# The Role of Corporate Partnerships in Today's Engineering Education

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**Abstract:** It is becoming increasingly more difficult for organizations, be they business or academic, to go it alone, due to competitive, economic and other pressures. As a result, these entities are forming partnerships in order to achieve faster results, leverage resources and share risks. More and more universities and corporations are partnering for mutual benefit. At Worcester Polytechnic Institute, corporate relationships are an integral part of undergraduate and graduate education, including research, technology centers, and student projects. A brief review is given of some different types of partnerships and how they are applied at WPI.

**Keywords:** partnerships, WPI

## Introduction

There is a significant trend in industry today for companies to form partnerships for mutual benefit. The nature of these alliances is varied depending on the type of companies involved, the industries they are in and the business needs that they have. What is an alliance? Segil (1) states: "An alliance is a relationship that is strategic or tactical, and that is entered into for mutual benefit by two or more parties having compatible or complementary business interests and goals." These partnerships provide many benefits to the participants. They add diversity, and bring new ideas, concepts, technologies, and market access. They also result in a reduced spending by the individual partners compared to if they did the task on their own, as well as reduced risk of failure. Of course, the net benefits will be shared, but that is a small consequence.

Universities are also businesses. They are in the service business of educating and training young adults, while increasing the worlds' s base of intellectual property through research efforts. Just as corporations are facing more and more pressures to improve their bottom lines, Universities today are facing more and more pressures to attract more highly qualified students, produce more research results, improve their endowments and even be more competitive athletically! Why not do what corporations have done; namely form partnerships to mitigate some of the pressures they face?

Important issues are defining what is meant by mutual benefit and by compatible or complementary. According to the dictionary (2), mutual is defined as "directed and received in equal amount". This is often a subjective assessment by the participants, and, as Segil points out, the benefits to each partner might vary throughout the life of the relationship. The dictionary defines complementary as "supplying needs or lacks", or restated, one partner provides to the other something the other does not have. As long as each partner is satisfied that the gives and gets are balanced, the alliance will be successful. But how do we define success? Bleeke and Ernst (3) use two criteria to define success. Each partner has to achieve their strategic objectives and an appropriate return on investment.

One set of partnerships that universities can form is university to university. This gets a little tricky. One of the basic principles of partnering is that the parties involved have complementary skills and needs that are not competitive. Sorting these issues out between two very similar organizations is sometimes difficult. It can, and should, be done, but it needs to be done with much care and thought.

Another set of partnerships is between universities and corporations. In this type of alliance, it is usually significantly easier to establish complementary skills and non-competing needs. The following table is a very simple look at the capabilities and needs of both universities and corporations and how they might match up.

| | **University** | **Corporation** |
|---|---|---|
| **Capabilities** | Theoretical intellectual property | Practical know how |
| | Potential employees | Job opportunities |
| | Research facilities | Cash |
| **Needs** | Cash | New basic technology |
| | Graduate placement | New employees |
| | Access to "real" problems | Continuous learning |

This brief chart indicates that each, the university and the corporation, has what the other needs, setting the stage for many partnership opportunities.

**Types of corporate/university partnerships**

There are many ways in which partnerships between universities and industry can be structured. These include, but are not limited to, the following arrangements.

*Sponsored research*

This is where the university conducts research in an area where they have previous expertise but the effort is focused, and funded, by the industrial partner. Usually, the work is performed by graduate students, with close supervision by the faculty. The amount of funding usually depends on the scope of the project and the ownership of any intellectual property developed needs resolution prior to beginning any work. Typically, the university will own the technology and grant an exclusive license to the industrial partner for a period of time. The royalty rate will vary depending on the area of investigation and commercial value. Also at issue is the ability of the university to publish its findings. The public disclosure is usually withheld until proprietary protection is obtained, either through patents or copyright.

*Centers, Institutes and Associates programs*

These are arrangements where universities establish consortiums of industrial members. There is typically a fixed fee for membership by the individual industrial partners and the research by the university is in an area of general interest to the industrial partners, but not specifically focused or directed by any individual member. An excellent example of such an arrangement is the University of Connecticut Biotechnology Center Associates Program (4). They have two categories of Associates. Participating Associates have interests in the ongoing research and specialized technologies that the Biotechnology Center and its facilities have. Sustaining Associates participate in the Center through the development of the biotechnology programs at the university and by helping steer the direction these programs take. The standard fee for an Associate is $10,000 per year, which can be paid either in cash or "in kind" with equipment, supplies or services. This flexible approach enables a wider variety of membership, thus increasing the productivity of the program. The Associates' fees are used to support "all levels of the Center's research and educational missions".

*Project support*

This is where the industrial partner supports student projects, typically for undergraduates. The industrial partner provides to the students and the university "real life problems" that the company needs solved. These projects typically last from one to two semesters and can be conducted either on campus or at the company's location. The support provided by the industrial partner usually consists of the problem definition, supplies and materials needed to conduct and complete the project, facilities, travel support, if necessary, and supervision and guidance. Upon completion of the project, the students make a formal presentation of their results to the company, with the university faculty advisor present. An example of project support for undergraduate teaching is The Learning Factory, a manufacturing engineering education partnership between the University of Puerto Rico at Mayaguez, Penn State University, and the University of Washington, in collaboration with Sandia National Laboratories and over 100 industrial partners. The mission of Learning Factory is "to integrate design, manufacturing and business realities into the engineering curriculum" (5). Its goal is to develop engineers who can "apply the fundamentals, formulate and solve problems, communicate, design and build, work in teams, learn on their own, and deal with ambiguity". The industrial partners provide market place or customer reality to actual interdisciplinary problems.

*Graduate fellowships*

A graduate fellowship is where an industrial partner donates to the university funds sufficient to support graduate study and research by one or more students for some time period. The motivation for the industrial partner in primarily philanthropy, stemming from a past positive relationship with the university, from an alumnus, for example, or in hopes of establishing a future relationship with the university. Possible outcomes include preferential job opportunities for the students and employee recruitment for the company.

*University academic department advisory board membership*

An excellent opportunity for industry and academia to develop a closer relationship and to improve mutual understanding of the other's needs is for individual academic departments at universities to establish advisory boards comprised of leaders from the industrial community. It is essential that the direction that engineering education and teaching takes be where industry will be going, not where it has been. Advisory boards help to better define future trends, which can be taken into account when developing curricula. The benefit to the industrial members on the advisory boards is the assurance that future graduates will be trained in ways that they need for their companies to remain competitive.

*On site course instruction*

It is critical for companies to remain competitive that their engineers be up to date with the latest technologies. An efficient means for the company to maintain up to date engineers is to have university partners provide courses and teach the latest state of the art right on the company's site. This helps to engage the largest audience from the company for the most efficient cost, while providing increased revenue for the university and enabling the faculty to get more closely exposed to industrial settings.

*Faculty consulting*

Obviously, a traditional means for companies to obtain leading edge technology they do not have in house is to hire expert faculty to consult. Again, everyone benefits. The company gets the knowledge it needs and its problem solved, the faculty learns of new applications and industrial needs, as well as earning some extra cash, and the university maintains faculty who are current with industry's needs.

*Jobs*

The is a need for industry to hire new engineers as their needs change and their companies grow. There is also a complementary need for universities to "place", or find jobs for, their graduates. When particular companies and universities develop close relations, they get to know better the other's needs and what they

have to offer, and have a good understanding of what they are getting from the other. The closer these ties, the more confidence that is developed in the partner's abilities.

**Corporate partnerships at WPI**

WPI has been a leader in engineering education, establishing a project based curriculum 30 years ago. Not only do undergraduate students receive strong, theoretical instruction in engineering principles, mathematics, the sciences, and humanities, they must demonstrate that they can apply the theory that they have learned to solve practical problems. One of the requirements that all WPI undergraduate students must meet in order to graduate is the successful completion of a Major Qualifying Project, or MQP. This is analogous to a senior thesis in the student's major, with the intent that the project demonstrate the student's ability to apply their learning and skills to solve a problem that is representative to the types of problems that would need to be solved "on the job". Our Engineering MQP's stress Capstone Design and typically involve research, development and fabrication of working prototypes. Most of these MQP's are sponsored by corporate partners. These partners provide to the university the "real problems" that need to be solved, resources, and critical business analysis to the engineering design. The corporate partners benefit by getting problems solved with minimal expenditures while getting exposed to potential employees "in action". The result is a win-win for both parties involved.

During the 1999-2000 academic year, approximately 200 undergraduate Major Qualifying Projects at WPI were completed, and over 50 companies were involved as sponsors. A day each year during the spring is set aside for the project teams to formally present their results to their faculty advisor and to the sponsoring company. Here are some examples of the topics of corporate sponsored MQP's at WPI.

> *Biomedical Engineering*: the poroelastic nature of bone; the interface between tissue and implanted devices; design of a wireless pulse oximeter that communicates via cell phone; electrodes for noninvasive ischemia detectiom.
> *Chemical Engineering*: fire retardant refrigerants; hydrogen-selective palladium membranes; diamond thin films; nanostructured catalysts.
> *Chemistry and Biochemistry*: synthesis of small molecules for application to the treatment of arthritis, osteoporsis and Alzheimer's disease.
> *Computer Science*: distributed game playing software; the visualization of neural networks; fast rendering of complex 3D geometry; dynamic data warehouse maintenance.
> *Electrical and Computer Engineering*: computer reliability; data security; global positioning; wireless networking; microprocessor system design; mixed signal integrated circuit chip design.
> *Humanities and Arts*: the construction and documentation of scenic design; a lighting-audio presentation for a commercial production company; a poetry portfolio.
> *Management*: FDA drug approval; factors necessary for merger success; inventory storage.
> *Mechanical Engineering*: aerospace structures design, fabrication and performance; Formula SAE race car design; understanding and improving the aluminum casting process; alpine ski design.
> *Physics*: continuous adiabatic demagnetization cooler for NASA; a calormetric study of frustrated liquid crystals; low temperature study of rare-earth doped glasses.

These are just a sampling of the corporate sponsored student projects. Other corporate partnerships at WPI include the Metal Processing Institute, the Center for Wireless Information Network Studies, the New England Center for Analog and Mixed Signal IC Design, and the Center for Firesafety Studies. The New England Center for Analog and Mixed Signal IC Design and the Metal Processing Institute are membership based alliances. Members pay annual fees, similar to the above described Associates Program at the University of Connecticut, and as a result of these fees they get to shape the agendas of the centers' research programs, as well as receive direct benefits from the results of the research. The Metals Processing Institute alone has over 120 corporate members! Industrial partners at the Firesafety Center support research, endow faculty, provide equipment and sponsor graduate student internships. The Center for Wireless Information Network Studies is sponsored not only by over 25 companies, but also by several government agencies throughout the world. One of its strengths is as a center for the information exchange among the various sectors of the wireless community.

## Conclusion

This paper has provided a brief look a some of the types of university/industrial partnerships and how each party might benefit from an alliance with the other, along some examples of just a few of the partnerships WPI has with industry. Corporate partners benefit from access to emerging new technologies and the solution of problems while the University benefits from financial support and the access to real problems that students can learn from.

It is clear that today, very few organizations, be they universities or corporations, can go it alone. Competitive pressures require that they do things faster, better, and cheaper. University-Corporate partnerships create opportunities to leverage complementary skills in a non-competitive way for mutual benefit.

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