

Corporate Assessment of Strategic Issues in Technology Management

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Abstract: Through a discussion of both current literature and the results of a new study described here, this article contributes to an understanding of the gap that exists between what employers in technology-based industries expect of new hires and the skill sets those new hires actually possess. As the pace of technological change increases, current managers and new graduates must be comfortable with managing and interacting with new technologies and the people charged with their implementation. In the case of new graduates, current literature reveals that employers are particularly dissatisfied with their ability to communicate technical topics, which is vitally important for effective business operations. A study focused on recent hires, managers, and executives familiar with Bucknell University's Institute for Leadership in Technology and Management (ILTM, 2003) corroborated these findings as well as identifying other areas of concern. A manager in a technology-based industry can use this article both to develop strategies for coping with existing problems and to identify ways that corporations can actively become involved in the education process to help close the gap between expectations and reality.

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Today the workplace is dependent on technology for everything from day-to-day communications to the actual manufacturing of a product. In order to excel in their positions, managers must have a firm understanding of the interactions between technology and management, and how their interaction affects business decisions. Colleges and universities strive to prepare graduates for the demands of a technology-infused business world. There is often a gap, however, between the expectations of current managers and the skill sets of recent graduates. Evidence exists that engineering and management program graduates often do not possess the complementary business and technical understanding needed to be immediately successful in technology-based industries.

According to a survey of almost 200 senior engineering managers and leaders conducted by *The Engineers Leadership Foundation* and the *Foundation for Professional Practice*, engineering knowledge is essential, but leadership positions

can be attained earlier if engineering students are exposed to management, public speaking, and other non-engineering coursework. The most highly recommended courses beyond an engineering curriculum included business management, public speaking, and marketing. In addition to taking courses, the professionals surveyed suggested involvement in activities like sports, internships, volunteering, and clubs to improve interpersonal skills (The Engineers' Leadership Foundation and the Foundation for Professional Practice, 2004). The same can be said for management majors—a well-rounded education both inside and outside of the classroom is necessary to succeed in a technology-infused business world. Any career involves the life-long learning and application of not only technical skills and theoretical knowledge, but also “people skills”, written and oral communication skills, and teambuilding skills.

In recent years, institutions of higher learning have made changes in curricula and have developed a variety of specialized programs in order to achieve that goal. These educational opportunities can be classified into several categories: engineering management, systems engineering, engineering entrepreneurship, leadership, internship, and other multi-disciplinary programs. Most of these programs are designed to introduce engineers to the business world through courses, project teams, and interaction with business enterprises and business leaders. Most schools also offer minors or individual courses designed to introduce students of all majors to technology and its impact on business. Overall, schools try to offer a variety of courses and extracurricular activities that allow students to gain a well-rounded education. Emphasis has also been placed on group projects or in-class group work to prepare students to work effectively on teams. Bucknell University's Institute for Leadership in Technology and Management (ILTM) is an example of a program created for that purpose.

In order to assess the climate for new hires in a technology-dependent business world, a study was conducted of ILTM graduates working in industry and other middle managers and executives who could give insight into the demands for engineering and management graduates. Questions were specifically focused on the appropriateness of themes such as leadership, globalization, communication skills, and critical thinking in obtaining a job and advancing in industry. Middle managers and executives were asked to define and rate skills, thought processes, etc., that are necessary to participate in and succeed in business today. The results of the study, which includes both quantitative and qualitative questions, were compared to previously published rankings of desirable skills for graduates. A comparison of overall new hire performance to that of ILTM graduates was used to examine educational opportunities that position employees on the “fast track” to management positions.

Employer Expectations in Existing Literature

In the current economic climate, it is important for managers and new graduates to have an edge over their competition. According to the National Association of Colleges and Employers (NACE), until recently there was a slightly positive outlook on overall projections for hiring of new college graduates. NACE's annual *Job Outlook* is a forecast of the job market for new graduates based on a survey of the organization's employer members. The fall 2006 edition of the survey was based on responses from 256 members representing service sector employers, manufacturers, government, nonprofit, and other employers. Results of the survey predicted an overall increase of 14.5% in new hires for 2005-06 as compared to the previous year, with the largest increase in hiring forecasted in the service sector (21.6%). The positive outlook continued a 3-year trend, with almost 94% of employers rating the overall job market as good, very good, or excellent. At that time, just under 6% ranked the market as fair, as compared to previous years when over half of the employers rated the job market for new graduates as only fair. Despite the positive outlook, the market was still competitive since job offers did not equal the number of candidates. As to which majors were the most in demand, the list was consistent with previous years: engineering, business/accounting, and computer-related majors were targeted at the bachelor's degree level (NACE, 2005).

Considering the competitive job market, the obvious question is what potential employers are looking for in candidates. According to the NACE survey, desired characteristics of an ideal candidate have not varied greatly from year to year. Topping the list of important qualities and skills are verbal and written communication skills; honesty, interpersonal and teamwork skills; motivation/initiative and a strong work ethic; and analytical skills. Although GPA ranked near the bottom, employers indicated that it is commonly used to screen candidates. Employers also placed emphasis on the importance of prior work experience, citing internship and relevant work experience as the most important. For new graduates, internships or co-ops are the best source of relevant work experience. The areas in which new graduates were judged to be lacking overall were communication skills, maturity and work ethic, commitment to the organization, and business etiquette. Furthermore, many recent graduates tend to have an unrealistic view of the workplace (NACE, 2005).

Once in the workforce, it is necessary to keep a competitive edge in order to advance to managerial positions. In the current economy, being up-to-date with the rapid pace of technological developments is important for maintaining employment, but when it comes to promotions, additional considerations must be made. This dilemma is especially relevant to engineering industries, where there has been a trend of non-engineers landing the management positions that are best suited for qualified engineers. The strong technical background from engineering is important, but so are the management and leadership skills that employers look for (Price, 1998). When moving to a managerial position, engineers in particular have difficulty adjusting from objective technological decision-making to the more subjective decision-making required in business. Engineers are trained to solve technical problems by defining the problem and then applying straightforward technical principles to develop a solution. Managers must make decisions by evaluating the possible impacts of various choices, a process that requires experience rather than just theoretical knowledge. Succeeding

in business requires a different mindset than solving a technical problem (Moretti, 2002).

Employers look for managers who exhibit strong leadership skills in a project-team setting, including the ability to adapt to change and using effective interpersonal skills (Price, 1998). An essential part of any business is proper functioning of interdepartmental, multi-disciplinary teams in which communicating is key. The team must stay focused on their goals, and tasks must be delegated in a manner that allows team members to utilize their skill sets to achieve those goals. Managers especially spend time talking to people in their own department and in other departments; being able to clearly convey a message through both written and oral communication is a necessity (for any position). In addition, it is imperative to understand the technological capabilities related to a project and then be able to explain the feasibility of a project based on the technical limitations. A firm grasp of how technology relates to business decisions is essential for a successful project (Moretti, 2002).

Study Background

One particular example of an educational program focused on technology management is Bucknell University's ILTM, founded in 1991 with a structure and themes devised to meet the needs of industry. ILTM offers an intensive two-summer program for twenty students from either engineering, management, or accounting that combines theory and real-life experience. The first portion of the program is a six-week on-campus session during the summer following completion of their sophomore year. During this session students are introduced to issues such as globalization, ethics, communication skills, critical thinking, teamwork, and leadership through in-classroom case studies and discussions, field trips, and a group project. The second portion of the program is an off-campus, minimum 10-week, paid internship. The internship program was installed in response to companies' desires to hire graduates with actual exposure to industry practices. The experience gives students exposure to every day planning and problem-solving activities in the organization and puts them in contact with managerial staff in the organization (ILTM, 2003).

In 2003 and 2005, a study was conducted to obtain feedback from individuals in industry about the expectations for graduates and to learn what can be done to better prepare them for successful careers. The ILTM program was used as the focus for conversation; results apply generally. The assessment discussed in this article was achieved by separately contacting both former ILTM students and corporate leaders in the business community. The ILTM graduates not only provided positive feedback on the program's effectiveness in preparing them for the work world, but also offered suggestions for updating its themes and format. They also offered an interpretation of employers' expectations from the viewpoint of recent graduates. The corporate respondents represented the opinions of more senior members of the business community, and provided their insights into what is expected of managers in technology-dependent fields as well as an assessment of how well colleges and universities are preparing engineering and management graduates. The responses provide guidance for employers as well as for changes that can be made in higher education (and ILTM specifically) by both students and educators.

The ILTM graduates contacted represent both engineering and business-related majors who were employed in entry or

mid-level engineering or managerial positions in a variety of industries, for example, working as an associate in investment banking/business analysis, an associate at a law firm, or a senior level design engineer. A total of 11 relatively recent Bucknell graduates, representing graduating classes of 1995 through 2003 provided detailed responses. Fifteen responses were also received from middle management and senior executives, not necessarily Bucknell graduates, from various industries – including the Senior Vice President of Human Resources for a leading developer of information technologies, and the CIO for a division of a leading global financial services firm. Many of the corporate participants have experienced the evolution of the business world firsthand, having been in the workforce for 15 to 40 years. A majority of the companies represented have had some interaction with the ILTM program, through projects, lectures, field trips, or internships. Appendix A contains a descriptive table of the participant pool – the position, company description, and experience level of each respondent is provided.

Two sets of questions were developed—one for ILTM graduates and one for mid-level managers and senior executives. Questions were both quantitative and qualitative and were carefully formulated with the help of Bucknell faculty members and staff who were acquainted with both the corporate world and the ILTM program. Quantitative questions asked participants to rate their answers on a 10-point scale, although it was later determined that a 5-point scale may have been easier to assess and could be used in future assessments. Questions for ILTM graduates were specifically focused on the appropriateness of themes such as leadership, globalization, communication skills, and critical thinking, in obtaining a job and advancing in industry. Managers and executives were asked to define and rate skills, thought processes, etc., that are necessary to participate and succeed in business today. They were also given the opportunity to rate and comment on the general preparation of engineering and management graduates to enter the work force. The questions asked can be seen in Exhibit 1.

Results (Mid-Level Managers and Senior Executives)

The corporate respondents were generally pleased with the preparedness of new graduates to enter the workforce, but cited several areas in which current managerial training could be strengthened. When asked what employers expect of technology managers, the responses were consistent with the qualities and skills that ranked highest in the NACE survey. Problem-solving/critical thinking, communication/interpersonal skills, teamwork skills, and drive were all frequent responses. In addition, respondents stressed the importance of technical competence and decision-making. The founder of an internet-based financial organization described the concept of drive or passion as, “a willingness to do whatever it takes, whether that be doing a job that is outside of their area, lower than their skills level, or being flexible to move into a different role/project/initiative quickly.”

There was some distinction made between the majors, because the nature of jobs pursued by engineering and business majors differ. Executives from a global supplier of micro-electronics for the defense industry, which does not participate in very much “pure research”, stated interest in engineering managers “who can apply those [engineering] skills in a business environment, so some knowledge of business principles is important.” On the other hand, management majors are not expected to have a grasp of pure engineering knowledge, though they should be able to

Exhibit 1. Questions Asked

ILTM Study (Mid-Level Managers and Senior Executives)

1. What is your current job title?
2. Are there ILTM graduates who have worked or currently work for you? Please comment on their preparation for entering your company and their subsequent progress.
3. What do employers expect of today's engineering and management graduates (for both fields and for each field individually)? That is, what skills, concepts and thinking abilities are most valuable?
4. Further, what is expected of top graduates in those fields? What separates “fast-trackers” from everyone else?
5. On a scale of 1-10 (1 being not at all, 10 being perfectly), how well are colleges preparing engineering and management students to deal with real-world problems and to be successful in their careers?
6. In a program such as ILTM, what is the relative importance of special tools and skills (e.g., GIS), critical thinking, knowledge about specific industries, and practice with interpersonal skills? Please rank and provide explanations or additional comments.

ILTM Study (ILTM Graduates)

1. How would you describe your current position - Very Senior Executive, Senior Executive, Middle Level Manager, Entry Level? What are your main responsibilities?
 2. On a scale of 1-10 (1 being poor, 10 being excellent), how well has the program fulfilled for you the purpose that it was created for – to prepare students for a workplace that integrates business and engineering principles? Please explain.
 3. Which portion(s) of the program (lectures, projects, internship, etc.) did you find most beneficial and why?
 4. On a scale of 1-10 (1 being poor, 10 being excellent), how appropriate were the ILTM themes (leadership, ethics, management, technology, globalization, etc.) when you participated in the program? Should the same themes be emphasized today? Are there themes that should be added?
 5. On a scale of 1-10 (1 being not at all, 10 being very), how important was ILTM in helping you in finding a job after graduation? Has it helped you continue to advance (please rank again)? If so, how?
 6. What do employers expect of today's engineering and management graduates (i.e., what skills, concepts, and thinking abilities are most valuable)?
 7. Which skills, concepts, and ways of thinking associated with ILTM do you find most useful in your profession?
 8. Given your educational and professional experiences, how should ILTM evolve in future years?
 9. Have you been involved with ILTM since you graduated from Bucknell?
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“apply systems thinking and have the ability to think through and plan work with much the same rigor as an engineer would.”

In addressing an area of weakness, the CIO of Treasury and Security Services for a leading global financial services firm stated that recent graduates need to be better prepared to face real-life problems. That is, once a student leaves the university, he or she

“must know that they aren’t case studies anymore because once the presentation has been made, it isn’t over—either you make money or you lose it. Graduates must be prepared to plan, build, and operate.” In order to prepare for the realities of the work world, students must obtain practical experience either through internships and co-ops or through classroom interaction with experienced workers.

Building on the previous question, the corporate representatives were asked to describe what differentiates top graduates, and the general response was simply an overall stronger skill set than other graduates. More specifically, top candidates are able to work effectively on a team, are passionate about their projects, customers, etc., exhibit strong leadership and communication skills, and display above average competence in their field (i.e., strong GPA). The Manager of Campus Relations for a world-wide technology, manufacturing, and services conglomerate described top graduates as “passionately focused on driving customer success...they act in a boundary-less fashion, always search for and apply the best ideas regardless of their source.” Along the same lines, the University Relations Manager of a global supplier of micro-electronics for the defense industry views top graduates as those individuals “who will be self-motivated, have a passion for excellence and success, have the ability to successfully negotiate and interact with peers and management, and view difficult situations as challenges rather than obstacles.” In short, graduates on the fast track strive to go above and beyond what is required of their job.

Considering what employers expect of job candidates, are colleges and universities providing students with a well-rounded education in order to meet those expectations? The overall response was that today colleges are doing a good job (12 out of 14 respondents provided a numerical score, with an average ranking of 7, a high of 9, and a low of 6) of preparing students to enter the work force, but that there were still definite areas for improvement. For example, a Financial Accounting Manager for a major manufacturer and service provider for health care products described the deficiency as: “students need to be able to better relate what they learn in class to potential real world issues or challenges.” One respondent suggested that as a solution to that problem colleges should invite “street-side people in to talk to students about the voice of the customers” and give students the opportunity to learn from others’ experiences, not just from textbooks. Internships and co-ops, begun as early as possible, would be another source of real-world experience before graduation.

Colleges and universities have been trying in recent years to improve preparation, so respondents were asked to determine the most important concepts that programs like ILTM should focus on. Overall, critical thinking/decision-making and effective interpersonal skills were considered the most important concepts. It was also determined that knowledge of a particular industry and mastery of special tools and skills were important but could be acquired on the job. A successful program was described as one in which students are “learning critical thinking and specific skills by examining real-world business cases and issues, ideally in a manner that forces students to work together in groups, present their findings, work against deadlines, etc.” Many companies provide new hires with an intense training period which could be enhanced by focusing on the same principles. One way that the ILTM program incorporates these principles is individual and group case study work in both the classroom and corporate setting—the use of case studies is equally applicable to corporate training programs.

A few themes (teamwork, communication, systems thinking) showed up repeatedly as answers to questions, which can be attributed to their importance in obtaining and maintaining a job. As far as teamwork is concerned, the distinction must be made between simply working together and actually being a team. A team is not a group of individuals who work independently and then combine their solutions into a presentation, but rather individuals lending their own skills and points-of-view to defining a problem, developing a plan of action, and executing a solution. An appropriate definition of a team is “a distinguishable set of two or more individuals who interact dynamically, interdependently and adaptively to achieve specified, shared and valued objectives” (Park, 2004). Directly related to successful teamwork is effective verbal and written communication both between team members and between the team and interested parties. The necessity of effectively conveying one’s ideas was explained by the University Relations Manager of a major supplier for the defense industry: “So often, good ideas or good talent get lost or dismissed because of the inability of individuals to effectively communicate... If critical thinking helps create the good ideas, then superior interpersonal skills help to drive and sell those ideas to success.”

The third theme, which was not always named specifically, was systems thinking—the ability to integrate information from various sources and understand the impact of a decision on the whole system. In addressing critical thinking, one respondent stated that leaders must be able to “look at problems and challenges, objectively analyze facts, apply those facts in the context of the situation/company/industry, and consider the various impacts and potential outcomes of decisions...the ability to use critical thinking and a holistic approach, becomes the stage setter for all future success.” The decision-making process must involve looking at the problem from all sides—technical, financial, etc.

Results (ILTM Graduates)

Former participants in the ILTM program were asked questions similar to those asked of corporate respondents as well as questions more specific to ILTM. The intention of this was to gauge how well the program addressed employers’ needs and if participants felt more prepared for their career as a result of the program. The ILTM graduates, like the mid-level managers and senior executives, were asked to define the skills and abilities that employers expect of college graduates. These participants brought different perspectives than the more senior corporate respondents, having been members of the workforce for 1 to 10 years. Consistent with corporate responses and the NACE survey, initiative, drive or work ethic, and teaming skills were frequent responses. A display of genuine interest in the company/project (through asking questions, staying current on industry-related happenings, etc.) is a concept that was not included in the NACE survey but was mentioned by several respondents. Oral and written communication and critical thinking/problem-solving were also listed as important abilities, but not with as much frequency. The lower emphasis placed on these areas was surprising but may be due to the benefits graduates have obtained from recent changes in higher education and from participation in the ILTM program, opportunities that were not available to the senior corporate respondents during their college careers.

Recognizing what employers are looking for, respondents were then asked which ILTM-related concepts they found most useful in their professional careers. A variety of answers were given, but the most frequent were leadership in a large

project, ethics, the ability to “think outside the box” in solving a problem, and understanding the role of technology in decision-making. An interesting response was the importance of current event connections—an ’03 graduate highlighted the fact that participation in ILTM contributed to “feeling more informed about critical national and world issues than I have at any other point in my life” and that “the examination of these issues in conjunction with their relevance to program themes is invaluable.” The idea of “doing whatever it takes,” which was emphasized in the previous responses from more senior individuals, was also expressed by a 2003 graduate who said, “in ILTM I learned to go above and beyond the call of duty—when you think you are prepared, prepare more; when you think you have uncovered all of the information, dig deeper; when you have no more questions to ask, brainstorm some more.”

Although other questions addressed the respondents’ participation in the ILTM program, the suggestions made can be applied universally to engineering/management education. Participants were first asked to rate how well the program prepared them for a workplace that integrates business and engineering principles. The ratings from the 10 participants who provided a rank ranged from 7 to 10 with half of the respondents awarding a 9 or better (the average rating was 8.7). One participant declined to provide a rating, citing that their workplace did not integrate business and engineering principles. In support of their ratings, respondents explained that ILTM was a solid introduction to material they would not experience in their normal engineering or management curriculums and that the opportunities outside of the classroom (project management, internships) were very beneficial. Another question asked the ILTM graduates to rate the appropriateness of the ILTM themes (leadership, ethics, management, technology, globalization, etc.) and again the respondents gave a positive response (10 out of 11 provided numerical ranks)—all ratings were 7 or higher, and over half were 9 or higher with a mean of 8.8. Suggestions for improving the themes included stressing written communication more (“being able to summarize thoughts to a senior audience succinctly”) and focusing less on globalization specifically but more on ethics (as well as pressures placed on managers by regulatory commissions).

The ILTM program combines many different methods of education (including case studies, field trips, project work, team-based learning, mentoring, traditional lectures and discussions, etc.) (ILTM, 2003), and when asked which portions of the program were the most beneficial, every facet was mentioned at least once. Overall, the project/group presentation (which incorporates both team work and communication skills) and the lectures from outside speakers were deemed the most beneficial parts. A 2000 graduate described the group project as the “lynch pin” of the program, providing participants with “real-life experience on an actual business case in a restricted time period.” A 1995 graduate admitted that while the group work was the most frustrating part, it was the most beneficial in the long run because it “forced us to integrate the principles we were learning into a real life example.” Another ’95 graduate found the lectures most beneficial “because it struck a desire for continuous learning in business and leadership.” An interesting comment from a 1999 graduate was that although the lectures were most enjoyable at the time, looking back “the interaction with top caliber students from other disciplines forced me to expand my usual technical methodology of decision making” which has helped him throughout his career.

Another goal of the ILTM program is to provide students with the tools to find a job after graduation. When asked how important the program was in that aspect, the ratings from 10 out of the 11 interviewees ranged from 3 to 10; however, half of the respondents gave a rating of 10 and the mean response was 8. Favorable responses included that the internship led directly to full-time employment and that discussing ILTM experiences was beneficial in the interview process. One graduate who gave a low rating stated that ILTM “was not concerned with helping students obtain full-time jobs,” but also admitted to using another resource (the Career Development Center) rather than seeking help from ILTM. The other moderate rating (5) came from a 1999 graduate who stated that he was recruited mainly based on GPA, but that he used his business experiences from ILTM to obtain the position he wanted.

While ILTM graduates seemed pleased with their experiences in the program overall, as with any program there is room for improvement. A common recommendation, and one that is being considered by the ILTM coordinators and Bucknell administration, is to extend the learning experience of the six-week on-campus portion beyond the summer to the regular academic year through additional classes or a minor. In light of well-publicized corporate scandals, respondents suggested focusing more on ethics and integrity, which could be achieved through additional case studies. Other suggestions were made to include topics on organizing and conducting effective meetings and to incorporate more debate.

Those contacted drew on their experiences and expertise from working in technology-reliant industries to examine the skills and preparation needed to achieve managerial success in those industries. The ILTM graduates recognized the educational experiences that have allowed them to efficiently manage technology resources and coordinate with diverse staff and co-workers. The more experienced managers and executives reflected on the attributes that were needed for new hires to move quickly into management positions and for existing managers to transition into a technological world. Effective technology management begins with the interpersonal skills to communicate with a variety of staff, co-workers, and clients, but equally important are an appreciation for technology’s role in the business community and on-going education in new technological advances.

Our results suggest that recruiters and managers can expect new hires with technical proficiency in their chosen field but with limited experience in interdisciplinary environments. Programs like ILTM are valuable because they offer students the interdisciplinary interaction that is not encouraged in a typical curriculum. Furthermore, new hires may not be prepared to express their ideas in multiple forums—multi-disciplinary working groups, formal presentations, memos, face-to-face meetings, etc. Managers should seek new hires with academic or internship experiences that required various forms of communication. ILTM is successful in giving participants the tools and real-world experience needed to jumpstart a career in technology management because of its close ties to industry. Students benefit from personal interactions with managers and executives through the program’s classroom sessions, field trips, group projects, and internship experience. At the same time, corporate participants are actively shaping their potential hires—many ILTM graduates obtain internships and even full-time employment with supporting companies. Becoming involved with a college program such as ILTM is an excellent opportunity

for corporations to get a head start in recruiting the top graduates and being assured of their skills.

Conclusions

The purpose of this article is to provide information about the attributes and educational experiences of successful managers of technology driven businesses. The article presents personal reflections from managers and recent graduates on the skill sets and abilities that are most crucial for initial hiring and later career success. This study is valuable to engineering managers because it describes how institutions are preparing students and, as a result, indicates skill sets that can be anticipated and sought in recent graduates. Discussion of Bucknell University's ILTM program highlights a type of experience that successful new hires had during college. By considering why the program is so successful in meeting employer demands, managers can then identify schools offering similar programs and begin recruiting equally well-prepared graduates. Where recruiting already occurs, managers could conduct inquiries and communicate concerns to relevant parties. If graduates in fact lack instruction in key areas, schools could then be encouraged to make curriculum changes or offer new extra-curricular opportunities. This article should at the least stimulate personal reflection on the most important features to look for in new hires—personal skills, challenging college experiences, beneficial programs, etc.

The study effectively gave an impression of what employers are looking for and offered some insight into how both educators and students can better meet those expectations. Based on the results from both the NACE survey and the corporate responses discussed here, it appears that in general colleges and universities are preparing students quite well for demanding careers.

This positive opinion is due in large part to the trend in the education of engineering and management students of incorporating team projects and presentations (written reports, PowerPoint presentations, etc.) whenever possible, the goal being the combination of working in teams and developing better communication skills. The natures of the projects typically require some use of critical thinking and, of course, base knowledge from the students' majors. Employers deemed all of those principles important; however, there are not nearly as many opportunities as both employers and students would like for students to work in multi-disciplinary teams. These teams are important in appreciating the various factors (both technological and business considerations) affecting complex decisions. The responsibility for improved preparation is shared—educators must offer opportunities and students must take the initiative to pursue them. Beyond that, managers must make educators aware of their expectations and be willing to take an active role in teaching students. One of the greatest accomplishments of ILTM is putting students in contact with working managers and executives who

offer first-hand knowledge and experiences. The partnership between ILTM and corporations is mutually beneficial and is an example of how technology managers can help shape the next generation of their new employees.

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References

- The Engineers' Leadership Foundation and the Foundation for Professional Practice, "Jump-starting Your Career as a Professional Engineer," <http://www.asce.org/raisethebar> (Jan. 4, 2004).
- "ILTM," <http://www.students.bucknell.edu/projects/iltm> (Dec. 21, 2003).
- Moretti, Gabe, "Engineers Find Surprises as They Move into Management," *EDN*, 47:19 (2002), pp. 67-71.
- National Association of Colleges and Employers (NACE), "Job Outlook 2006" (2005).
- Park, Kyoung Shin, "Effects of Network Characteristics and Information Sharing on Human Performance in COVE," (1997) <http://www.evl.uic.edu/park/cove/> (Jan. 10, 2004).
- Price, Bradford S., "Managers and Leaders Needed All the Way to the Top," *Civil Engineering*, 68:8 (1998), p. 8.

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Appendix A

	Interviewee	Position	Company Description	Experience Level
Mid Level Managers and Senior Executives	1	Human Resources Business Partner/ Associate Manager	Major pharmaceutical firm	mid-career
	2	Financial Accounting Manager	Major manufacturer and service provider for health care products	10-20 years
	3	Manager of Campus Relations	World-wide technology, manufacturing, and services conglomerate	mid-career
	4	Sr. VP of Engineering and Research; ILTM Founder	United Parcel Service	40+ years , now retired
	5	CIO for Treasury and Security Services	Leading global financial services firm	mid-career
	6	University Relations Manager	Global supplier of micro-electronics for the defense industry	mid-career
	7	Founder and CEO	Internet-based financial organization	10-20 years
	8	Sr. VP of Human Resources	Leading developer of information technologies	20+ years
	9	Sr. VPs of Human Resources and Engineering	Global supplier of micro-electronics for the defense industry	N/A
	10	Human Resource Manager	Technology company focusing on communications, environmental, life sciences industries, etc.	mid-career
	11	Corporate Executive (Worldwide Franchise Controller) & college recruiter	Major manufacturer and service provider for health care products	30+ years, now retired
	12	VP Finance & Administration	New biotechnology company	Mid-career
	13	Chief Financial Officer	Investment, trust, and wealth advisory firm	10-20 years
	14	Vice President	International provider of engineering contractors	30+, now retired
	15	Retired COO, Board of Directors	Worldwide developer, manufacturer and marketer of medical devices	30+ years
ILTM Graduates	1	Entry level engineering, 6-month rotational program	Major pharmaceutical firm	recent graduate
	2	Third-year Associate	Law firm	5-10 years out of college
	3	Sales Marketing Manager	World-wide technology, manufacturing, and services conglomerate	5-10 years out of college
	4	Associate in Investment Banking/ Business Analyst	Leading global financial services firm	recent graduate
	5	Entry level	Internet-based financial organization	recent graduate
	6	Primary Middle Office Representative for Investment Advisor Trade Activity	Leading global financial services firm	recent graduate
	7	Entry level, Program management of integrating and testing projects	Leading systems integrator and information technology company	recent graduate
	8	Entry level, 2-year rotational program in Internal Consulting Services	Leading global financial services firm	recent graduate
	9	Program Engineer, ATV design	Design and manufacture of recreational transportation and accessories	recent graduate
	10	Fiduciary Account Officer	Leading global financial services firm	recent graduate
	11	Sr. Level Design Engineer, advanced individual contributor	Leading, worldwide medical products and services company	5-10 years out of college