AC 2009-1576: ROI: RETURN ON INVESTMENT AS A FACTOR IN DESIGNING GRADUATE RESEARCH PROJECTS FOR MUTUAL BENEFIT

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ROI: Return on Investment as a factor in designing graduate research projects for mutual benefit

Increasingly, flagship engineering/industrial technology departments are expanding their engagement with R&D (Research & Development) efforts that are of mutual benefit to local/regional industry as well as themselves. The benefits of such partnerships, often educational and economical, accrue to students, faculty and the industrial partners [1], [2]. Much of this work is done pursuant to graduate students' masters or doctoral theses/dissertations. The perspective advanced by this paper is to detail the shaping of such work that has resulted from Weekend Master's Program (WMP) in the College of Technology so that it is not solely of academic merit, but simultaneously also of direct value to the industry where the problematic situation arose. This M.S. in Technology degree program for off-campus professionals in an on-campus weekend plus distance education format began in the fall of 1998 [3].

"The WMP program was developed in response to industry demand for graduate distance education in technology that would meet the needs of full-time industry and business professionals" [3]. It is an accelerated degree program that allows professional to earn a M.S. degree in 22 months. Participants attend class sessions on the West Lafayette campus from Friday afternoon to Sunday afternoon for three weekends each semester. Students progress in a single cohort, and take seven credit hours of course work for four semesters and five credit hours for one summer session. In addition to the face-to-face contact during the on-campus sessions, instruction is delivered via distance technologies so that ongoing faculty contact is facilitated. Students typically spend an average of 20 to 25 hours per week completing out-of-class assignments [4]. Each student complete a directed project (very similar to an M.S. thesis but is more applied in nature) that typically address a technical, business, or operational problem within the student's workplace.

There are currently 4 cohorts of WMP running concurrently, and there have been 9 cohorts successfully completed since the beginning in 1998. Two of the cohorts currently meet in West Lafayette, and one is located in Columbus, Indiana. Another was specifically designed for Rolls Royce (RRMP) and is delivered on site at their location in Indianapolis (this is the second round for the Rolls Royce program). A typical cohort has 25 students and often has 2 or 3 students from the same company. There are a wide variety of manufacturing and service industries represented by students in the WMP, and corporations are provided assurance of protection of information that is of a propriety nature.

Specifically, this paper highlights the role of Return on Investment (ROI) as a shaping factor in the design of legitimate research projects for graduate students and also the paper will provide a set of suggestions which would enable other graduate programs to follow suit in implementing the process. An overview of the advisement process that results in Masters projects that involve a significant focus on ROI is shown in Figure 1.

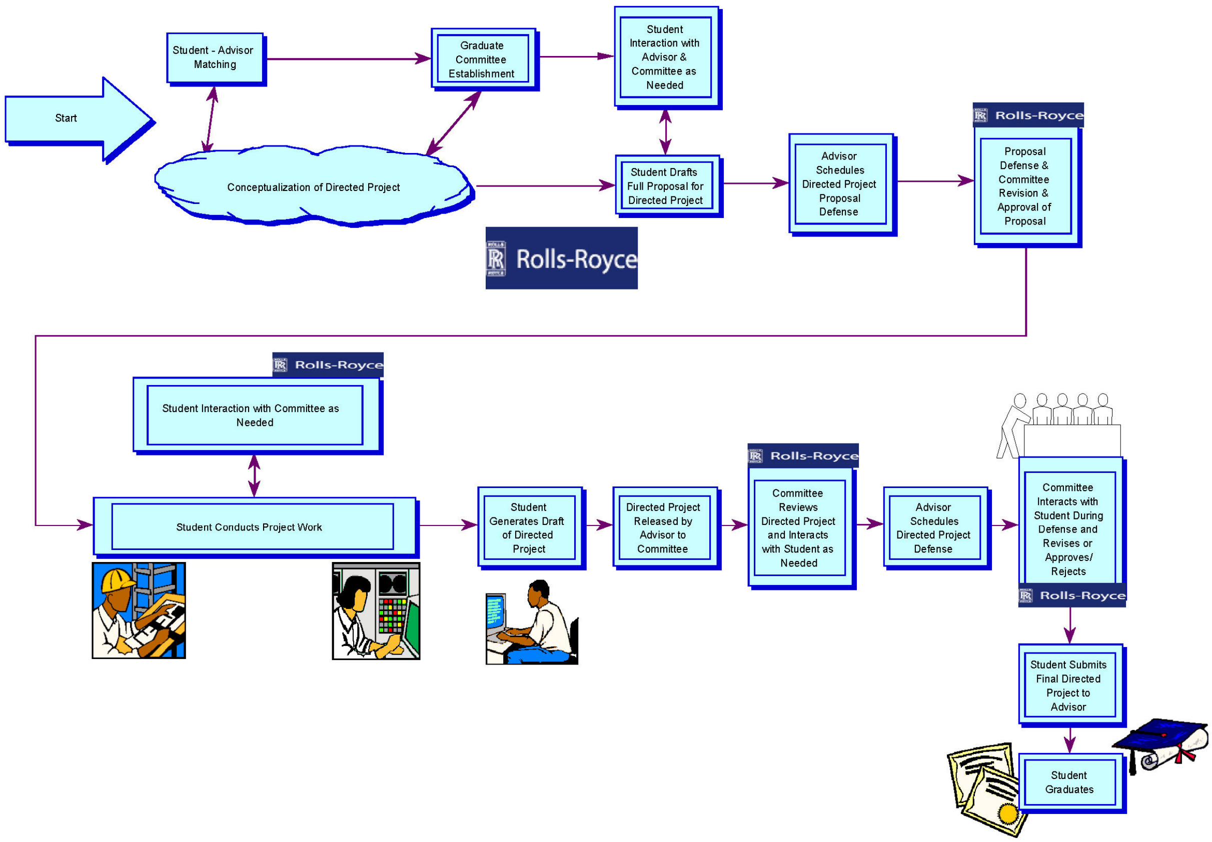

Figure 1: Advisement Process Resulting in ROI Focused Masters Projects

The process involved begins with the graduate student's identifying the locus of a problem in industry and subsequently with the establishment of the problem's consequences/significance in measurable terms that are meaningful to the industry concerned. Examples could include: personnel time, quality costs, materials usage, energy requirements, data burden and the like.

A necessary second step is to establish the theoretical foundations and knowledge gaps that form the context for the problem identified in the first step. Once steps one and two are reconciled, students will find it necessary to conceptualize a methodology for addressing the identified problem in a manner that is commensurate with their capabilities, interests, the program characteristics and the hosting industry's willingness and resources. At Purdue, we facilitate the first three steps by involving an appropriately credentialed manager from the hosting industry as a member of the student's graduate committee. It is this committee that guides the student through the entire graduate program and research project and that ultimately evaluates the project's quality and acceptability during a final defense/examination.

The steps required to reach an acceptable Masters project include:

1. Industrial problem identification and validation by the graduate student researcher and committee
2. Selection and certification of industrial committee members

3. Establishment and examples of ROI measures
4. Student and industry evaluations of the research experiences
5. Documentation of ROI for a series of industrial projects and the consequences thereof

Outcomes & Consequences

The chief outcome of the ROI focus has been the development of effective Masters graduates with the industrial ROI perspective well housed with the norms of academic research quality. The consequence of this has been our programs significantly enhanced marketability to industry and demonstratable growth. Figure 2 documents this.

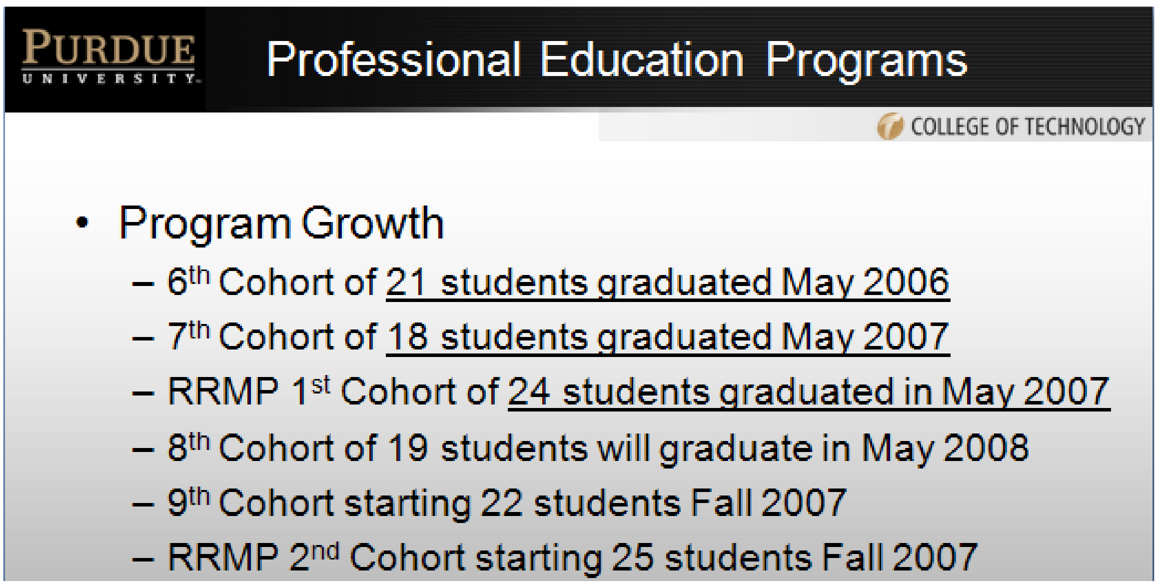

Figure 2: Program Growth

Even more to the point of this paper is the evidence documenting the experience of the companies that employ our program's graduates. Figure 3 highlights some of the monetary savings generated by the student projects and it clearly demonstrates that these are far from insignificant – even on a per student average basis.

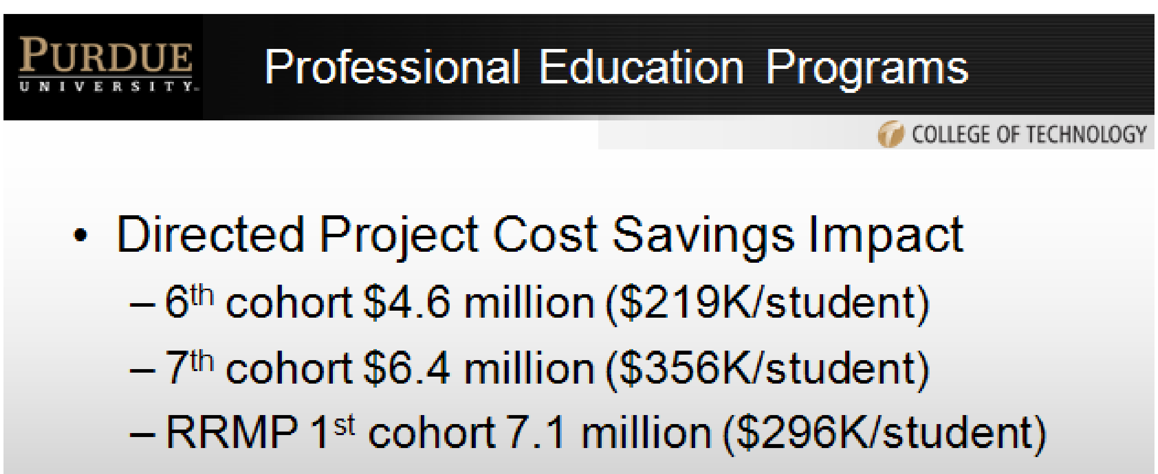

Figure 3: Dollar Consequences of Program Participation

Yet another consequence that must not be overlooked is that participation in such programs has a significant faculty development value to the professors involved. By frequent and consequent interaction with industrial personnel, often in industry settings, faculty are able to learn of emerging trends and technologies well in advance of those who do not participate.

The final consequence that needs to be shared is the impact that this focus has had on program enrollment. Figure 4 documents this clearly.

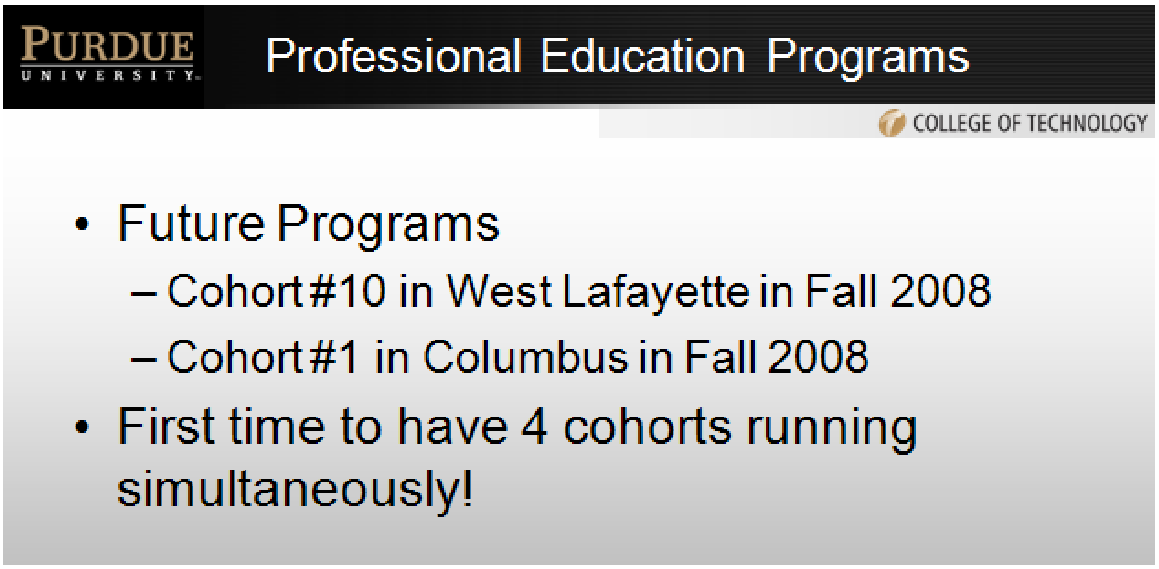

Figure 4: Program Enrollment Impact

Recommendations

There are many implications and recommendations that can be advanced pursuant to reflection on our faculty team's experience with the Weekend Masters Program at Purdue University – West Lafayette. Among the most important are the following:

1. The necessity for faculty who are committed to incorporating an industrial perspective into their courses and research project advisement.

2. The involvement of industrial managers and leadership in the advisement of masters research projects.

3. The necessity for beginning consideration of the research project right at the beginning of the masters program and not to leave this until the program coursework has been completed.

4. Provision of a detailed project report template (as provided in Attachment A) to guide student right from the beginning.

5. Strong encouragement to have industrial participants on student masters committees require dollar based ROI metrics as they guide the students towards their project proposals.

6. Significant commitment by the industries employing the students to active participation in the project and recognition of the university's timelines.

7. Include industrial and/or sponsor decision makers in the program planning right from the beginning. This is essential for such considerations as intellectual property, confidentiality and program content delineation.

8. Provide sufficient (more than anticipated) support to both faculty and students for using distance learning technologies.

9. Showing faculty the opportunities for converting such activity into tangible scholarship that affects their promotability and merit evaluations.

10. An absolute requirement for responsiveness of faculty, i.e., maintaining frequent contact, via any means available with their advisees in the program. Because of the nature of business, this clientele has far greater expectations and need for such responsiveness than does the typical university clientele.

1. Dobrowski, T. College-Industry Collaboration, 2006 ASEE Annual Conference Proceedings of the American Society for Engineering Education. (2006).

2. Exploring common ground: A report on business/academic partnership. Washington, D.C. American Association of State Colleges and Universities. (1987).

3. Newton, K. A., Sutton, J. J., and Dunlap, D. D., Instructional Delivery Rationale for an On and Off-Campus Graduate Education Program Using Distance Education Technology, 2000 ASEE Annual Conference Proceedings of the American Society for Engineering Education. (2000).

4. Accelerate your career: A five-semester weekend program of master of science degree in technology for professionals. West Lafayette, IN. Purdue University. (2007).

Attachment A: Recommended Directed Project Outline

Cover Page

Abstract

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References

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