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Enabling the U.S. Engineering Workforce to Perform: Developing Financial Sustainability to Ensure High-Quality in Professional Graduate Engineering Education

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Abstract

This is the third paper in the panel session of the National Collaborative Task Force for reform of professionally oriented engineering graduate education to make it more relevant to the needs of industry to ensure a strong U.S. engineering workforce for competitiveness. This paper addresses the need for new funding mechanisms to initiate, develop, and sustain high-quality professional graduate education both at comprehensive universities and at research universities across the nation. In today's economy of tight university budgets, it is unrealistic to think that universities can initiate and sustain high-quality professional graduate programs without external support. Whereas scientific research is the primary focus at many schools of engineering across the country, and is supported directly by federal funding, it is now evident that professional graduate education does not fit this model of funding. This paper begins the exploration of new funding schemes in collaboration with industry and government support to sustain the increasing momentum for the advancement of professional education in engineering practice and technology leadership for 21st century universities.

Funding Models for Education

The funding model for graduate education in public universities is usually different from funding model for undergraduate education. Most states usually reimburse public universities for each undergraduate student served through some formula, which can vary from discipline to discipline. For example it is more costly to educate students in fields of engineering and technology, medical science, and certain areas of physical and life sciences compared to some liberal arts fields. Also, in addition to the states support for undergraduate majors, universities charge students tuition and other fees to cover the costs of instructional delivery.

However, most of these same universities rely on a different funding model to support graduate education. Most public universities do not receive formula funding to support graduate education. Unlike undergraduate education, most public universities are not reimbursed for serving graduate students. In some fields of study, graduate students serve an instructional need for their respective fields of study. For example, in areas of liberal arts and science, some graduate students serve an important role as instructors in the undergraduate classroom or laboratory. This becomes a form of employment supported by the fee structure for undergraduate education. In some areas of science, engineering, and technology graduate students may serve a dual role as instructor and research assistant.

Primary funding to support graduate students in engineering, science, and technology usually comes from the sponsored research program activity of the faculty in their fields of study. The current source of funding for graduate education with a research focus is usually federal or private. This funding supports student salary stipends, tuition waivers, and other expenses associated with their educational objectives, which in most cases may have a strong research component. This funding model has steadily evolved as a response to a basic research model, which is at the core of the mission of major public research universities [1] (Boyer or other citation).

In the past few years, some states have recognized that funding of the research mission for research universities should be an important state priority. For example the state of Indiana provided a model for funding the research mission of Purdue University, just as they fund the undergraduate education mission of the institution. The formula will provide state funding as a percentage of new external funding beyond an established benchmark level established the 2003-04 budget. This new funding will be used to support improvements and maintenance of the research infrastructure [2]. While this model holds great promise in providing the necessary funding to support basic research in engineering, science and technology, appropriate funding to support high quality professional programs is still inadequate to meet the needs of business and industry.

However, funding models to support professional graduate education have not evolved in a manner necessary to support high quality educational experiences in engineering and technology. Some professional graduate programs rely primarily on tuition and fees from students, which are often paid by the company or business employing the student. These tuition and fees are usually not enough to support the focused research agenda, which benefits both student and company.

As we begin developing a dialogue for addressing he need for a different funding model for supporting advanced professional practice graduate education, an examination of current and potential future sources of funding may be useful in guiding a meaningful discussion. Appendix A provides a comparison of the different funding models for traditional research oriented and advanced professional practice graduate education [3].

Questions to Be Considered

One of the primary purposes of this paper is to present some background information on current conditions of funding models for graduate education. The traditional approach currently used to fund research graduate education has matured to a model that appears to be very similar between peer institutions. The competition for external funding of research, although competitive,

produces high quality basic research that is vital to future economic development in the United States.

However, there is a need for a different funding model for high quality professional graduate education. This will involve examining a different set of questions and discussions, which will hopefully produce a funding model, which will provide the necessary support for universities to adequately fund professional graduate education in engineering and technology. Appropriately funding professional graduate education will insure the development of entrepreneurs has not matured and developed to an acceptable stage. If we are going to educate and develop engineering and technology professionals who will move scientific discovery from the research laboratory to production and the market place, we will need a funding model to support this mission.

The development of a series of questions to guide this discussion regarding funding models and sources is essential. Some questions for considerations are as follows.

1. Should states include a funding model for professional graduate programs?
2. Should funding models for basic research also include applied or focused research?
3. What are the incentives for corporation to fund or support professional graduate programs?
4. Does the federal government view professional graduate education as an important catalyst for economic development?
5. How do we create an environment for professional graduate education programs and research based graduate programs to coexist and complement each other?
6. What type of leadership model will be needed to lead people to develop and implement a new funding model for advanced practice professional graduate programs?

References

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Appendix A

Financial Differences: Between Advanced Professional Education for Engineering Practice and Leadership of Technology Development And Graduate Education for Academic Scientific Research

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Traditional Research-Oriented Graduate Education For Basic and Directed (Applied) Scientific Research

Students
Resident students pursuing academic or industrial research careers.

Tuition
Primarily borne by universities and federal research grants.

Faculty
Research-oriented faculty who are pursuing academic scientific research and teaching careers.

Teaching at undergraduate and graduate research levels.

Funding
- Research Tuition
- Federal research grants
- State support
- Gifts and Endowments
- Faculty chairs

Advanced Professional Education For Creative Engineering Practice and Leadership of Technology Development

Students
Working professionals with an already established competence in industry.

Tuition
Primarily borne by industry and industry tuition reimbursement policies.

Faculty
Professional-oriented faculty who are pursuing creative engineering practice and teaching careers. Core plus adjunct faculty in industry.

Teaching at undergraduate and advanced professional engineering levels.

Funding
- Professional Tuition
- Federal educational support
- State support
- Industrial support
- Gifts and Endowments
- Faculty chairs