apply and the extent to which they rely on overall market sentiment. Stepping out of beaten paths and assessing future prospects resulting from strategic foresight by management teams open-mindedly can result in higher returns. Overall, investors should be aware of the key role they hold for the evolution of emerging industries. Being prepared with deep industry knowledge is thus a promising path to identify future industry ‘stars’ to invest in and for participating in the success of a rising sector.

Finally, policy makers, though not the main group of actors for this dissertation, can gain from the findings in two ways. On the one hand, policy makers need to consider their role in creating uncertainty through regulation. Uncertainty is a key challenge for emerging industries and reducing it through prudent and time-consistent decision making helps managers as well as investors. On the other hand, policy makers can take an active role in firms that are dominated by public ownership. In boards of directors and similar decision committees they have the opportunity to drive the strategic change of highly regulated industries.
5.3 Limitations and Implications for Further Research

As all management research, this dissertation can only shed light on a small portion of managerial life. The limitations that result from my studies are therefore discussed in the following. Drawing from the limitations, this thesis then ends with implications for future research.

The first limitation concerns the **limited sample size** in Chapter 2 and Chapter 4. Chapter 2 analyzes the six largest electric utility firms in Switzerland which produce ~90% of the country’s electricity. The high share of electricity production covered makes me confident for the representativeness of the paper, however future research could take a deeper look at the various smaller companies in the market and in particular on their linkages to the dominating six firms. The same applies to Chapter 4. Although a 10 year timeframe is used, only 37 transactions that qualify as diversifications decisions took place. This sample size is sufficient to provide robust insights when compared to other event studies (Keele et al., 2011). Still, as the renewable energy industry evolves further and diversification activities continue, future studies can use this analysis and add the next wave of takeovers and stake acquisitions. This could particularly enhance the findings on entry timing.

Second, a limitation results from the used **data sources**. The majority of data gathering is based on publically available, secondary sources. While this approach was purposely chosen to get a complete picture of the respective topic, for example to cover the entire board network of the six utility firms in Chapter 2, some qualitative insights are not captured. Direct insights on the link of investor reactions and market sentiment, or information on the quality or strength of different industry-ties are expected to enhance the presented results. Research conducting in-depth interviews with investors, managers, and policy makers can therefore add to the findings of this thesis.

The third limitation concerns the **timeframe** of the different analysis. Chapter 2 analyses two points in time. Based on these two points it proposes preliminary indications for varying results depending on the environmental turbulence level. Chapter 3 covers four years of performance data and two sectors. Chapter 4 assesses short-term investor reactions. All three decisions regarding the timeframe of the studies are justifiable due to time and data collection constraints. The extension of the findings to longer time periods or long-term implications can nevertheless contribute to the better understanding of the strategic challenges in the renewable energy sector.
Fourth, the topic of this thesis is “Strategic Management in Emerging Industries: Evidence from the Renewable Energy Industry”. As indicated by the title, all studies directly focus on the renewable energy industry. While this is reasonable to account for industry specifics, the conclusions drawn for emerging industries in general need to be treated with caution. As stated in the introduction, the renewable energy industry is a sector that fulfills the characteristics of an emerging industry. To fully transfer the findings of this dissertation to other industries a verification of the results in other industry settings is needed.

As already indicated in the limitations, this research provides several opportunities for further research. The verification and testing of the findings in other settings, regions, emerging industries, or uncertainty contexts is one option. The confirmation or disagreement with the presented results can further enhance the discussion on strategic management in emerging industries. This could be particularly valuable for the findings on diversification timing in Chapter 4 and on the role of diversity in Chapter 2. Moreover, additional firm-specific controls or moderators, such as growth and business model theme in Chapter 3, can enhance the understanding by a more detailed investigation of different driver-performance relationships. Qualitative assessments, through interviews and case studies are recommended regarding network ties, board-level dynamics, and investor reactions. This could be done for example through a procedural analysis of board dynamics (Parker, 2007; Samra-Fredericks, 2000; Soderholm, 2009). The above illustrated findings on contextual influence also mark a starting point. A deeper understanding of the influence of varying uncertainty levels is desirable. To achieve this, different uncertainty constructs (Milliken, 1987) and perceptions would need to be conceptionalized. Afterwards their influence on decision making and investor reactions could be tested. This and other proposed research options can also be extended to different decisions committees and stakeholders. The role of policy makers needs, for example, continued consideration. An assessment of the influence of media, environmental groups, social movements, or lobbying associations could generate insightful results as well. Last but not least, the social interactions that contribute to strategy formation need more attention. Starting from direct and indirect exercise of influence through investors and policy makers, and ranging to a better understanding of behavioral dynamics that shape these interactions, there exists a bouquet of promising research avenues.


5.4 References


6 Appendix

Conference Presentations

Earlier versions of the papers that form this dissertation were accepted for presentation at the following conferences:

Paper 1:


Paper 2:


Paper 3:

Curriculum Vitae
Melanie Katharina Oschlies

Personal Data
Date of Birth February 8, 1983
Place of Birth Weingarten, Germany

Education
2010 – 2013 Institute for Economy and the Environment, University of St.Gallen (HSG), Switzerland
Ph.D. in Business Administration/ Strategic Management incl. position as part-time Research Associate
2006 – 2008 University of St.Gallen (HSG), Switzerland
Master of Arts in Accounting and Finance, incl. exchange semester at NUS Singapore
2002 – 2005 University of St.Gallen (HSG), Switzerland
Bachelor Degree in Business Administration, incl. exchange semester at HEC Montréal
1993 – 2002 Gymnasium Weingarten, Germany
Abitur

Professional Experience
Since 2008 Bain & Company, Zurich, Switzerland
Strategy Consultant
2005 – 2006 Internships at:
Roland Berger Strategy Consultants, Frankfurt Germany
Siemens Management Consulting, Munich, Germany
Permanent Mission of the Federal Republic of Germany to the OECD, Paris, France
Thalia Holding, Hagen, Germany
KPMG, Frankfurt, Germany
PricewaterhouseCoopers, Cologne, Germany