Perspective of Southeast Wisconsin High Tech Industry on Government and University Programs

James Lombardi, Dr. O. G. Petersen
Milwaukee School of Engineering

Abstract

Results from a study show less than 10% of Southeast Wisconsin high tech companies felt that federal and state government funds were important for them to form R&D alliances with universities. Furthermore, only 52% of the companies have ever worked with a university and less than 20% actively pursued university alliances. Generally, companies stated the main impediment to forming a university alliance was that they believed such alliances were too time consuming.

Study recommendations are: (1) universities should strive to meet industry's needs instead of attempting to promote their own expertise; (2) Southeast Wisconsin universities should improve their technical relevance and credibility so that more high tech companies become interested in their offerings; and (3) increase the awareness to all sizes of high tech companies regarding available government R&D funding sources in order for government funds to effectively serve as a catalyst.

The subjects of the study were 57 top executives and 31 managers and engineers from Southeast Wisconsin high tech companies with more than two employees. Standard Industrial Classification codes used by the Department of Commerce and the Bureau of Labor Statistics define the organizational format of the study.

Introduction

Interaction between industry, government, and universities relating to research and development (R&D) has a long history. In their book, *Managing the Partnership Between Higher Education and Industry* [1], Matthews and Norgaard point out that "the Morrill Act of 1862 provided the basis for partnership between industry, education, and government in various areas of R&D in science and engineering." The purpose of government funding was to yield useful products in the marketplace. Language in current federal government publications from the Departments of Commerce and Defense, the National Science Foundation, and the Advanced Research Projects Agency still support this traditional intent of government funding.

One area of R&D activities which is in the forefront of concerns to government officials involves the area of high tech products. Greater collaboration between higher education and industry was promoted by the federal government to accelerate innovation and improve high tech competitiveness. In addition, state governments (including Wisconsin) initiated technology

funding and assistance programs base their existence on improving the economic performance of the high tech sector by attempting to stimulate R&D interaction between industry and academia.

Many success stories have been presented in the literature [2,3] of specific companies benefiting from R&D relationships with universities. The authors recognize the benefits these companies reaped from the procurement of government funds and the relationships formed with universities. But little consideration has been given to the perspective of the bulk of high tech companies on the influence of government funding in their willingness to form industry-university alliances and the effectiveness of university R&D assistance. Specifically, does industry think government funding is a requirement for them to form an alliance with a university and does industry feel such alliances meet their requirements relating to the factors of time, money and expectations? This paper explores these latter questions for high tech industry in Southeast Wisconsin.

Delimitation of the Study

Cost and logistical considerations were not the only factors considered in focusing this study on the Southeast (SE) portion of Wisconsin. Small high tech companies play a vital role of creating new jobs in SE Wisconsin. Pearce and Robinson [4] discuss the achievements attributed to small high tech companies with fewer than 100 employees. They state, "such small firms nourish innovation and the commercialization of new technologies by accelerating the R&D process." According to the Wisconsin Department of Development [5] , "most of Wisconsin's high tech firms are small, with 71% employing, on the average, fewer than 25 employees." Further, most of Wisconsin's high tech firms are located in the Southeast portion of the state. This large percentage of companies employing less than 100 employees justifies using SE Wisconsin as a focal point in this study.

An essential part of this study involves recognizing the different types of industries defined under the heading of high tech industry. For that purpose, the standard industrial classification codes (SIC) were used, a numeric categorization system developed by the federal government agencies such as the Department of Commerce. This system organizes industries at increasingly fine levels of disaggregation. The most general categories, such as agriculture, mining, manufacturing, and construction are represented by a one-digit code. Each of these categories is further subdivided into major groups with an added digit resulting in a two digit code. This process is continued resulting finally in four digit codes representing individual industries. High tech industries were then defined to be those which had an above average level of R&D expenditures to sales and an above average number of scientific and technological personnel relative to total employment. All companies falling within the industries meeting these definitions were then considered as high tech companies. It is recognized that this definition is somewhat imperfect since when an industry is classified as high tech, all companies within that industry are considered high tech. Also, companies that individually might qualify as high tech would not be classified as such if the industry they belong to is not classified as high tech. It should be noted that Wisconsin, like other states, does not have industries in every four-digit high tech SIC-code. The use of directories from the Wisconsin Department of Development and the Milwaukee Technology Consortium identified specific companies for the relevant SIC-codes. A listing of a total of 523 companies with more than two employees resulted with a majority of

the companies in SIC-codes 36 (Electronic/Electrical Equipment and Components) and 28 (Chemicals/Materials and Allied Products).

A total of 206 companies were chosen from eight different major 2-digit SIC code industries for participation in a survey. The number of companies representing each SIC group was based on the same percentage that group comprised of the original total of 523 companies. The individual companies comprising the set of 206 companies were chosen in a reasonably random manner. The survey method was organized into three phases. The first phase consisted of phone calls to 29 prospective participants from 2-digit SIC groups 35 and 36 followed by the questionnaire if they agreed to participate. This first phase of the process acted as a pilot-test. Speaking to respondents directly and receiving a fast turn-around via fax determined if there were any significant problems with the questionnaire. The second phase consisted of calling 37 prospective participants from 2-digit SIC group 28. The last phase involved a mail survey sent to 140 prospective participants. This last phase did not entail any phone contact. All possible subjects received the identical information, whether by phone or a cover letter, such as the identity of the investigator, the focus of the study, etc.

Results

The questionnaire is shown in Figures 1 and 2. The information gathered from questions in Figure 1 focused on the status of the respondent within the company he/she represents and basic information about the company. The questions of Figure 2 were intended to determine the relationship each company has had with a university and to what extent government funding played a role in forming that relationship. A rating continuum was employed to allow for expressing some degree of strength for the conviction expressed. Questions were worded to check for some degree of consistency in the answers. The length of the questionnaire was deliberately kept short to increase participation. The rate of response from the questionnaire was 42.7% (88 responses) with the returns being highest for the first phase which had the most personal contact with the respondents.

Responses to the Participant/Company profile are shown in Figures 3a, b, and c. The intent of the survey was to elicit a response from the highest possible qualified level within the company. It can be seen that small companies (less than 100 employees) form a majority of the companies sampled and the respondents being decision makers within the company.

Responses to the questions involving the rating continuum are summarized as follows:

1. The majority of high tech companies, large or small, in SE Wisconsin perform 100% of their own R&D internally.
2. The majority of high tech companies, large or small, in SE Wisconsin do not actively pursue R&D alliances with universities.
3. Companies will form R&D alliances with universities for a variety of reasons. Government funding is a minor factor in this process.
4. Slightly more than half of the respondents cannot give a strong opinion on university alliances because none were ever formed.

5. High tech companies appear satisfied with their internal expertise in delivering innovative ideas to their products.

The flow chart of Figure 4 shows the responses of the survey as an initial input and the final output of approx. 10% of companies who relied on government funding to foster innovation. The remaining 90% of the companies pursued other avenues for achieving their R&D.

Conclusions

The most important point to be made is that only approx. 10% of the high tech companies in SE Wisconsin rely on government funding to increase their level of R&D within the company. The rest of the companies felt government funding was not necessary but were willing to accept such funding, if available, in pursuing R&D. It appears that the attempt by government to foster innovation and increase cooperation between industry and academia favors only a few high tech companies. This suggests that for government funding to be effective, some changes in policies be made to better promote high tech industries. Also, to further industry-university alliances the universities ought to take a closer look at themselves to see if they are offering the type of assistance that the high tech industries are in need of

Notes:

[1]Jana B. Matthews and Rolf Norgaard, 1984, *Managing the Partnership Between Higher Education and Industry* (Boulder, CO: National Center for Higher Education and Industry), p. 65.
[2]Lee Bergquist, 18 April 1995, "Area companies go to school to solve problems," *Milwaukee Journal Sentinel*, p. 9D.
[3]Peter Millard, March 1995, "Giant STEP Closer: Wisconsin is poised to create the extension network that its small and medium-sized manufacturers need; DOD ponies up $1.75 million to help companies ride the 'third wave' of economic development," *Corporate Report Wisconsin*, pp. 25-28.
[4]John A. Pearce II and Richard B. Robinson, Jr., 1989, *Management* (New York: McGraw-Hill, Inc.), pp. 679-680.
[5]Wisconsin Department of Development, Nov. 1990, *Interim Report of the Governor s Science and Technology Council* (Madison, WI), p. 23.

Biographic Information

JAMES LOMBARDI holds a BSEE from the University of Wisconsin-Milwaukee and a Master's degree in Engineering Management from the Milwaukee School of Engineering. He currently works as an Electrical Engineer at Krones Inc. in Franklin, WI with responsibilities for integration of machine vision systems into high speed manufacturing lines.

DR. O. G. PETERSEN is an Assoc. Prof. in the Dept. of Elect. Eng. and Comp. Science at the Milwaukee School of Engineering and Assoc. Director of the Applied Technology Center. He is a former Member of the Technical Staff at AT&T Bell Laboratories. His areas of interest are integrated circuit technology, high speed integrated circuit design, and quality in manufacturing. He received his Ph.D. from the University of Pennsylvania.

RESEARCH AND DEVELOPMENT (R&D) QUESTIONNAIRE

PARTICIPANT INFORMATION REQUEST

1. What is your title? (check one)

- ☐ President
- ☐ Owner/Entrepreneur
- ☐ General Manager
- ☐ VP (specify) _____
- ☐ Manager (specify) _____
- ☐ Engineer (specify) _____
- ☐ Other (specify) _____

2. Which of the following best describes your industry? (check one)

- ☐ Chemicals/Materials (SIC #281-289)
- ☐ Fabricated Metal Products - Ordnance (SIC #348)
- ☐ Engines/Turbines (SIC #351)
- ☐ Printing/Paper/Food Products Machinery (SIC #355)
- ☐ Computer Equipment (SIC #357)
- ☐ Electrical Power Equipment (SIC #361)
- ☐ Electrical Industrial Controls/Products (SIC #362)
- ☐ Communications Equipment (SIC #366)
- ☐ Electronic Components and Accessories (SIC #367)
- ☐ Measuring/Analyzing Instruments (SIC #381 & 382)
- ☐ Medical/Dental Instruments (SIC #384)
- ☐ Computer Business Services (SIC #737)
- ☐ Other (specify) _____

3. How many employees work at your companies location? (check one)

- ☐ 1-49
- ☐ 50-99
- ☐ 100-249
- ☐ 250-499
- ☐ 500-749
- ☐ 750-999
- ☐ over 1000

4. How many engineers and scientists work at your company? (check one)

- ☐ 1
- ☐ 2-5
- ☐ 6-19
- ☐ 20-49
- ☐ 50-99
- ☐ 100-249
- ☐ 250-499
- ☐ 500-999
- ☐ over 1000

5. Your job functions are? (check all that apply)

- ☐ General and Corporate Management
- ☐ Design/Development Engineering
- ☐ Engineering Services - Tests/ Quality
- ☐ Basic Research
- ☐ Manufacturing/Production
- ☐ Other (specify) _____

6. Does your company perform R&D? (check one)

- ☐ Yes
- ☐ No

7. What percent of R&D is done internal to your company? (check one)

- ☐ 100%
- ☐ 75%
- ☐ 50%
- ☐ 25%
- ☐ 0%

PLEASE COMPLETE BOTH SIDES OF FORM

Figure 1

INSTRUCTIONS: We would like to know your opinion on research and development (R&D) in your company. Please indicate the extent to which you agree or disagree with the following statements about R&D. Circle the appropriate number using the scale below.

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
8. R&D is important to our company.	1	2	3	4	5
9. If our company does NOT receive government grants, we would perform less R&D.	1	2	3	4	5
10. Our company would be interested in forming a R&D alliance with a university if government would provide matching funds.	1	2	3	4	5
11. Our company would be interested in forming a R&D alliance with a university even if there was NO government funding.	1	2	3	4	5
12. Our company actively pursues R&D alliances with universities.	1	2	3	4	5
13. The only reason we would form a R&D alliance with a university is because certain government contracts/grants require it.	1	2	3	4	5
14. Our company uses private/independent consultants to assist in R&D.	1	2	3	4	5
15. Our company feels private/independent consultants are more credible than universities in assisting R&D.	1	2	3	4	5
16. Our company feels university alliances are too costly.	1	2	3	4	5
17. Our company feels university alliances are too time consuming.	1	2	3	4	5
18. Our company feels university alliances do not meet company expectations.	1	2	3	4	5

19. Have you ever worked with a university? (check one) YES _____ Which one? Marquette _____ UW-Milw. _____ NO _____ MSOE _____ Other _____

20. If you were to choose a university for a future project, which one would you choose? (check one) Marquette _____ UW-Milw. _____ MSOE _____ Other _____

Additional Comments:

Figure 2

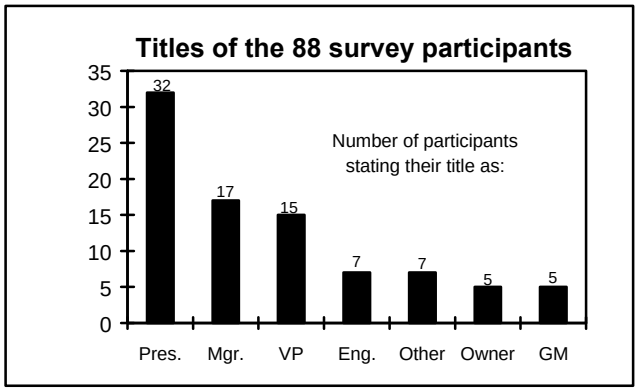

Figure 3a

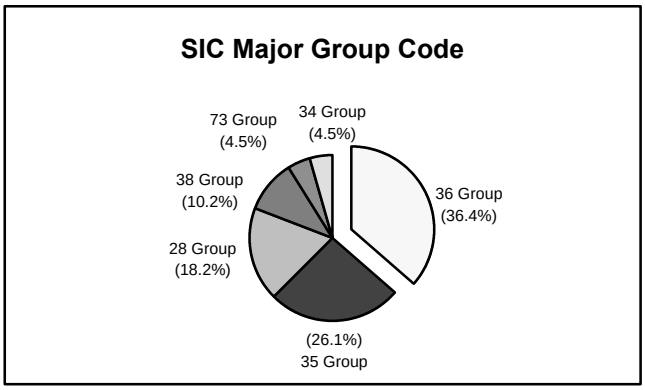

Figure 3b

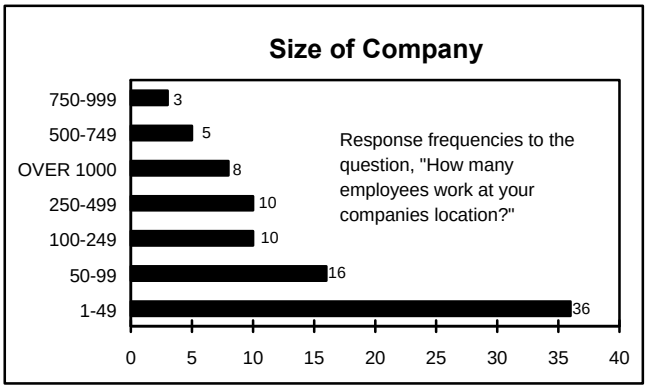

Figure 3c

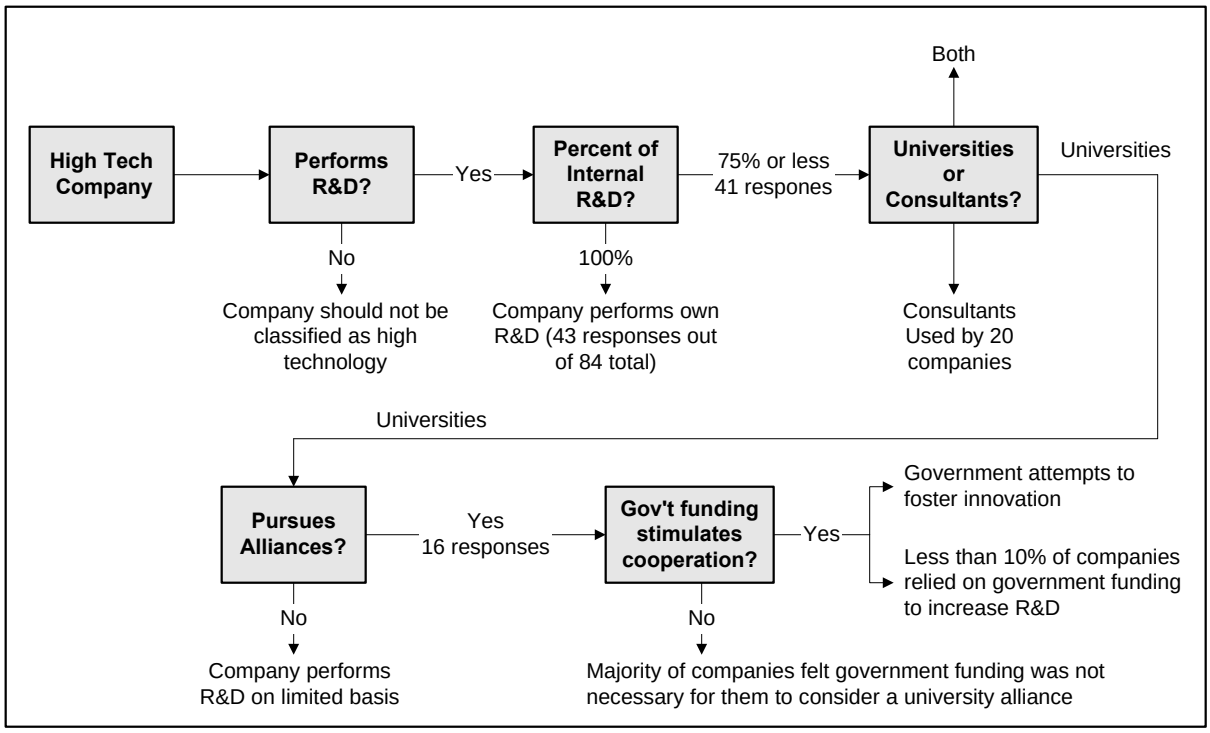
High Tech Company
Performs R&D?
Yes
Percent of Internal R&D?
75% or less
41 respones
Universities or Consultants?
Both
Universities
No
Company should not be classified as high technology
100%
Company performs own R&D (43 responses out of 84 total)
Consultants Used by 20 companies
Universities
Pursues Alliances?
Yes
16 responses
Gov't funding stimulates cooperation?
Yes
Government attempts to foster innovation
Less than 10% of companies relied on government funding to increase R&D
No
Company performs R&D on limited basis
No
Majority of companies felt government funding was not necessary for them to consider a university alliance

Figure 4