

ENGINEERING EDUCATION STANDARDS IN DEVELOPING COUNTRIES

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Abstract - Engineering education in developing countries has been greatly affected by economic turmoil in most of the developing countries in the last three decades. While some of these countries have limited natural resources, others have literally squandered their national wealth through governmental mismanagement. The result is that many sectors of the nations' economies were paralyzed creating a situation where prioritization of national needs become an art of poor vision rather than a process based on sound fundamental economic and social policies. Engineering education has been particularly affected because of the financial outlay and specialized manpower needed to successfully establish good engineering education programs in the universities. The lack of regional, political and economic stability has resulted in the universities losing many of their university lecturers and obsolete infrastructure for engineering education. Technological advances under the existing conditions are slow to trickle down to the engineering programs in these countries resulting in an unfavorable impact on standards of engineering education in developing countries. This paper examines the difficulties facing the universities as they strive to provide decent engineering education to the citizens while shaping the future and philosophy of the countries next generation of leaders to better advance the importance of engineering education to the growth and development of the countries.

Index Terms – development, financial outlay, governmental mismanagement, growth, national needs, specialized manpower, standards, technological advance.

INTRODUCTION

In the early stages of engineering education in developing countries, proper planning went into the building of the infrastructure, training of lecturers and provision of all necessary support facilities. There were hardly any budgetary constraints and all laboratories and workshops were provided and books and related teaching materials

were available. The curricula were properly designed and well executed. In fact, the curricula compared favorably with any other in the world, since most of them were designed with the assistance of experts from the best engineering programs in the world. The graduates of the engineering programs performed well and competed favorably with graduates of engineering programs from the developed countries. Indeed most of them entered graduate programs in Europe and the United States of America to obtain, in most cases, their doctoral degrees in several disciplines of engineering. Most of these doctoral students from developing countries returned home upon the completion of their studies to teach or practice engineering in their respective countries. This trend continued until late seventies and early eighties, when the economic and political instabilities in these countries started. Funds to the universities were drastically reduced and industrial unrests also plagued the universities. It was not long after this that the engineering programs began to feel the impact of the instability. Many engineering professors left the universities for the industry and others started migrating to the countries where they trained. The standard and quality of engineering education started to deteriorate. Books became scarce and expensive. Laboratory and workshop equipment were not properly maintained and broken equipment could not be replaced. Engineering education in developing countries was therefore greatly affected by political and economic turmoil, in most of the developing countries in the last three decades. While some of these countries have limited natural resources, others have literally squandered their national wealth through governmental mismanagement. The result is that many sectors of the nations' economies were paralyzed creating a situation where prioritization of national needs become an art of poor vision rather than a process based on sound fundamental economic and social policies. Engineering education has been particularly affected because of the financial outlay and specialized manpower needed to successfully establish good engineering education programs in the universities. The lack of regional, political and economic stability has resulted in the collapse of the educational system. Technological advances under the

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existing conditions are slow to trickle down to the engineering programs in these countries resulting in an unfavorable impact on standards of engineering education. This paper examines the difficulties facing the universities as they strive to provide decent engineering education to the citizens while shaping the future and philosophy of the countries next generation of engineering leaders to better advance the importance of engineering education to the growth and development of the countries

CHALLENGES

The challenges to meeting high standards of engineering education in developing countries are many. The key challenges are instability on college campuses, aging infrastructure and funding, faculty development, and curriculum development.

Instability on College Campuses

Many college campuses in the developing countries have become quite unstable due to students and lecturers' strike actions. In some cases, these have led to the closure of the universities for several weeks. This results in loss of many lecture hours in an academic year, making it impossible to maintain the quality of education. It is important that other non disruptive avenues be found for students and lecturers to express their grievances without the disruption of classes on such a large scale. Although this problem affects the whole university, engineering education receives quite a negative impact from these activities. Valuable lecture hours, workshops and laboratory work are lost. This is primarily responsible for the falling of standards in engineering education. This has reached such a proportion that employers have resorted to retraining the engineering graduates upon employment.

Aging Infrastructure and Funding

Owing to the political and economic instability, funding for education has become a real issue in the developing countries. Literally 100% of the funds come from the governments and their instability translates to a direct drop in the level of funds that go to education. It should be noted that while the United Nations recommends that developing countries should contribute up to 26% of their Gross Domestic Product (GDP) to education, most of the developing countries (Ghana, South Africa, Malawi, Rwanda and Nigeria) contribute between five to seven per cent and some as low as 0.7% to education [3, 5]. The developing countries will do well to learn a lesson from the Asian countries. It is a well known fact that the technological break through in that part of the world is a product of a huge investment in human capital. It is important for the developing countries to see the need for higher investment in human capital development. The need

is more so for the university system that has fallen into several years of neglect and under funding. Some of these countries are looking at and taking World Bank loans to revamp their university system. The loans among other things are meant to upgrade facilities, teaching and learning in the universities [4]. They will also support a more rapid development of computerized networking (Internet) systems within and among university campuses [7]. An area of university education being addressed is the autonomy of the university system. In Nigeria, a university autonomy bill has just been passed this year [6]. Among other things, the bill gives power to the Governing Councils to be in control of the administration of the universities. One aspect of the bill that may particularly yield extra funds for the universities is that they can now embark on a new level of fund raising to generate additional revenue to supplement government subsidy. It has been stated that poor funding and financial crises shall continue to plague the universities unless they now diversify their economic base by adopting fund raising techniques and relationship building with individuals, corporations and business organizations that share the values and vision of university education [8].

The result of decades of neglect is that infrastructure in most engineering programs in developing countries are old and obsolete and urgent steps must be taken to arrest the situation. Some of these steps are stated above.

Faculty Development

Faculty development plans for engineering faculty members in developing countries are not comprehensive and research facilities are hardly available. Faculty members are therefore handicapped in their teaching and in their upward mobility in their careers in terms of promotion. This creates a situation where lecturers are frustrated and therefore lured into leaving to take up appointment in the more lucrative and challenging engineering industry. The policy of "publish or perish" in this kind of environment is very detrimental to proper staffing of engineering programs in the developing countries. Most of the engineering programs are relatively young and they need nurturing to make them strong and productive. However, the dedicated lecturers needed to plan, design and grow these programs may not have much time for research. This has resulted in a situation in which the dedicated lecturers needed are hard to find. Funds for faculty development must be set aside to ensure that lecturers have adequate funds to attend seminars, workshops, and conferences on a regular basis. The enabling environment for research must also be provided by ensuring the availability of research facilities and research grants.

Curriculum Development

Engineering education curriculum like any other curriculum needs regular review and one way to do this is to provide teaching enhancement grants to lecturers to encourage them to review and update course contents and continue to search for better ways of teaching the courses. The curriculum must be dynamic and made to respond to national and regional needs. Feedback from graduates, the engineering community, corporations, employers and all stakeholders in engineering education must be processed and all positive and beneficial feedback must be used to improve the courses in particular and the engineering curriculum in general.

STANDARDS

It is an accepted norm that universities are built on high standards that are common to all parts of the world. However, for many developing countries, engineering education standards have fallen drastically. Nigeria's universities, once some of the African continent's best institutions, for example, have been impoverished over the last two decades, as a result of the inadequate use of allocations and priorities. When it began, Nigerian higher education seemed to have a bright future. After independence, the university system expanded in an orderly way. Initially, many instructors were British, only a small number of top students could attend college, and standards were high. This situation all changed with prolonged deterioration of funding and infrastructure. This is not unique to Nigeria. It does, however, illustrate the cost to human capital that falling standards can create in a developing economy. Adequate funding both from the governments and the industry must be made available to fund engineering education so that the damage done by the years of neglect and low priority placed on education can be corrected.

A possible approach to resolving some of these issues rests on virtual education where the key infrastructure component would be to connect these universities to the virtual world. The ability of these countries' leadership to articulate and respond to the needs of the 21st century workforce will not only strengthen their economic bases, but it will also influence political and economic stability within these countries. There is a critical need therefore to examine the way engineering educational standards can be raised through linkages with external agencies.

CONCLUSION

Engineering education in developing countries faces several challenges. The overall effect of these challenges caused by political and economic instabilities is to create an environment lacking funds, the necessary infrastructure, books, computers, dedicated lecturers and support from the public and all these factors contribute to falling standards in engineering education. The governments of these countries must give education the priority it deserves by abiding by the United Nations recommendation of contributing 26% of the Gross Domestic Product to education. What this will do is to first provide enough funds to the universities to recover from several years of neglect. Once this recovery is complete then the universities can now chart a new path of excellence in the 21st century by taking advantage of modern technology to enhance their performance. This will directly affect engineering education standards. With adequate funding and availability of adequate infrastructure and support systems, engineering education will be positioned strategically to maintain high standards once more.

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