Knowledge Transfer via Employee Mobility in the U.S. Laser Industry

ERIN FAHRENKOPF

TEPPER SCHOOL OF BUSINESS
CARNEGIE MELLON UNIVERSITY
Research overview

- Examine firm knowledge flows from a micro perspective
- In particular, argue that individuals gain essential knowledge during their work experiences that are beneficial to fueling industry activity
- Conduct interviews with scientists and engineers working in industry to examine employee knowledge use across firm boundaries
Firm interdependencies in industry

- Traditional theories of industrial activity have firms competing against one another
  - When one firm gains another loses
- But empirically, we often observe complementary relationships between firms in the same industry
  - Firms in the same market benefit from one another
- Ex: clustering of firms in the same industry, positive relationship between industry entry and density
Why a complementary relationship?

- Organizational ecology – *legitimation* – firms in the industry establish institutions for new entrants (Carroll and Hannan, 2002)

- Disagreement theory of spinoffs – new entrants pursue new opportunities (Klepper and Thompson 2010)

- Agglomeration economies – *spillovers* – (Marshall 1890)

- One mechanism possibly explain these results is the movement of individuals across firm boundaries and their subsequent knowledge use
What is knowledge transfer by employee mobility

- Individuals at incumbents learn about the nuances in developing the technology, customers and supplier needs, or other supporting processes.
- Then can go on to use their knowledge across firm boundaries and support the entry efforts at new firms.
- Thus, if knowledge transfer by employee mobility occurs firms generate resources for other firms.
Current evidence on KT by employee mobility

- Empirical work using patent data show that knowledge transfer by employee mobility is substantial (Almeida and Kogut, 1999, Rosenkopf and Almeida, 2003, Song et al., 2003, Singh and Agrawal, 2011)

- In particular, evidence that hiring firms cite newly hired inventors’ work at their prior employers

- The current research study extends what we know by examining some micro assumptions made in this literature
Research question

- We still need a baseline understanding on whether workers provide industry specific resources for further industry activity after they change firms
- So I examine this question using a bottom-up approach
- More specifically I examine,
  - (1) Do individuals moving between firms use knowledge they gained during a prior organizational experience?
  - (2) Is the knowledge they use between firms widely available?
U.S. laser industry

- Examine employee mobility in the context of the U.S. laser industry
- Industry conditions provide a good test case to examine employee mobility and knowledge transfer across firms
  - Lots of industrial research activity
  - Many entrants
  - Importance of experience in laser production (Klepper & Sleeper 2005)
  - Multitude of pioneering opportunities (Bhaskarabhatla 2013)
Beginnings of the U.S. laser industry

- First workable lasers built by those in industrial labs in the early 1960s
- Theodore Maiman of Hughes Laboratories first built a laser using ruby crystal
- Then came the uranium laser from IBM’s Watson Research Center
- And the Helium Neon laser out of Bell Labs
- Laser development is very differentiated across the various media used
US laser industry

- The material used in the laser ties to the wavelength produced
- Determines what the laser can do
- The applications amenable to lasers are far reaching
  - Medical devices
  - Cutting and welding tools
  - Scientific instruments
  - Cat toys!
Industry density, firm entry, and inventor mobility in the U.S. laser industry

- Inventor movement count
- Industry density
- Number of firm entrances

Notes: source of firm data is Bhaskarabhatla & Klepper 2014. Inventor mobility inferred with US patent data
Empirical method: interviews

- Consult individuals who have experience working in two firms
- Ask about current use of knowledge that was gained during prior employment experience
- Ask if knowledge used was industry specific (not available elsewhere)
- Conduct interviews with individuals from a variety of firms in the laser industry
Examine experiences of those in industry

- How to access a sample from multiple firms? In other words, how to get an industry perspective?
- I attended an industry wide expo in which roughly 250 companies come to show off their latest products
- Part of CLEO: 2014 (Conference on Lasers and Electro-Optics)
The qualification criteria for interview: worked in a minimum of two different firms and work directly with technologies.

The interview lasted ~20 minutes.

No identifying information, used “prior employer” and “current employer”.

I conducted 24 interviews over 3 days.

Challenge was to get 20 minutes but this became easier as the conference progressed.
• First ask →

• Did you learn anything during your time at your prior employer that you have found useful at your current employer?
Knowledge use across firm boundaries

General learning from experience

- “I think every time we show up for a job, your boss expects you to bring everything that you learned before. I don’t think I have been in a situation where somebody says yeah all that stuff you know forget that.”

Industry specific benefits

- “The prior employer was really in that ultrafast game at the beginning and went through a lot of the pains of development so when I came over here I brought some good knowledge on what should and should not be done.”
Findings – knowledge use

Aggregated answers to: I gained knowledge and skills pertaining to ______ during my time at my prior employer that I have found useful at my current employer.

<table>
<thead>
<tr>
<th></th>
<th>Regulations and standards</th>
<th>End product technologies</th>
<th>Supporting technologies</th>
<th>Customers</th>
<th>Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Average agreement</td>
<td>3.35</td>
<td>3.74</td>
<td>3.43</td>
<td>3.45</td>
<td>2.76</td>
</tr>
<tr>
<td>(2) Share indicating strong or moderate agreement</td>
<td>0.65</td>
<td>0.61</td>
<td>0.61</td>
<td>0.59</td>
<td>0.38</td>
</tr>
<tr>
<td>(3) Share indicating strong or moderate agreement in <strong>at least one category</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.92</td>
<td></td>
</tr>
</tbody>
</table>

Note: (1) based on a five point scale with 5 as strongly agree, N = 24
• Are there other companies or learning institutions where you could have learned these skills and knowledge?
Industry specific learning

- “There are other companies that do similar things and I could have learned similar things from. I think for the particular technology that I used and its application to gas sensing, I was in a unique position and there is nobody else doing this.”

- “We developed techniques for fabrications of optical crystals and important components of these devices. And actually that was probably the primary thing that my new company was interested in. [] The other places where the work is being done are universities. We were one of the first to take out of the university setting into industrial setting. So I don’t think I would have learned this from any other company, at that time.”
“We were doing something very innovative that wasn't done anywhere else in the world, so the answer is that some of the skills I could've probably learned in the academia - metrology - and in other companies, but some of the skills we learned the hard way by figuring it out ourselves so I would say the answer's not black and white, there are some skills I could've learned and some that we were learned by our own.”
Findings – knowledge availability

<table>
<thead>
<tr>
<th>Aggregated answers to: Are there other companies or learning institutions where you could have learned these skills and knowledge?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulations and standards</td>
</tr>
<tr>
<td>Share of respondents indicating availability <strong>only at competitors of prior employer</strong></td>
</tr>
</tbody>
</table>

Note: includes only respondents that indicated using knowledge gained during prior employment.
Research contributions

- Descriptive evidence individuals use important knowledge across firm boundaries
- Complements other work on employee mobility
- Highlight a mechanism by which individual behavior can have implications on the industry level
- Showcase a new methodology to examine individual behavior across an industry
Thanks!

I would like to acknowledge support from the Center for Organizational Learning, Innovation and Knowledge at Carnegie Mellon and the National Science Foundation [Grant 1360210]