INFORMATION TECHNOLOGY PARTNERSHIPS BETWEEN INDUSTRY AND ACADEMIA

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ABSTRACT

This paper describes the problems facing Information Systems educators in keeping current and producing graduates with skills that are valuable to employers. These problems are often magnified by rapid changes in technology. This paper proposes use of partnerships and learning alliances between industry and education as one approach to solving these problems. Several types of partnerships, including examples, are presented. These include: advisory committees, student internships, industry projects for college seniors, faculty internships/consulting, faculty/industry exchange programs, faculty training and updating, hardware/software resource sharing, mentoring, research grants and contracts. Many universities have established an industrial relations office that specializes in facilitating successful partnerships with industry.

INTRODUCTION

The many advancements in computer technology in the last few years, both hardware and software, have brought new challenges and opportunities to industry and academia alike. As most computer and information technology professionals are aware, the useful life of computer hardware was measured in years during the 1950s, '60s, and even into the '70s; but we now find new models of computers being introduced almost every month. Systems design methodologies and software development tools are also changing rapidly. Change is one of the few constants in technology; the business/ academic connections must be revisited often (Heiat, Heiat, and Spicer, 1995).

THE PROBLEMS

In an attempt to remain competitive, companies and organizations that rely on computers are being forced to continually upgrade their systems. This is not only costly, but in a period of time when the emphasis has been on corporate downsizing (right sizing), mergers, etc., it is extremely difficult to obtain and/or keep personnel who are knowledgeable in the use of the latest computer technology. We see a multitude of new job titles in this arena that did not exist ten years ago (e.g., database analysts, telecommunications/networking specialists, EDP security/auditing specialists, user support analysts, office automation specialists, web master, web developer, web programmer) (Mawhinney, Morrell and Morris, 1994).

In addition to the problems which are caused by the rapidly changing technology, the budgetary constraints under which many MIS Departments are working makes it very difficult, if not impossible, to provide the training needed to keep personnel up-to-date. On the other hand, it has long been considered the responsibility of our educational system to provide graduates with the background and skills necessary to be successful in their chosen fields of employment. For that reason, when employers do recruit graduates, they look to colleges and universities with a curriculum that utilizes new technology and emphasizes current practices (Davies, 1989). Because of the rapidity in which technological changes are taking place, computer educators are finding many obstacles to fulfilling this responsibility. These obstacles include limited budgets, lengthy curriculum review cycles, obsolescence of hardware, software, proliferation of new course topics, obsolescence of faculty skills, and the difficulty of recruiting qualified faculty. These obstacles are further magnified when you consider the ever changing demands of industry. Historically, the degree requirements that were in effect at the time a student entered college are the same requirements that must be met four, five, or even more years later when the student is ready to graduate. Although this policy was

initially designed to protect students who might never graduate due to ever changing requirements, it also means that students who are majoring in a technology-oriented discipline may be graduating with skills that are obsolete by the time they complete the stated requirements for graduation.

Another major problem faced by colleges and universities is a problem similar to that faced by industry: keeping instructors up-to-date and qualified to teach students how to use the latest computer hardware and software. Even if instructors do find ways to keep current personally and then attempt to modify course content to include the use of new technology, they often find it necessary to develop their own teaching materials because there are no up-to-date instructional materials.

Based on the experience of the author, the problem most frequently mentioned by educators and students is the lack of hardware and software representing the latest technology. Some academic institutions are attempting to solve this problem by requiring students to provide their own personal computers and related software. This results in a shift of the budgetary problem from the institution to the student and, at best, is only a temporary solution because the institution is obliged to, but doesn't always, provide appropriate hardware and software to the faculty for research and course development.

So far, numerous problems have been identified, but few solutions have been offered. In fact, the author believes that the above problems will only become worse if educational institutions and industries do not work together to solve these problems. Organizations need employees who are skilled in the use of the latest computer technology, but they don't have the time or trainers to complete the training. Academic institutions, on the other hand, have faculty with the expertise to provide the training needed by industry, but are unable to acquire the latest versions of hardware and software. Some researchers have concluded that businesses and universities share some similar challenges, and increased cooperation between the two entities will assist in shared solutions for both (Christensen and Philbrick,1992,Wright,1992). The author believes that the key word is "cooperation." By combining their resources and partnering together, many of the problems and shortcomings faced by each can be alleviated. Based on my experience, it is time for universities to join forces with industry and use creative partnerships to the fullest. This paper discusses how.

PARTNERSHIPS TO EXPLORE

An important way in which corporations may invest in the future is by funding university research and development efforts in technology-related efforts. Donations by corporations may be in the form of money, computer hardware/software, donated and paid employee time, efforts, skills and training. Nine ways in which partnerships can be formed are summarized in Table 1 and discussed and illustrated with examples in the following sections of this paper.

TABLE 1
PARTNERSHIP OPPORTUNITIES
BETWEEN INDUSTRY AND ACADEMIA

1. Advisory Councils
2. Student Internships
3. Industry Projects for College Seniors
4. Faculty Internships/Consulting
5. Faculty/Industry Exchange Programs
6. Faculty Training and Updating
7. Hardware/Software Resource Sharing
8. Mentoring
9. Research Grants and Contracts

Advisory Committees

A problem that is of particular concern to CIS/MIS educators is that of attempting to keep the curriculum up-to-date. Which software packages, programming languages, systems methodologies, and case tools should be taught and/or utilized? What hardware should be used? More often than not, there is no single answer to these questions. Each campus must determine the needs of the community it serves. That is, what are the needs of the major recruiters or companies in the area? The intent here is to identify the needs of companies collectively and not individually. A campus can't be all things to all people.

Rather than work in a vacuum, universities should determine what computer hardware, software, and applications are being used in the organizations which hire their graduates. An excellent way to accomplish this is through the formation of an advisory committee which is made up of alumni, MIS Managers, and recruiters. The individuals selected should be in a position to know the

needs of their organizations, as well as having a feel for the direction that the computer industry is moving. Traditionally, alumni of the program and managers who have hired graduates of the IS program are in a position to provide input regarding the relevancy of the content of individual courses and the curriculum as a whole.

It is recommended that this advisory committee meet as a body at least once each year. Preferably, the meeting would be scheduled one or two months before the deadline for submitting curriculum change proposals. The agenda for each meeting should include a report on hardware and software in use or on order by the university, curriculum changes being considered, and any problems since the last meeting of the committee. Faculty requests for resources and curriculum changes that have been recommended or supported by an industry advisory committee are usually looked upon more favorably by the campus administration than those submitted by departments that do not utilize advisory committees. In addition, it has been the author's experience that organizations that have an employee on an advisory committee are much more likely to enter into some form of "partnership" with the university. An advisory committee could be structured as an affiliates program or friends of the department where members pay a fee to belong (e.g. UCLA affiliates). A word of caution, members of an advisory committee must understand and accept the fact that they are advisory only and not in a position to dictate curriculum and/or practices to the university.

Example: California State Polytechnic University, Pomona invites industry input. Although not referred to as an advisory committee, California State Polytechnic University, Pomona (Cal Poly, Pomona), utilizes input from industry in its decision process as it relates to curriculum and course content. The faculty of the CIS Department at Cal Poly, Pomona traditionally hosts a luncheon for industry "friends of the department" approximately once each quarter. About 20 corporate recruiters, MIS managers, and key alumni are invited to these luncheons with different industry representatives being invited each quarter. The faculty of the CIS Department make a short presentation after lunch to describe what has been accomplished during the past year, problems that have been encountered, and changes (to hardware, software, and curriculum) that are being considered. Each attendee is then given the opportunity to describe changes in MIS being considered and/or implemented by his/her organization and to provide comments, both positive and negative, about the changes being considered by the department. The input from the corporate representatives has proven to be extremely valuable in the final decision process at Cal Poly, Pomona.

Example: PeopleSoft establishes alumni outreach program and academic advisory council. An emerging model of partnerships is heavy involvement of alumni who work in industry to help with the recruitment of new graduates. PeopleSoft, a software company based in Pleasanton, CA, is successful at recruiting large numbers of technical personnel through alumni. The firm usually targets its recruiting efforts at about 10 universities annually, for example, Carnegie Melon, Cal Tech (Pasadena), Howard and Tuskegee Universities. The alumni of these schools who are team leaders make frequent visits to these campuses over the course of a year. Occasionally informational speeches are made to technology students to inform and attract them to PeopleSoft.

The "PeopleSoft on Campus" initiative is geared toward integration of PeopleSoft software training into the curricula of colleges. Developed by PeopleSoft's Academic Advisory Council to meet needs of the academic community, the program centers on how the business world utilizes PeopleSoft. Beginning in 1999, PeopleSoft Human Resource Management and Financial Software (HRMS) has been distributed free of charge to Universities for students to experience first hand. As part of this pilot program, PeopleSoft representatives came directly to Cal State, Hayward in support of this program. It is appropriate to comment here that the role of the PeopleSoft Academic Advisory Council has more of a corporate orientation than most advisory boards for universities.

Student Internships

The term internship is used to describe all programs where students work part-time in a position related to their chosen career field while continuing to make progress toward their degree objective. Student internships are not new, but they are often not utilized by industry. The question might be, why aren't student internships used more by businesses considering the many benefits that can be derived? Some of the benefits to the employing agency are: (1) a ready source of "skilled" applicants, (2) an opportunity to test employees without a long-term commitment, (3) a relatively inexpensive source of labor, (4) highly motivated employees, and in some cases, (5) applicants who have been "prescreened" by the university. According to a 1994 New York Times article, employers nationwide are

hiring four of every five of their college interns full-time after graduation (Lum, 1994).

The benefits are not limited to employers. Internships also provide benefits to the university. An internship provides (1) a real world test of the academic program, (2) a supplement to classroom learning, (3) access by the student to expensive resources, (4) a ready market for the product (graduate) of the university, and (5) a motivated student because classroom learning becomes more relevant.

Example: California State Polytechnic University, Pomona has a well-established internship program with approximately 65-70 students receiving academic credit for their work experience each quarter. Because some organizations may have a policy (sometimes union controlled) against hiring part-time employees, Cal Poly, Pomona has established contracts to provide "temporary MIS employees" with two major organizations. The most successful program has been in existence with the County of Los Angeles for over ten years. In that situation, the university fills temporary positions with qualified students and, in turn, bills the County for the students' services. A pay scale has been agreed upon as part of the contract whereby the pay is different for lower-division, upper-division, and graduate students. In fact, the contract also specifies an hourly wage for faculty consultants. The agreed upon pay scale includes an "administrative charge" for administering the payroll function for the contract employees (Wagner, 1995).

Industry Projects for College Seniors

Complex subjects are learned best by students if the students are involved in a variety of different teaching methods. Students can read about the subject, observe demonstrations, listen to lectures by an instructor, or be actively involved in the learning process through the assignment of a project or case study. Students usually learn best by physically doing something. In this case, the more realistic the project or case study assignment is, the more valuable the learning.

Since most companies have a backlog of systems and programming projects, it would seem quite likely that one or more of those projects could provide a valuable learning experience to students. A key consideration in selecting real projects from industry is that the projects must: (1) fit the timeline of the term, either 10 or 16 weeks, (2) have a required deliverable at the completion of the project, and (3) provide a learning experience consistent with the learning objectives of the course and curriculum.

Real-life senior projects from industry provide a good introduction to the problems that will be faced after graduation. Of particular value is the students' realization that communication skills are important if they must work in a team environment and meet periodically with the industry liaison. The university benefits inasmuch as many of the projects involve hardware and/or software that is not available at the institution. The cooperating organization gains by having a low priority project completed at virtually no cost. Based on the experience of the author, companies that do end up implementing the student-developed results are often quite willing to make a contribution (hardware, software or money) to the university.

Example: California State University, Hayward arranged for a team of seniors in CIS to work on a database design project for Oracle Corporation. After graduation the students were offered employment--evidence of a mutually beneficial arrangement. Subsequently, Oracle donated software to the University for use in student labs.

Example: California State Polytechnic University, Pomona utilizes real-life projects in its capstone course for all CIS majors, CIS 466 Systems Development Project. Student teams of 4-5 students are assigned to each project which culminates with a formal written and oral presentation (defense) of the project solution to the management group which provided the project.

Faculty Internships/Consulting

Faculty internships, unlike student internships, usually involve full-time employment during the summer. In some instances, a faculty internship could require the faculty member to take an unpaid leave of absence from teaching for one or more terms. Regardless of the duration of the internship, the employer and university both enjoy benefits from the program. The employer gains from the expertise of the faculty member, while the faculty member gains insight into the use and application of some of the latest computer technology.

Example: IBM occasionally hires a college professor on unpaid or sabbatical leave. IBM also participates in employee exchanges that include University faculty as well as IBM employees. For example, IBM formed a cooperative program with the University of North

Carolina at Chapel Hill to educate faculty from around the United States to learn new research and instructional uses of computer technology. The main purpose of this program is to integrate technology into the curriculum by using computer equipment and packaged software.

Faculty/Industry Exchange Programs

A few large corporations, such as International Business Machines, have been involved in faculty/ industry exchange programs for many years. In this program, a faculty member is assigned to work for the cooperating organization while an employee of that organization is scheduled to work at the university. That work might consist of teaching courses, assisting in new course development, and/or training other faculty in the use new hardware or software. These exchanges are usually of a short duration, usually one year or less, and the salary and fringe benefits of the people involved are maintained by the original employing agency.

Example: IBM has a faculty loan program. The faculty loan program is an agreement between senior IBM employees specifically located in North America and the university of the employee's choice. A maximum of 7 employees per year of some 200,000 in North America are selected to participate in this program. Once an employee is selected, s/he is placed in a "leave status" from their current position within IBM to become an acting university faculty member at an American University.

Typically the recipient Universities are delighted to obtain a "free" professor for any amount of time. Part of this time is used to plan for these programs by IBM and the participating universities before the partnership agreement is complete. The legally binding one-page Document of Understanding (DOU) is prepared to avoid any legal problems. The appointment is arranged initially for one year but can be extended up to a three-year term. The employee assumes the role of faculty member in his/her area of expertise in the appropriate department of the university.

Participating universities do not compensate the acting professor and are not obligated to IBM through any financial, personnel, or informational exchanges. The employee remains on the IBM payroll and is reimbursed for all expenses related to the assignment to the university. IBM management perceives the costs incurred as a long-term investment in the technological education of US students. Upon completion of the assignment, the employee may return to the past position at IBM or venture into a vacancy at his/her management level. Sometimes the employee may opt to retire from IBM and join the University faculty for an extended period of time if not permanently.

Faculty Training/Updating

One of the problems faced by both businesses and academic institutions is that of attempting to keep personnel up-to-date with the latest technology. Most large organizations attempt to overcome this problem by providing training for their employees. In many instances, this involves paying all expenses to send one or more employees to another training site for a few days—in some cases one or more weeks. It is not unusual for IT training to cost about $1,000 per day per employee, excluding any travel expenses. This is extremely expensive if many employees must be provided with the same training. In those cases, organizations often hire a professional trainer and hold the training sessions at the local place of business. When this is done, the cost of the training is usually a fixed amount regardless of the number of individuals being trained. In these cases, it costs the company nothing to invite one or two faculty from the local university to attend the training session. The only cost to the university is that of providing a substitute teacher for the classes missed and, in many CIS/MIS Departments, the missed classes are taught as an overload by other faculty in the department as is traditionally done at Cal Poly, Pomona.

Hardware/Software Resource Sharing

In the past, many companies have donated computer equipment that they no longer need to academic institutions. Although this is still a possibility, there is a high probability that any equipment being offered as a donation is already obsolete and will not be of any major benefit to an academic institution either. Another way in which access to needed hardware/software can be provided to universities by industries is via networks. Since most companies are now using networks to communicate with different entities within their organization, the CIS/MIS Department at the university can be established as a node on the company's network. It may be necessary to limit access by the university to certain hours of the day so that the ongoing operation of the company is not impacted. In addition, care must be taken by the company to assure that access is controlled and limited to only those areas previously agreed upon. With proper controls, valuable resources can be shared with an academic institution with virtually no extra cost to the company.

Some much needed software cannot be obtained by universities because of the high cost of licensing. On the other hand, it is quite possible that a local company may have a licensing arrangement that provides more copies of software than that company actually needs. For example, a company that needs 30 copies of a software package may find that the cost is the same for 25-50 copies. Some of the excess copies, with permission of the software company, can be "loaned" to the university. In the long run, the company benefits because graduates will be trained on the software that companies are using.

As noted above, the sharing of software or use of software licensed to another person or entity should only be done with the written permission of the software vendor. Based on the author's experience, such permission can usually be obtained if the software vendor is involved early in the decision process and knows how and where the software will be utilized in the curriculum.

Example: Microsoft software donations. Of the 3.4 million estimated technology jobs nationwide, 10% are vacant, thereby slowing the growth of technology-based industries. (Virginia Tech University Study, 1998). By donating software to high schools and colleges, Microsoft hopes to persuade students to select a technical professional career and eventually relieve the shortage of technically qualified workers. Furthermore, investing in development of future technical professionals is consistent with the Microsoft goal of retaining 90% market share.

Microsoft launched a software donation project to benefit middle schools, high schools, vocational and technical schools, and universities that specialize in computer science and technology training. In 1998 recipient schools were given over 18,000 software licenses, Microsoft Visual Development tools and operating systems. Software licenses were for Visual Basic, Java Professional Edition, Visual InterDev Web development, Office 97 Developer Edition, and Windows, or NT operating systems. Through these software donations Microsoft helps to provide practical solutions to complex challenges facing high schools, and especially college and university computer science, engineering and information systems departments attempting to integrate new technology into their curriculum. A web site was prepared to assist faculty in the integration of these tools into the curriculum (www.microsoft.com).

Example: Intel partnerships. Intel began a three-year partnership grant program called Education 2000 for the advancement of information technology research and development and curriculum development. To win a grant, universities must demonstrate academic excellence, commitment of the university to support the grant objectives, and the potential benefit to students and faculty. Intel takes the initiative by sending a team of people to the universities identified, interviews the faculty, and determines what the needs are and how best to help the university. The donated equipment helps to keep the university computing facilities on the leading edge of technology . The main disciplines to benefit from the Intel grants so far are computer science and engineering. Additional disciplines that may become eligible include anthropology, astrophysics, medicine, biotechnology, business, public policy, journalism and the arts. Grants are made in the form of high-speed multi-media computers, workstations, servers, and networking hardware and software.

Not only is software donated, but funding is provided for various projects such as developing next generation, content based networked multi-media technology for "digital storytelling." Recipients have the option of also working on specific needs for their schools. For example, Columbia University, has opted to upgrade all digital operations. As a direct result of an Intel grant, Columbia upgraded the entire infrastructure of its journalism school which conducts collaborative research with the engineering school by using Intel equipment to investigate multi-media searching and storytelling applications.

Intel and other companies with similar programs often find it easier to work with schools and departments that have established industrial relations departments to interface with industry (www.Intel.com).

Schools located in geographic proximity to Intel and other large companies stand to benefit from partnerships also. By seeking to improve the curriculum, computing, and software environment of local schools, these multinational corporations hope ultimately to hire local graduates, which saves the firm relocation expenses upon hiring.

Mentoring

Mentoring programs usually focus on attracting a diversity of students to technical majors such as engineering, computer science, information systems and the sciences. Often the mentorships are established through someone who matches mentors with students; the relationship may involve coaching and/or tutoring over a span of several years. Either a representative from industry, a faculty member or graduate student will

volunteer to team up with and assist female and minority students in particular who may have difficulty with prerequisite subjects such as math. Successful mentoring programs lead to the selection of technical majors by these students and facilitate their successful completion and eventual employment. The company that sponsors the mentor benefits by increasing the pool of potential employees and the individual student benefits by enhancing their employability through improved education.

Example: Motorola establishes mentorship programs. Business models have evolved over the past several years to incorporate faculty and university administrators into the "learning leadership team model and initiative" headed by Motorola, beginning in 1992. The main focus of these models is for faculty to understand that all changes in reference to technology education must be systematic, with a team to support this change and that a student-focused approach must be used to determine the specific areas for future change. Northeastern Illinois University has been the academic leader for these partnerships, including the Minority Mentorship Program, which matched incoming freshmen with faculty who help to build a personal support relationship (www.motorola.com).

Example: Hewlett Packard partners to mentor women, minorities. Hewlett Packard has been a pioneer in a variety of partnerships to further educational enhancement within the technology arena. In 1997 HP announced a partnership to broaden opportunities for women and minorities in the engineering, computer science and related technical fields. Called "Diversity in Education Initiative," HP entered into partnerships with various universities and school districts to focus on K through 12 levels of education. This program provides monetary gifts to universities that work together to prepare females and minorities for college level math and science courses as a foundation for pursuing engineering and computer science majors in college. This program targets majors where women and minorities are under represented, due to difficulties in math and science.

HP provides scholarships to high school and college students and provides job opportunities for them while attending school. These support systems are provided to increase the graduation and employment rates of women and minorities specifically. HP management felt that this extra effort of philanthropy would spark interest among other organizations to follow suit.

Participants involved in this program are the University of California, Los Angeles with the Los Angeles Unified School District, San Jose State University, working with Alum Rock Elementary School and East Side Union High School Districts, Northeastern University, Boston with Boston Public School district, Lower Roxbury area, and the University of Texas at El Paso with the El Paso Independent School District. These universities collaborate with each other to work with several high schools, middle schools and elementary schools.

All participating Universities are on a five-year plan to implement math and science enrichment and mentoring programs for high-school students to increase retention rates of female and minority students with a specific focus on preparing for computer science. A total of $125,000 has been received for each of the five years; each school annually receives $25,000 to support these initiatives. Partners within the K-12 areas receive $290,000 each to carry out math and science programs on each grade level. Engineering and Computer Science students have the opportunity to apply for $3000 scholarships provided by HP to each of the university partners for this project.

The ultimate goal is to alter the pattern of women and minorities dropping out of engineering and computer science majors more often than Caucasian males. Hewlett Packard hopes to increase the mathematical skills so that these students are well prepared to enter into technology specific industries and compete well in college. HP has also encouraged universities and other corporations to offer technical classes for students.

In 1996 Hewlett Packard continued its support for these and related programs by donating over $40 million in cash and products to improve the quality of education from kindergarten to the university level. The University of Washington and the California State University System are among the many beneficiaries of Hewlett Packard donations (www.hp.com).

Research Grants and Contracts

Many corporations see funding university research and development efforts in the area of technology and science as a valuable way to invest in the future. Donations may be in the form of money, computer hardware/software, or even employee time. Relationships with industry have eased the financial burden of many universities which in the past were not able to conduct intense research due to

the limited availability of government funding. University research has become increasingly dependent on corporate donations. Corporations have created and opened the window for outreach and technical growth while in conjunction these donations provide students with the chance to continue their knowledge with hands-on experience using current technology in industry. Universities are building opportunities for faculty and staff that will provide the knowledge needed to help students quickly acclimate into the work force with computer literacy, knowledge about software applications, programming and operating systems. The corporations benefit by gaining access to the best students for potential hire and to innovations that lead to new products. Thus, collaboration between faculty, principal investigators, national laboratories, non-profit research centers and industry researchers can be mutually beneficial.

Example: Sun Microsystems facilitates collaborative research. Sun Microsystems, located in the Silicon Valley of California, has been actively involved in the educational community specific to technology. Collaborating with faculty, research directors and principal investigators at universities, national laboratories and nonprofit research organizations, Sun's presence is very large in this geographical area. Consistent interest and interaction with these organizations through collaborative efforts have helped to enhance the success and future of Sun. All projects that Sun participates in have the common mission, According to Sun Micro's web site (www.sun.com/products-n-solutions.edu), future technology having commercial importance within the next two to five years ultimately provides direction for engineers and management at Sun.

Sun has founded the program and created provisions for easy accessibility for new projects. Graduate level or undergraduate level students may simply discuss partnership ideas with faculty advisors, who in turn communicate these ideas to Sun. The mission of Sun collaborative research is to recruit and hire the best students, encourage and promote faculty research and sabbaticals, student internships, transform university research into new Sun products, and to create future trends in computer and information technology. The initiative owner, along with the Sun Technical Sponsor, oversees the implementation of the particular project (www.sun.com/products-n-solutions/edu).

Example: Apple Computer partners with Carnegie Mellon. Apple Computer joined forces with Carnegie Mellon University in a collective effort of resources to build a Mac II version of Mach, a multiprocessor operating system. Over a two-year period of production, the final product, Mac IIs, is available to run Project Andrew application. Project Andrew is a wide area network that allows users to run applications on the networks of other machines (www.apple.com).

STANFORD UNIVERSITY: PARTNERSHIP PIONEER

Stanford University, known for bridging and building many technologically based partnerships with corporations globally, reported that in 1998 the University was actively involved with 20 corporate partners. With the consistent donations of these corporations, Stanford has been able to explore and expand core research, enhance outreach capabilities, and enter into new collaborative research projects. These partnerships have enhanced the curricula of several Stanford schools and departments and have increased awareness of the importance of information technology and input from public policy makers on technology-specific topics (www.stanford.edu/group/scip/).

Stanford computer industry project for software research. Using the funding received from many of its partners, Stanford University has entered into a strategic research project specific to software. Another venture resulted in Stanford conducting research about segmentation in the software industry. The focus of this study, conducted under the auspices of the Sloan Foundation, is current patent law, piracy, trade policy, labor, immigration, education, antitrust, international competition, quality and technology change (www.-scip.stanford.edu/scip/).

Strategic uses of information technology project (SUIT) facilitated by education forum. Stanford created an educational forum in 1996 geared toward senior level executives to meet and discuss technology needs of the business world. After much success in the first forum, the project was incorporated into the Stanford graduate-level executive education program. Various portions of this project have been presented and well-received at conferences around the world. Thus, the educational forum assumed the role of an advisory board to help Stanford get started with SUIT (www.stanford.edu/group/scip/).

CONCLUSION

The above suggestions are only some of the ways in which organizations and universities can partner to

overcome some of their problems and achieve their objectives. It should be noted that the benefits that can be attained far exceed any costs that may be involved in the implementation of these suggestions. Many of the suggested areas for partnerships presented in this paper have been proven effective at universities where the author has taught. The author is of the opinion that all of the suggestions for partnership ventures could work to some degree for all colleges and universities. Many have already established an "industrial relations" office that specializes in such endeavors and helps to promote communications among faculty, staff, students and industrial representatives that facilitate successful partnerships.

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Regarding web sites consulted, see Appendix or contact author for hardcopy backup obtained.

APPENDIX

At the time of writing, the companies listed below were found to have web site content related to partnerships. The best approach to identifying specific articles and descriptions is to go to the general site and search for "partnership" topics. This is because of the dynamic nature of web sites, which are likely to change between the submission of this manuscript and the distribution of the journal issue in which it appears.

Apple Computer: www.apple.com
Hewlett Packard: www.hp.com
IBM: www.ibm.com
Intel: www.intel.com
Microsoft: www.microsoft.com
Motorola: www.motorola.com
Oracle: www.oracle.com
Peoplesoft: www.peoplesoft.com
Stanford University: www.stanford.edu/group/scip/
Sun Microsystems: www.sun.com/products-n-solutions.edu