

## **“Survey Results on the Influence of University Research on Industrial R&D”**

**RIETI, Tokyo**

**April 6, 2001**

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Our paper, “Survey Results on the Influence of Public Research on Industrial R&D,” was based on findings of the Carnegie Mellon Survey on Industrial R&D. I worked on the paper with Wesley Cohen and Richard Nelson. We evaluated the contribution of public (or university) research on industrial R&D.

Our motivation stemmed from the change in the role of universities over the last few decades. We have seen more patents and funding going to universities and deeper ties between universities and industry. We have also witnessed a growth in the number of university research centers and technology transfer offices in the US.

Policy implications are the following. Money is tight and competition fierce, so public research must generate economic growth and be relevant to industry. The role of university research in innovation has been analyzed using two models. The linear model depicts a one-way stream where universities make a discovery and hand it over to industry, which are marketed by firms. From this view, universities are funded to get more out of the other end. But this model doesn't seem to hold. The other view, the feedback model, depicts university research playing equal roles in the initiation of projects as in the completion of projects.

Our questions are the following. What is the importance and function of university research? What is the importance of specific fields? And what are the channels for accessing the knowledge?

We concluded that university research was pretty important, in a broad range of fields; it is as important for initiating as it is for completing projects; public channels are critical; and large firms are the biggest users of the research.

In terms of methods, we had no software. We asked R&D managers to respond to questionnaires. We had a total of 1,267 observations, from a broad range of firm sizes. Our data were organized into 34 industry groups, disaggregated into 64 industries. So it was a study of the entire manufacturing sector.

Looking at the results, we ranked the sources for R&D projects' initiation and completion of an existing project. No too surprising was that customers were ranked first—in line with corporate philosophy. Firms' own manufacturing came in second. Joint ventures were third. And university research was ranked fourth as a source for suggesting research projects. For project completion, the firms' manufacturing came in first, customers second, joint ventures third, university research fourth, and competitors fifth. Looking at these results, we can say that university research is at least in the middle, outside the industrial chain.

We also looked at which industries considered university research important for suggesting new projects. Drugs and biotechnology was first. Next were petroleum, steel, and machine tools. For project completion, car and truck was first, drugs second, and glass and aerospace third.

Was there a correlation between university research and high tech use or mature industries? We found no correlation. It is neither high tech nor mature industries that primarily use university research. This finding is controversial. But there really is no problem. Universities are contributing to industry research. Project completion is about equal to project initiation in terms of importance. And it is a feedback system.

In absolute terms, what does industry get from the research? Twenty-nine percent of US manufacturing are using university research findings. And eight percent develop prototypes from the research. For development of new instruments and techniques, the number was 22%. Of all industrial R&D, \$26 billion can be attributed to university research; it was \$19 billion for new instruments and techniques.

Which academic fields are most important? Materials science is most broadly used. More than one field was important; research is broadly pervasive.

Another interesting finding is how the information gets from the university research to industry—the channels of knowledge. Publications were at the top, followed by informal interactions with faculty. Then came conferences, consulting, contracts, hires, joint ventures, patents, and licenses (except in drugs). The channels tended to load together: if one was important, another would be too. For example, if members from industry read a publication, they may follow it up with an informal meeting with the faculty member who wrote the article.

So open science sources are the most important. Conversations, personal interaction,

and public dissemination are intertwined.

Throughout the study, drugs were the outlier. Patents and licenses were key for the drug industry. But you cannot generalize from findings of this one sector.

What firms were most likely to use university research? Large firms were most likely. And startups were more likely than established firms were.

What are our conclusions? Public research is broadly pervasive. University research is about as important to solving problems as it is to initiating new projects. And meetings are important channels, so governments should not undermine open interaction. The limitation of our research is that we only looked at the flow effects of research, not the stock effects.

## **Commentary**

**Akira Goto**

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The OECD is conducting a very similar survey next year. This research is popular among policymakers and academics in many countries. In terms of policy implications, let me say that university-industry relations are complex. And policy should be based on this overall picture. There may be too much emphasis on patents and licenses, which can hinder publications (the most important channel).

## **Question & Answer**

***Q: For using the research, patents and licenses may be more important for the entire process.***

***Q: You say “open science” and “absorptive capacity” are both important. How do you reconcile these two contradictory points?***

***Q: SMEs seem to be excluded from the benefits of the research. How can we fix this?***

***Q: You didn't mention the category of universities—such as state, Ivy League, private, etc. There are 600 universities in Japan and 2,000 in the US***

**John Walsh**

We didn't ask that question, so we don't know.

***Q: What are universities' competitors in this realm?***

***Q: The people who are leaving research labs to go to universities could stimulate new businesses.***

**John Walsh**

Though most science is done at the top universities, most of the interaction is probably done at regional universities because people may be more familiar with local schools.

To make sure all firms' benefit, I am not sure. It could be an economy of scale issue. Smaller firms might not be in the financial position to take on half-completed projects. Building up absorptive capacity is important.

It may be true that firms feel more comfortable using patents.

***Q: Japan copied the Bayh-Dole Act, but your research says it is not that important. What can Japan do?***

***Q: What motivation is there for universities to collaborate with industry?***

***Q: The style of contract is important too.***

***Q: Why is the drug sector different from the rest?***

**John Walsh**

Drugs are the industry was patents work. It is a historical accident. Biology has gotten more productive in the last 30 years. It could also be related to the biotechnology revolution.

*-The RIETI editorial department is responsible for this article.*