Energy Investment Decision-Making Under Uncertainty: The Influence of Behavioral and Social Effects

by Nina Hampl

Doctoral thesis of the University of St. Gallen

Supervisor: Prof. Dr. Rolf Wüstenhagen

PROBLEM STATEMENT

Risk perceptions [...] can become the most significant barriers to investment, even for renewable energy technologies that are cost competitive with conventional energy-supply options.

– Sonntag-O’Brien and Usher (2004: 3)

1. Substantial investments in renewable energy are required

Change to power production from renewable energy will require about $3.6 trillion additional investment within the next two decades (IEA, 2008).

2. Total new investment in renewable energy has grown

by around 17% from $220 billion in 2010 to around $267 billion in 2011 – BUT this is still a fraction of what is and will be needed (UNEP, 2012).

3. Investments in renewable energy are subject to considerable uncertainty

e.g. volatile oil price, ongoing technology development, uncertainties related to public policies, lack of information about historic financial performance.

How do investors make energy investment decisions under conditions of increased uncertainty?

OVERVIEW PAPERS OF THIS THESIS

First Paper | Second Paper | Third Paper
--- | --- | ---
Venture Capital | Public Equity Markets | Debt and Equity Capital

- The Strength of Strong Ties in an Emerging Industry: A Joint Test for the Effects of Status Hierarchies and Personal Ties in Venture Capitalist Decision-Making
- Invest in What You Know: An Experimental Approach to Investigating the Influence of Corporate Brands on Individual Investors’ Decisions
- Management of Investor Acceptance in Wind Power Megaprojects: A Conceptual Perspective
- Hampel Nina, Wuebker Robert, Wüstenhagen Rolf
- Hampel Nina

MAIN CONCLUSIONS

- Behavioral and social effects do influence investors
- Need to increase understanding of investor behavior under uncertainty
- Investors and policy makers need to pay attention to such effects

EXAMPLE: RESULTS FIRST PAPER

<table>
<thead>
<tr>
<th>Relative Importance %</th>
<th>Return Potential</th>
<th>Founder Experience</th>
<th>Technological Maturity</th>
<th>Regulatory Exposure</th>
<th>Deal Source</th>
<th>Lead Investor</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.38</td>
<td>6.61</td>
<td>6.41</td>
<td>3.17</td>
<td>VERY HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Finding 1: relative importance of personal ties (deal source) higher than for status hierarchies (lead investor)

- Finding 2: in a geography with high VC network density (US) personal ties (deal source) are more important than in a geography with low VC network density (EU)

EXAMPLE: METHODOLOGY FIRST PAPER

- Conjoint analysis: simulation of real-time decision situations
- Decision objects (e.g. products, investment opportunities) can be described along a set of characteristics or attributes (e.g. color, price; return potential, founder experience)
- Each attribute contributes to overall utility of the object
- Investors make choices between different investment opportunities (choice tasks) to reveal information about part-worth utilities of deal characteristics

Figure: Sample choice task

Out of these three investment opportunities in the Clean Energy industry, which one is the best option that you would investigate further (aspects of the deal that are the same are grayed-out, so you can just focus on the differences).

<table>
<thead>
<tr>
<th>Lead investor</th>
<th>Draper Fisher Jurvetson</th>
<th>Draper Fisher Jurvetson</th>
<th>Draper Fisher Jurvetson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deal source</td>
<td>E-Mail business plan</td>
<td>E-Mail business plan</td>
<td>E-Mail business plan</td>
</tr>
<tr>
<td>Return potential</td>
<td>15x in 5 years</td>
<td>15x in 5 years</td>
<td>20x in 5 years</td>
</tr>
<tr>
<td>Technological maturity</td>
<td>Finished product</td>
<td>In production with customers</td>
<td>In production with customers</td>
</tr>
<tr>
<td>Founder experience</td>
<td>Previous start-up founder</td>
<td>Previous start-up founder</td>
<td>Graduate student</td>
</tr>
<tr>
<td>Regulatory exposure</td>
<td>Very High</td>
<td>Very High</td>
<td>Very High</td>
</tr>
</tbody>
</table>

Sample:

- 86 independent VCs
- 50% each from US & Europe
- 3,132 choice tasks in total

- Finding 3: for less and very high experienced VCs personal ties (deal source) are more important than for medium experienced VCs