Returns to Alliance Portfolio Diversity: The Relative Effects of Partner Diversity on Firm’s Innovative Performance and Productivity

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Tim de Leeuw, Boris Lokshin, Geert Duysters
Introduction I

- Alliances are ubiquitous phenomenon (Contractor & Lorange, 2002)
- Increasing # of simultaneous alliances (De Man & Duysters, 2005; Li, Qian, & Qian, 2012)
- Unlikely 1 alliances provides all

- Alliance portfolio perspective (Wassmer, 2010)
  - Different partners types (e.g. Duysters and Lokshin, 2011)
  - Incorporating (dis)synergies (Wassmer & Dussauge, 2011; 2012)
Alliance Portfolio Diversity (APD) has been studied:

- Financial performance (Faems, De Visser, Andries, & Van Looy, 2010; Lavie & Miller, 2008; Mouri, Sarkar, & Frye, 2012; Wassmer & Dussauge, 2011)
- Innovative performance (Srivastava & Gnyawali, 2011, Duysters & Lokshin, 2011; Wuyts, & Dutta, 2012)
- Firms’ exit via sell-off and shutdown (Bruyaka & Durand, 2012)

Only 1 performance dimension
Firms balance strategies, maximizing exploration and exploitation (e.g., Cao, Gedajlovic, & Zhang, 2009; Venkatraman, Lee, & Iyer, 2007)

- Relative performance effects?
- Differences in optima?
Independent variable:

- **APD: Different types of alliance partners** (c.f. Faems, Van Looy, & Debackere, 2005; Oerlemans, Knoben, & Pretorius, 2013)
- **Different partner types=different resources** (e.g. Aschhof & Schmidt; 2008; Belderbos, Carree, Diederen, Lokshin, & Veugelers, 2004; Teece, 1980)

Dependent variables:

- Productivity
- Radical innovative performance
- Incremental innovative performance
Theory: APD and performance

+ Supplement, complement internal innovation (RVB, e.g. Poot, Faems, & Vanhaverbeke, 2009)

+ Combine, invest or exchange in skills, assets and knowledge, (e.g. Dyer, 1996; Nooteboom, 1999), like successive production stages

- Budget equation (Burt, 1992)

- Information overflow (too many, wrong time, attention) (Koput, 1997)

- Monitoring and controlling costs (e.g., Faems, Janssens, Madhok, Van Looy, 2008; Gulati & Singh, 1998)

- Inefficient resource allocations, opportunistic behavior (Combs & Ketchen, 1999; Teece, 2002), relations specific investments and adverse selection

- **H1/H2: APD: Inverted U-shaped, both productivity as innovative performance**
Theory: Optimum productivity

- Combine, invest or exchange in skills, assets and knowledge, (Nootenboom, 1999; Williamson, 1985; Rosenzweig et al., 2003) like successive production stages

- Types of partners in the supply chain:
  - Supply chain management, Just In Time delivery, reductions of waste, optimalization of processes, economies of scale

- Reduce uncertainty:
  - Joint forecasting (Metters, 1997), absorbing uncertainty, share risks, provide economies of scope (Baker, 1990; Burgers, Hill, & Kim, 1993)
Theory: Optimum Radical inn. perf.

- Radical: New innovations:
  - Adaptation of knowledge base (Cohen & Levinthal, 1990)
  - Concentrate limited # types of alliance partners (e.g., Belderbos et al., 2006; Riggs & Von Hippel, 1994; Zucker, Darby, & Brewer, 1998)
  - Attention-based theory (Simon, 1947; Ocasio, 1997)
  - Maximum span of control (see Simon, 1957; March, 1978)
  - Knowledge spillovers (Combs & Ketchen, 1999; Jiang et al., 2010; Teece, 2002)

- **H3:** For radical innovative performance the point where additional APD becomes unproductive will be higher than for productivity
Theory: Optimum Incremental inn. perf.

- **Incremental:** Improvement of existing p.p.s:
  - Dominant design is there
  - All kinds of partners can provide resources, types are exchangeable (Garriga, von Krogh, & Spaeth, 2013; Feller, Parhankagas, & Smeds, 2007; Laursen and Salter, 2006)
  - Fine tuning: sufficient knowledge in-house, no large adaptation of knowledge base
  - Focal firm able to integrate the full range of information and resources; types of alliance partners (Pavitt, 1998)

- **H4:** *For incremental innovative performance the point where additional APD becomes unproductive will be higher than for radical innovative performance*
Theory: APD and 3 perf. dimensions

Organizational performance

Alliance Portfolio Diversity

Incremental innovative performance

Radical innovative performance

Productivity
Data

- Community Innovation Surveys (CIS)
- The Netherlands
- Panel data: 1996-2006 (minus 2002 due to differences)
- Large, medium and small firms (~14,000 observations)
- 26 industries
Measurement

- **Independent variable:**
  - APD: 7 types of alliance partners (national and foreign)

- **Dependent variables:**
  - Productivity: turnover per employee
  - Radical: % turnover new to the market
  - Incremental: % turnover new to firm and improved

- **Controls:** R&D intensity, Firm size, Firm AGE, APDexp, Resource constraints, Use of codified external info, MNE, Part of domestic group, basic research, performing R&D, continuous R&D, buying R&D, 26 industries and years.
Methods

- **DV = censored (%)**
  - Random effects, Tobit analysis
    - Individual effect to control for unobserved heterogeneity
    - Retain firms with only one observation
    - Retain time-invariant variables
    - Does not suffer from incidental-parameter problem

- APD and financial: GLS
## Results

Table 2: Analyses of APD and financial, radical and incremental innovative performance

<table>
<thead>
<tr>
<th></th>
<th>Productivity</th>
<th>Radical inn.</th>
<th>Incremental inn.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>5.71 (0.09) ***</td>
<td>10.12 (2.72) ***</td>
<td>17.24 (2.33) ***</td>
</tr>
<tr>
<td>Alliance portfolio diversity (APD)</td>
<td>0.46 (0.24) *</td>
<td>34.20 (6.06) ***</td>
<td>23.54 (6.75) ***</td>
</tr>
<tr>
<td>Alliance portfolio diversity Squared</td>
<td>-0.79 (0.38) **</td>
<td>-25.64 (9.11) **</td>
<td>-9.02 (10.36)</td>
</tr>
<tr>
<td>Tipping point</td>
<td>0.29</td>
<td>0.67</td>
<td>-</td>
</tr>
<tr>
<td>Number of partner types at tipping point</td>
<td>7.59 (0.96) ***</td>
<td>11.43 (1.24) ***</td>
<td>-</td>
</tr>
<tr>
<td>Resource constraints</td>
<td>-0.03 (0.03)</td>
<td>2.31 (0.77) **</td>
<td>3.69 (0.79) ***</td>
</tr>
<tr>
<td>Part of domestic group</td>
<td>0.14 (0.07) *</td>
<td>-2.08 (3.24)</td>
<td>1.99 (2.84)</td>
</tr>
<tr>
<td>Use of codified external information sources</td>
<td>-0.10 (0.05) *</td>
<td>1.04 (1.31) *</td>
<td>6.36 (1377) ***</td>
</tr>
<tr>
<td>R&amp;D intensity</td>
<td>-0.10 (0.01) ***</td>
<td>0.06 (0.21)</td>
<td>0.36 (0.22)</td>
</tr>
<tr>
<td>MNE</td>
<td>0.09 (0.07)</td>
<td>-1.83 (3.23)</td>
<td>2.26 (2.83)</td>
</tr>
<tr>
<td>Firm size</td>
<td>-0.06 (0.01) ***</td>
<td>-1.57 (0.24) ***</td>
<td>-2.23 (0.24) ***</td>
</tr>
<tr>
<td>Firm age</td>
<td>0.00 (0.00) ***</td>
<td>-0.10 (0.03) ***</td>
<td>-0.14 (0.03) ***</td>
</tr>
<tr>
<td>APD experience</td>
<td>-0.04 (0.03)</td>
<td>0.28 (0.86)</td>
<td>1.40 (0.88)</td>
</tr>
<tr>
<td>Dummy: Close to basic research</td>
<td>0.09 (0.06)</td>
<td>4.44 (1.48) **</td>
<td>1.53 (1.59)</td>
</tr>
<tr>
<td>Dummy: R&amp;D active</td>
<td>-0.03 (0.03)</td>
<td>3.93 (0.88) ***</td>
<td>2.21 (0.90) *</td>
</tr>
<tr>
<td>Dummy: Continuous R&amp;D</td>
<td>0.11 (0.03) ***</td>
<td>6.85 (0.82) ***</td>
<td>7.77 (0.88) ***</td>
</tr>
<tr>
<td>Dummy: R&amp;D outsourced</td>
<td>0.18 (0.03) ***</td>
<td>1.37 (0.69) *</td>
<td>0.44 (0.74)</td>
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<tr>
<th></th>
<th>No. observations</th>
<th>No. individual firms</th>
<th>No. left-censored observations</th>
<th>No. right-censored observations</th>
<th>σ_u</th>
<th>σ_e</th>
<th>R-square</th>
<th>Log likelihood full model</th>
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<tr>
<td></td>
<td>10685</td>
<td>8461</td>
<td>-</td>
<td>-</td>
<td>0.71 (0.02) ***</td>
<td>0.84 (0.01) ***</td>
<td>17.84%</td>
<td>-27347***</td>
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† p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001. The models included 25 industry dummies and 5 year dummies.
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✓ **H1** APD $\rightarrow$ Productivity $=$ Inv U.
✓ **H2** APD $\rightarrow$ Inn $=$ Inv U. (partly)
✓ **H3** Optima Rad $>$ Optima Productivity
✓ **H4** Optima Inc $>$ Optima Radical
**Results**

Productivity, Radical and Incremental innovative performance (f) APD

![Graph showing productivity, radical and incremental innovative performance](image-url)

**Productivity**
- X: 0.33
- Y: 0.63
  (8 partner types)

**Radical**
- X: 0.67
- Y: 22.73
  (12 partner types)

**Incremental**
- X: 1.00
- Y: 32.49
  (14 partner types)
Discussion and Conclusion

- Results differ per performance dimension
- Different levels APD optimal for different dimensions
- Performance new partner, depends on previous APD: management of portfolio
- Multiple performance dimensions + multiple APD dimensions
Thank you
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