

Building Sustainable Industry Partnerships That Engage Faculty and Prepare Job Ready Students

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I am a teaching instructor at East Carolina University in the College of Technology and Computer Science. Since January 2002 I have taught undergraduate Information and Computer Technology courses in the Department of Technology Systems. I also play an active role in building positive industry relations between our department, local businesses, and industry partners. Current industry recognized certifications include; Certified Cisco Network Professional, Microsoft Certificated Professional, Nortel Certified Technology Specialist, EMC Information Storage and Management, IPv6 Forum Certified Engineer (Gold), IPv6 Forum Certified Trainer (Gold), and Cisco Certified Academy Instructor. I received my MBA from Wayland Baptist University of Plainview Texas and my BS in Professional Aeronautics from Embry-Riddle University of Daytona Beach Florida. I am currently enrolled in the Technology Management PhD program at Indiana State University and expect to graduate in the fall of 2014.

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Dr. Leslie Pagliari serves as Associate Professor of Technology Systems and Associate Dean for Academic Affairs in the College of Technology and Computer Science. Her research interests center on STEM initiatives, global supply chain issues, and new technologies in the distribution and logistics sector. She was one of three professors in the United States recognized in an Inbound Logistics Article featuring leading professors in today's supply chain curriculum.

She has worked with a team of colleagues throughout other colleges at East Carolina University to plan a STEM initiative for 8th grade girls. This initiative helped bring more than 85 Pitt County girls to campus to engage them in Science, Technology, Engineering, Math and Medicine Fields. In addition, Dr. Pagliari collaborates with many external organizations. She is past president of APICS (Association of Operations Management) and past Education Chair for the CSCMP (Council of Supply Chain Management Professionals). She also served as a board member for the Museum of the Marine in Jacksonville, NC and the Eastern Carolina Safety and Health School. She continues to serves on multiple organizations with the University, College, and Department. Finally, Dr. Pagliari was selected and completed the BRIDGES Academic Leadership for Women hosted by UNC-Chapel Hill.

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Abstract

There is growing pressure on colleges and universities to better prepare students for the workplace and to measure the value of academic programs by the number of students hired after graduation. At the same time, educational institutions are facing deep budget reductions and reduced levels of support from both State and Federal governments. Additionally, employers are demanding that graduates from a university program have more real-world integrated experience. Feedback gathered from academic program advisory boards and findings from literature reviews on university and industry partnerships indicate that increasingly, there is a growing gap of technology knowledge between industry and academia. One such view is that universities tend to stop at the introductory or theoretical levels of technical education, giving students solid academic knowledge, but not the practical world-of-work skills that industry demands. This paper will present in detail how a partnership model developed at East Carolina University successfully builds and manages sustainable industry partnerships. It will also give concrete examples of how collaboration can build successful relationships between universities and industries in order to help students be successful upon graduation.

1. Introduction

“With declining budgets and increased pressure to deliver a prepared and hireable workforce, universities must look externally for resources to assist with recruiting and retaining top students^[1].” The College of Technology and Computer Science at East Carolina University (ECU), Greenville, NC, has established a multifaceted industry partnership model that engages faculty and students with professionals in industry to enhance the educational process and prepares students for success entering a constantly-evolving professional landscape. The model is designed to strengthen the relationship between our college and industry from four strategic directions.

- Providing faculty from engineering and technology disciplines as consultants to industry through a dedicate outreach program, the Center for Innovation in Technology and Engineering.
- Generating continuous feedback through establishing relationships with industry professionals at the college and university level.
- Encouraging student professional and technical development through a Career and Development Leadership Center.
- Creating opportunities for students to gain valuable industry experience through internships, co-ops, and capstone projects with industry partners.

The remainder of this paper will discuss each of these four strategic directions.

2. Faculty engaged as consultants to industry

Part of the University mission includes regional economic development, which requires building effective industry partnerships through the involvement of the faculty. To encourage faculty-industry collaboration, the College created the Center for Innovation in Technology and Engineering (CITE). CITE's primary mission is to provide access to college resources for businesses and the industrial community. Encouraging faculty to leave the boundaries of campus and work alongside industry has enabled our college to build a strong rapport with regional businesses and produce a network of potential employers for students. By growing links and connections to the regional industry base, CITE has aided in helping students with numerous opportunities for capstone project, internships, and full time positions. Additionally, CITE has developed working relationships with several companies for non-funded, research based activity which has helped our faculty with research agendas and teaching material.

CITE works closely with the college faculty to help them develop an "off-campus" mindset and provides a unique opportunity to become engaged in projects that are beneficial to industry, students, the university, and the community. Faculty members share in the benefits from the partnership through experience with real time industrial and technology problems. The students benefit from faculty exposure to, and experiences with, regional manufacturers and businesses as the faculty will bring these experiences and knowledge back into the classroom in the form of examples, learning modules, and class discussions. Additionally, some CITE projects utilize students to assist in projects, thus providing hands-on experience. Industry benefits from this relationship by having access to a cost effective, highly skilled regional resource. As an outreach program, CITE provides a cost effective alternative for specialized industrial training and project implementation. The CITE program has a positive impact on regional business based on positive survey feedback, and the number of repeat projects requested by client companies.

As a fee based service, CITE allows faculty to be contracted and compensated for work performed off campus. The fees charged by CITE are charged to client companies on a "per day", rather than "per person" basis, making the training extremely cost effective. The program generates a reasonable return for the college that can be used to provide a discretionary expenditure funds for student travel and extra-curricular activities. Table 1 shows the revenues generated by the CITE program over a five year history. Because CITE is a stand-alone operation within the college, the fees must cover all direct, overhead, and general and administration (G&A) costs, as well as generating a per project profit. Direct costs include a fixed hourly labor rate for faculty, materials, and travel expense. Overhead costs include expense items for CITE staff, including travel and miscellaneous expenses. G&A costs include payroll taxes, employee benefits, and University fees. Overhead and G&A are calculated as a percentage of the gross labor fee. Table 2 shows the breakdown of general and administration fees.

Table 1. CITE Revenue History

	2008 - 09	2009 - 10	2010 - 11	2011 - 12	2012 - 13
Companies Engaged	33	28	45	30	17
Total Fees Invoiced	\$141,655	\$194,610	\$110,174	\$170,180	183,400
Faculty Compensation	\$124,995	\$95,500	\$88,140	\$130,335	\$120,000

Table 2. General Administration Fee Breakdown

Description	% of Gross Fee	Explanation
Social Security	6.20%	Employer's portion
Medicare	1.45%	Employer's portion
University Admin Fee	1.75%	Processing fees to College from University
Retirement Contribution	14.23%	University and faculty pension contribution
Workers Compensation	0.20%	University requirement
Sub-Total G&A	23.83%	

Table 3 shows an example project costing model. In the example, a market rate of \$1,000 per eight hour day is used to demonstrate a one day project with no material or travel cost. Salary to faculty is established at an \$85 per hour rate, allowing for a 12.4 profit percentage.

Table 3. Costing Model Example

Item	Rate	Cost	Percent of Total
Invoice to Client Company	\$1,000 / 8 hours	\$1,000	100.0%
Direct Labor	\$85 per hour x 8 hours	(\$680)	68.0 %
Overhead	5% of direct labor	(\$34)	3.4 %
General & Administration	23.83% of direct labor	(\$162)	16.2 %
Total Profit per Day		\$124	12.4 %

While CITE projects are based on pedagogical materials already developed, all projects are customized to the client company. Projects for CITE fall into two primary categories, professional development or workshops. Professional development projects are established to fill a knowledge gap within a client company or to enhance their capability. Workshops are essentially consulting projects wherein faculty guide a client company through a process to target a specific outcome. Approximately two thirds of projects are professional development, and the remaining one third are workshop / consulting.

Two example projects with regional companies contracted through the CITE program are detailed below to demonstrate the training and workshop formats and student benefits.

- Example project #1 - One client company was interested in training their entire supply chain staff to provide a uniform body of knowledge for a workforce ranging from new hires to thirty years of experience. A series of courses was developed and delivered multiple times over five years to insure that all employees had a chance to attend. The course sequence began with “Basics of Supply Chain Management”, moved to “Forecasting and Scheduling”, then to “Procurement and Sourcing”, and finally to “Warehousing and Logistics Management”. The course was developed based on text books and the Association for Operations Management (APICS) body of knowledge for certifications as a Certified Supply Chain Professional, and Certification in Production and Inventory Management. The win-win for this faculty-industry partnership was demonstrated through positive survey feedback and execution of short term projects by attendees. Benefits to ECU students were derived by revising course delivery and

curriculum content, focusing on the areas of interest from the project delivery.

- Example project #2 - A workshop related course was established for project management, including use of Microsoft Project software. Many industry engineering groups are fully engaged in leading shop floor level projects, and a need for formal project management training was recognized by engineering managers. Rather than set up lecture based training, a workshop format was adopted to allow teams of engineers to develop a scope, work breakdown structure (WBS), communication plan, and project plan for an actual upcoming future company project. At the end of the workshop, the company had a developed scope of work, a WBS complete with time and resource estimates, and a baseline Microsoft Project file to conduct tracking once the project initiation took place. A benefit to ECU students was gained through establishment of core project management needs, software tutorials, standardized templates, and course modifications with focus on the knowledge gaps experienced during the projects.

Establishing a program such as CITE requires a long term commitment to achieving the strategic goal of industry outreach. Ten years into the initiative, the strength of the program was only realized through the strength of the commitment maintained as the CITE program evolved through the work of three successive directors, three department chairs, and two deans. A five step process is proposed to establish a similar fee based, external industry outreach program:

- Establish strategic vision and goal
- Establish level of faculty interest
- Hire full time staff member to lead industrial outreach
- Develop internal administrative procedures to facilitate outside projects
- Begin networking to find opportunities

The first critical step is administration commitment which must come from the Dean of the College and involved department chairs. At ECU, the program began as a half time endeavor for a tenure track faculty, but that model needed to be abandoned due to research commitments. The lead for CITE was handed to a fixed term faculty, again on a half time basis. The absence of research requirements allowed more time to pursue industrial contacts, but was still not sufficient. The program only gained traction when a full time, non-faculty staff member replaced the fixed term faculty for leadership. With the mandate to achieve the University goal of economic development through industry outreach, the full time staff member had the time and motivation to make contacts in the industrial world.

Before going to regional industry, the second step is finding faculty with the right mix of motivation, time, and matching skill sets required by potential client companies. As a fee based external program, a business mindset is required for execution. The College must be comfortable that the resources, i.e. faculty, are available to develop and deliver quasi-customized mini courses and workshops during the business work day. At stake is the reputation of the University, since offering this service means commitment to follow through and deliver a quality program.

As previously stated, a full time staff member is required to lead and manage the program. Thus, the third step is to put the right person in place to lead the program. This is considered a sales and marketing position within the college staff, and thus requires a skilled individual with the ability to interact with industry and have a working knowledge of the requirements and practices of academia. Leadership of the program should not be a shared commitment with teaching, research, or publication responsibilities.

Once a full time director is in place, the administrative systems to support an internal, for profit operation must be developed. Compensation of faculty for external projects may not be the norm at most colleges, and thus care must be taken in determining the processes to approve and pay faculty, as well as handle ongoing project expenses. Also, a predetermined time allotment for faculty may need to be established to avoid a conflict of commitment to students and other obligations. ECU has established an eight hour per week release policy as a starting point.

Finally, when all the pieces are in place, a long term view for developing this type of program is critical. First, industrial networking and finding the right contacts takes time. In addition, corporate training is need based, so demand is difficult to forecast and harder to plan. The ideal place to start is with local companies represented on departmental advisory boards and companies that actively recruit students from the university. Also, key to the success at ECU were contacts developed at the local community colleges, which generally have an outreach mandate but lack the resources to meet all the needs. In many cases, our college has been able to partner with a community college to provide a service to a local company.

3. Continuous feedback through industry professionals

Many college deans and department chairs view industry advisory boards as most useful in soliciting strategic and programmatic advice, political influence, connecting the students to the community, in helping support fundraising objectives and the promotion of the mission of the institution^[2]. However, the true benefit of a well managed advisory board is that they get external people actively involved in the department or college^[3]. External involvement by industry is a critical component in understanding the needs of employers so that curriculum and degree offerings can be fashioned to produce a graduate with the most in-demand skill sets and knowledge^[4]. Also, advisory board members are motivated to share their experiences and become involved with students to enrich their learning^[2].

Program advisory boards

The College of Technology and Computer Science offers both graduate and undergraduate degree programs through four academic departments: 1) Computer Science, 2) Construction Management, 3) Engineering, and 4) Technology Systems. Within these four departments are housed nine separate degree programs each of which maintains its own program specific advisory boards. Recruiting and retaining effective board members to sit on nine separate program advisory boards is indeed a challenge that requires a systematic approach such as the seven components proposed by Koong (2003)^[5].

The seven components to building effective advisory boards as proposed by Koong:

- Clearly communicated mission, goals, and objectives.
- Develop a recruiting package for advisory board members.
- Recruit from as many diverse industry sectors as possible.
- Allocate support resources to nurture and strengthen the advisory board relationship.
- Use innovations to retain and strengthen relationships and minimize attrition of board members.
- Assess contributions and strengths of each board member.
- Have a plan for separation and exit of board members.

Dean's advancement council

The Dean's Advancement Council provides an opportunity for alumni and friends to become more engaged with the College, through efforts as advocates, resource finders, contributors, and consultants. The Council serves as advisory to the Dean of Technology and Computer Science to further the college's goals, support its continuing improvement, and ensure its future success. Both on and off campus, the Council assists the Dean and faculty in promoting a positive image and good relations with constituent groups at the local, regional, state, and national levels. Specific accomplishments include:

- Fully funding the David Smith Leadership Award with a foundation of \$25K. The membership this past year helped fund the scholarship, including one of the council members personally donating the final \$5K needed for it to become a funded scholarship for the college. This scholarship honors one of the College's students killed in action in Afghanistan.
- Donations ranging from \$150,000 – \$250,000 funded two labs: an electrical engineering student lab, and an information technology (IT) SAP lab.

The Council consists of up to twenty-five distinguished persons, including alumni, industry leaders and friends of the College, who are appointed by the dean. The dean consults, as appropriate, with the Vice Chancellor for Academic Affairs, the Vice Chancellor for University Advancement, department chairs, program directors, and the College's Gifts Officer to identify persons to be invited for membership. Persons are appointed to two-year renewable terms with one-half of the membership appointed each year effective July 1. There is no membership fee; however, Council members are expected to provide their own transportation, lodging, and other expenses for attending meetings and encouraged to hold membership in the Chancellor's Society (\$1000 annually).

The advancement Council meets in the fall and spring of each academic year. The College's Gifts Officer serves as the dean's liaison with individual Council members. The Gifts Officer also coordinates and arranges the logistics for Council meeting. Standing committees and their chairs are appointed by the chair of the Advancement Council upon consultation with the dean, who then appoints appropriate Council members, department chairs, program directors, the College's development officer, faculty members, and students as ex-officio members.

4. Student professional and technical development

In 2009, the College launched its own Career Development and Leadership Center (CDLC) as a satellite branch of the University Career Center to ensure that students have access to the technical and leadership skills both needed and required by employers before they graduate. The CDLC supports an environment where students can gain professional experience in the workplace through paid and unpaid internships, formal and informal co-op positions, capstone courses, volunteer work, and service-learning courses.

The mission of the CDLC is to provide a single point of contact for employers, the ECU Career Center, faculty, and students. The goal is to ensure that students are prepared for seeking employment through hands-on experience in their respective fields. The center supports departments within the college to provide the following:

- An experiential learning component to their major's education.
- To enhance their graduates' professional opportunities.
- Organize events for the college such as career development day, leadership day, external guest speakers, and resume skills training.
- To maintain oversight and keep appropriate records documenting student placements, employer contact information, and other forms and contracts as needed.

Involvement of industry partners is critical to the success of the CDLC, and they generously give their time to support through participation and support for College Networking Day events, mock student hiring interviews, industry panel discussions, and guest speaker events.

College Networking Day Event

Our college utilizes an Annual (Career) Networking Day separate from the University Career Fair to target employers focused on our college degree programs. Although the University sponsors twice annual career fairs, feedback from students and employers prompted the creation of a separate college level event with a targeted focus on students graduating with specific degrees and skills sets from our programs.

Recruiting companies and students enjoy several benefits from this event. Potential employers spend time networking with faculty, tour the college facilities if desired, and have an efficient use of their time by only speaking with relevant degreed students along with a recruiting area with continuous faculty interaction and "on the spot" references. Prior to the actual student walk around and career discussions, faculty and corporate recruiters have dedicated networking time. This is valuable time for both the corporate recruiters and faculty to exchange information on recruiting needs, preferred candidates, and curriculum content. Given this is a college based event, recruiters prefer the environment because the students that they are seeking have the requisite skill sets. During the event, faculty remains in the area to introduce students and provide real time feedback to both recruiters and students.

Important lessons learned which benefit students include timing of the event, faculty interaction, and a working knowledge of recruiter wants and needs. First, the Networking Day timing has

been established to be as early in the spring semester as possible. Spring was selected over the fall as companies seem to be more in tune with their financial situation and hiring goals than in the fall. Also, early spring gives students looking for work, either for full time or internship employment, the ability to complete the interview process prior to final exam and semester end pressures. A vital lesson learned is keeping faculty engaged in the process throughout. The faculty interaction during the event has provided a wealth of knowledge on recruiter goals and key requirements for student job seekers. Additionally, faculty can serve as “head hunters” by passing on real time information to students on company needs and opportunities.

The event is open to all majors within the college seeking full time employment or internships, although freshman and sophomores are highly encouraged to attend to begin building their confidence and professional network. The event has been a great success based upon positive, informal feedback from employers and students. The initial invitation list of employers started with members of the advisory boards from the departments and programs within the college, and targeted regional businesses. Table 4 shows that the number of employers represented has grown each year of the event.

Table 4. Career Networking Day Attendance History

	Spring 2011	Spring 2012	Spring 2013	Spring 2014
Recruiting Companies	41	49	52	54
Student Attendees	186	236	344	247

Mock interviews

The University began a mock interview program known as Helping Individuals Reach Employment Destinations (HIRED). Each semester, the CDLC coordinates mock interviews between students and volunteer interviewers from industry. The program is open to all majors and all academic levels. Some faculty make participation part of course grades to encourage students to attend. The interviews give students an opportunity to develop and practice interview skills and proper interview etiquette in a one – on – one situation. Since the fall of 2010, more than 520 students in the College have participated in the mock interview program. As of the 2013/14 academic year, the program has been augmented to include a web record video question session. Students answer typical interview questions and the responses are reviewed by Career Center staff to provide feedback to students. Student comments on these programs include the following:

- “This is a great program where students have the chance to sit down and have a real interview. I think this should be mandatory for every student in every major.”
- “I received an incredible amount of valuable information from a very knowledgeable and credible professional! What I received was invaluable and I believe everyone should participate in this program.”
- “Before this I would say an interview with a future employer absolutely scared me, but finding all the things I need to bring to an interview as far as information goes really eased my worries about being interviewed in the future.”

Industry panels

Many degree accreditation agencies require that colleges and universities provide activities that encourage and support the development of students as professionals and the continued professional development of faculty ^[6, 7]. One of the programs offered by the CDLC to provide student development is the industry panel. Industry panels are organized each semester and the panel consists of representatives from four to eight companies from various industries who are invited to speak on technical and professional development topics. It is an open forum that encourages interaction and collaboration between the students, faculty, and industry representatives. These events provide students an excellent opportunity to learn directly from hiring managers and human resource people what they are looking for in new hires. Faculty and students have the opportunity to ask questions and network with professionals from industries within and outside their discipline. The industry panel events are open to students and faculty from all majors.

Guest speaker events

Industrial partnerships can be generously leveraged to benefit students through guest speakers, whether in the classroom or at excursions to their operations to put pedagogical material into context for students and provide additional credibility to the faculty lectures. One way this is exploited at ECU is through a program developed between student leaders and faculty referred to as a “Professional Development Point” (PDP) program. In the PDP program, students may earn points on their final average by attending instructor approved professional meetings where they listen to guest speakers, attend college organized “after hours” events, or take industry tours where there is generally a post tour question and answer period. The effectiveness of utilizing guest speakers is enhanced through question and answers, and the utilization of a student incentive program such as PDP brings in a larger audience to facilitate this.

Participation in the PDP program is voluntary for faculty, but all faculty members within the program agree to provide final average bonus points. One faculty member within a program coordinates and tracks the events, and written rules are established to govern what constitutes a PDP event and point administration. As an example, the requirements within one degree program at ECU has established that no PDPs are earned for any presentation conducted during regular class time or for a required activity of any course, and that all point allocations are determined by the student prior to the start of the final exam period. Additionally, PDP points awards and limits are:

- Attend 2 documented events: 1 point
- Attend 3 documented events: 2 points
- Attend 4 or more doc events: 3 points

5. Opportunities for industry experience

ECU has a mandate to “respond to employer demands for graduates with applied experiences” and that the University should “form a partnership with business to support growth in experiential learning opportunities for students ^[8].” It is well recognized that practical hands-on

experience outside of the classroom has a positive impact on student success after graduation. This goal is pursued through internships, co-op employment, and capstone projects.

Internships and co-ops

Building strong industry partnerships has proven to lead to more internship and co-op opportunities for students. The College of Technology and Computer Science at ECU strongly encourages each faculty member to visit with industry partners off-site to build a rapport that can lead to student internship and/or co-op opportunities. The impacts of face – to – face relationships are quite positive. An example of one such relationship is a partnership with Cisco Systems (Cisco) that began in 2011. Nurturing a close relationship with Cisco executives has led to many productive student internships, co-ops, and full-time hires. Some of the tangible benefits for students are:

- Practical and realistic application of information technology knowledge.
- Hands-on experience that is invaluable in confirming or redirecting a chosen field of study and career path.
- Visibility to hiring employers and expansion of their human network.
- Hands-on experience to equipment that they would normally never be able to access.
- Confidence building and learning to multi-task with school, job, and certifications.
- Performance motivator at school and learning the value of a high GPA early.

Cisco recruits approximately 12 co-ops and interns from the College of Technology and Computer Science at ECU each semester. To facilitate this, all students are invited to attend a 1½ hour information session. Students are eligible to be hired after their freshman year, and typically hired for six to eight month cycles and interns for a full year. Many of the co-ops and interns get an opportunity to stay for more than one cycle. The co-ops and interns are expected to work a 40 hour week, work towards industry certifications, and maintain a 3.0 GPA.

When many of these co-ops graduate, they have a degree and possibly an industry certification, plus valuable work experience which makes them more competitive at a professional level. Many times the co-ops will have job offers before they graduate. Employers benefit by retaining experienced and tested talent. The student and future employer benefit from the graduate entering the workforce with increased confidence, deeper job understanding, and higher productivity. Direct corporate feedback includes:

- “Students from ECU arrive with a high level of networking and IT knowledge. Some also arrive with industry recognized IT certifications that are encouraged through the school’s curriculum. The school has invested in their labs so as to provide students with practical hand-on experience using real equipment rather than simulators. When we receive co-ops to work in our lab positions, they ramp up quickly and are able to apply IT knowledge learned. Many of these students are able to perform at a higher and more complex level because they do not have to focus on learning the basics. This means that less time is spent training these students and leads to a faster return on investment.”

- “Upon completion of the co-op experience students returning to school are prepared for other opportunities such as lab or teacher assistants. The school directly benefits from the experiences of the returning students.”

Direct student feedback includes:

- “In my opinion, from a student perspective, I believe that the relationship with Cisco has provided an invaluable opportunity to me and my fellow classmates. I have had first class training with routers and switches while studying at the University and now almost at the end of my undergraduate program the relationship that the University has built with Cisco has opened up a door of opportunity for me to go work as a co-op and use some of what I have learned in a real world environment. What does this mean? It means I get to further my training with a company that many people in my field only dream of working for, and it is all because of the relationship that ECU has with Cisco. Thank you for providing my fellow classmates and me with these great opportunities.”
- “During my time at the University, I was able to work for the college and to participate in some special projects that were associated with local and regional employers. These programs allowed me to gather additional technical experience outside of the classroom and to network with other professionals. At graduation, during the "Great Recession", jobs were scarce. It was my University's and professor's relationship with working professionals that helped me land my first job. The same relationships helped me to land my second job, and eventually make it to Cisco, my ultimate technical destination job. Without the partnerships and specials projects that ECU has with industry, this would not have had been possible.”

Capstone projects

Capstone projects are an effective way for students to experience the real-world challenges facing business and they offer the additional benefits of enhancing a school’s reputation and attracting donors^[9]. Industry sponsored capstone projects are an integral part of our degree programs and provide excellent opportunities for students to apply the theoretical knowledge learned in courses while gaining experience working inside a corporate environment. Industry partners also benefit from these projects by becoming educational partners with the university, having a chance to “test out” potential new hires, and being able to complete projects at low cost^[10].

As an example, in the Information and Computer Technology (ICT) program, the capstone course is a two semester course that is offered to students during their senior year. In the first semester, students form their project team, identify their project, work with the client to solidify the project scope, and finally present their project proposal as a written report and oral presentation. In the following second semester the students create detailed project management plans, give weekly status presentations, execute the project, generate a media press release, and give a public presentation to close out the project. These capstone projects provide students with a unique opportunity to work on real-world consulting projects and to solve actual client problems. The outcome is positive for both the student, who gains practical experience applying

skills learning in the classroom, and the client, who benefits from real operations improvements. Table 5 documents the capstone history since 2008.

Table 5. Capstone Project Statistic from the ICT Program.

	# Students	# Teams	Type of Project	
			Industry	On-Campus
2008 - 2009	15	5	4	1
2009 - 2010	39	10	5	5
2010 - 2011	30	8	4	4
2011 - 2012	31	7	2	5
2012 - 2013	33	7	4	3
2013 - 2014	41	8	6	2
Total	189	45	25	20

Two example capstone projects conducted by ICT students are detailed below:

- Hoop Pole Creek Virtualization capstone project: The purpose of this project was to virtualize Hoop Pole Creek Nature Preserve located along the Crystal Coast of North Carolina. The project created a virtualized environment for Carteret County, NC with the intent to draw more tourism and make applying for grants easier. The goal was to create an environment that mirrors Hoop Pole Creek by using actual topographical map data. The three person team demonstrated changes over time through virtualization of the nature preserve.
- Boys & Girls Club of Pitt County capstone project: The main goal of this project was to update and document the network of the Boys and Girls Club. There were several needs that required the attention from the team of five information technology students. These included cable management, documentation of the existing network, adding remote access capabilities, centralized authentication, and separation of the network designed for the patrons from the executive branch located in the same building.

6. Conclusions

Leveraging industry partnerships to prepare job ready students is a critical component to meeting increasing demands on institutions of higher education to validate their role as educators. This paper discussed four primary methods to focus on education aspects of preparing students for post undergraduate employment.

First, industry outreach programs utilizing engineering and technology faculty members as consultants to industry help build a strong rapport with regional businesses, subsequently creating an effective network of potential employers for students. It is not enough to merely prepare students to enter the workforce, but universities need to strengthen their role as brokers between graduating students and companies looking for entry level talent. By growing links and connections to the regional industry base, outreach programs lead to opportunities for capstone projects, internships, co-op positions, and full time hires. As an added institutional advantage,

outreach provides potential for faculty income, research projects, scholarship funding, and direct donations to a university.

Second, the value of continuous feedback from industry advisory committees cannot be understated. The benefit of exploiting advisory boards lies in the involvement of external industry professionals that have a sense of value concepts and skills needed for students as they leave university. External involvements from industry professionals also properly help align curriculums and degree offerings to produce graduates with the most in-demand skill sets and knowledge.

Third, becoming job ready is also a personal responsibility for students, and development centers targeted at professional and technical development facilitate this. These types of university led centers maintain an environment where students can gain professional experience in the workplace through volunteer work, service learning course, guest speakers, leadership speakers, and focus networking events such as college level career fairs and/or industry discussion panels. These types of activities and events provide students excellent opportunities to learn directly from industry employers and begin a personal network for potential employment.

Finally, universities must embrace the need to link program plans with the need to create opportunities for students to gain valuable industry experience through internships, co-ops, and capstone projects with industry partners. It is well recognized that practical hands-on experience outside of the classroom has a positive impact on student success after graduation. Capstone projects are an effective way for students to experience the real-world challenges facing business while simultaneously enhancing a school's reputation. Building strong industry partnerships can lead to more opportunities for students, allowing graduates to enter the work force with confidence and through understanding the job requirements and the impact of company culture.

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