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Issues relating to the profile of quality engineering research at the University of Technology, Jamaica (UTech)

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ABSTRACT: In this article, the authors discuss the essential issues of quality engineering research at the University of Technology, Jamaica (UTech), Kingston, Jamaica, especially with regard to the issues of industry/academia links. Issues concerning engineering practice and education are put in their proper socio-political perspective. Matters covering engineering practice and education, which are typical of many small developing island states in the context of presently powerful paradigms of globalisation, such as the Bologna process and the UK's Research Assessment Exercise (RAE 2008), as well as the free market economy, are highlighted in the article. How can quality engineering research acquire its proper ideological identity? Indeed, how can it internationalise within itself the issue of appropriateness and other socio-cultural concerns? What should be the pragmatic and ideological future of quality engineering research, especially for a small developing island state like Jamaica? These are the types of questions for which answers are suggested.

INTRODUCTION

In this article, the authors investigate the essential issues of quality engineering research at the University of Technology, Jamaica (UTech), Kingston, Jamaica, within the context of globalisation as it relates to a country starved of research financing and with regard to industry/academia links. One aim of this article is to place the issues of quality engineering research at the UTech in its proper economic-political perspective and to highlight strategies in *walking between the raindrops* from global and national perspectives.

Kick-starting quality engineering research in a new university, such as the UTech (university status was accorded in 1995), with reference to delineating and studying the forces that influence and affect engineering practice and education, is far more complex for a country such as Jamaica. This is particularly so when compared to advanced economies, like the UK where grants for general research allocated to universities topped £1,251 million, with one university, namely the University College London, accounting for £93m of this total [1]. In addition to the financial challenges of cultivating quality engineering research, highly competitive and reciprocal mobility of engineers exists for the first time as per the Washington Accord and the Bologna Declaration [2][3].

Research is a central element of UTech's core business. The extent to which the UTech is engaged in quality engineering research has a role in determining the status and quality of its engineering programmes, as well as the contribution that it makes to economic and social development.

Therefore, the main issues/challenges are as follows:

- Industry/academic links:
  - Poor institutional infrastructure;
  - Limited scale and critical mass;
  - Staff without the necessary prerequisites;
  - No traditional resources for research.
- Engineering practice and education:
  - New disciplines without research traditions;
  - Poor inter-linkages within the engineering profession from a socio-political perspective are critical to the discussion with a view of the appropriate initiatives taken at the UTech in fostering quality engineering research.

SUGGESTIONS FOR A QUALITY ENGINEERING RESEARCH PROFILE

Three general headings are being discussed by the UK's Research Assessment Exercise (RAE 2008) engineering panels [4]. They provide an insight into the overall quality engineering profile. This is depicted in Figure 1, which illustrates how research outputs, the research environment and esteem are the focus points.

Some current thoughts on the relevant criteria are listed below that, in many instances, are less prescriptive than hereto and follow a similar pattern to the Accreditation Board for Engineering and Technology (ABET) 2000 Criteria [5]. Thus, it serves to create a focus on the methodology of assessment.

Research Outputs

With regard to research outputs (50%):

- Normally four research outputs/person;

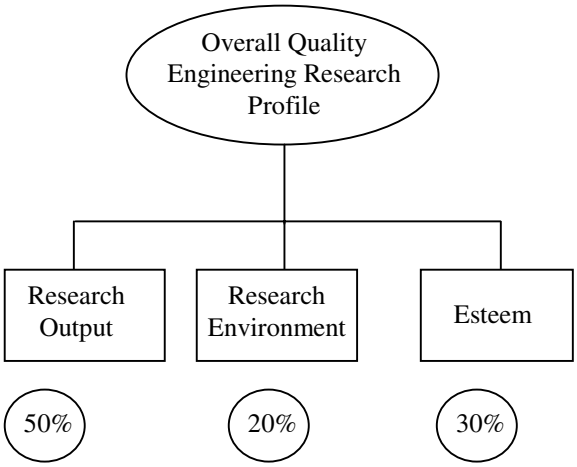

Figure 1: The quality engineering research profile.

- This figure is less for those new to academia, either at the start of their careers or recruited from industry, or for those who have had career breaks;
- Outputs should cover published papers; conference contributions; technical reports; patents awarded; evidence of new processes, materials, new devices/software; books/chapters, etc;
- Outputs should be assessed through excellence in the following key areas:

    - Originality, significance/impact and rigour;
    - All types of research (applied, interdisciplinary, practice-based) are given equal weighting.

- Staff are encouraged to explain concisely (up to 100 words) why particular research outputs have been selected and their significance or impact, for example:

    - Independent recognition concerning the quality of output, eg prizes awarded;
    - Significance of output, eg the impact on industrial processes or practices, or on other research;
    - Inclusion of evidence to support the reasons given, eg details of contacts in industry who have benefited from work, new research areas opened up, etc (subject to so-called *dipstick testing*).

Research Environment

With regard to the research environment (20%):

- Research student quantitative data;

    - Number of students;
    - Particularly interested in completed degrees;
    - Profile based on overall numbers and distribution across assessment.

- Textual information:

    - The institution's vision, strategy and, where relevant, updates on research plans;
    - Mechanisms and practice for promoting research and sustaining research culture;
    - The nature and quality of the research infrastructure;
    - Arrangements, if applicable, for supporting inter-disciplinary and collaborative research;
    - Arrangements, if applicable, for the commercialisation of research ideas, support for technology transfer and for interactions with end-users;
    - Approaches to developing and supporting staff.

Esteem

With regard to esteem (30%):

- Research grant quantitative data:

    - All external funding for research is to be considered equally;
    - Profile based on ranked order of value/full-time equivalent (FTE) and distribution across assessment.

- Textual information of esteem indicators:

    - Information includes plenary addresses, prizes, patents awarded, honours and awards, editorships, learned society engagements, prestigious fellowships, consultancies, long-term collaborations, leadership of consortia, considerations of the context of the career stage of the individual;
    - Exemplars of the following:

        * Interdisciplinary or multidisciplinary research;
        * National or international collaborations;
        * Commercialisation activity.

    - Distribution across submissions.

The general ingredients under these general headings that are being considered are not beyond the UTech's scope for *best fit*. What is important is that the rigour in methodology should be emphasised, rather than the application. Methodology can be international, applications are often local, and so deemed not to create a level playing field for universities such as the UTech.

PIVOTAL INDUSTRY/ACADEMIA LINKS DEVELOPED THROUGH THE TRANSFORMATION FROM NON-UNIVERSITY STATUS TO UNIVERSITY STATUS

From a historical standpoint, the UTech has evolved from its original non-university status. The Institution was established in 1958 and went through a few name changes to become the College of Arts, Science and Technology (CAST). The levels of engineering programmes offerings were certificate and diploma, which were based upon those prepared and examined by UK examining bodies, such as the City and Guilds of London Institute (CGLI) and the Union of Lancashire and Chestshire Institutes (ULCI). The CAST scheme was revised in 1986 to give degree-granting status to the Institution via the College of Arts Science and Technology Scheme (Approval Order) of March 1986.

The University of Technology, Jamaica Act (1999) was promulgated on 29 June 1999 and took effect retroactively to 1 September 1995.

During this period, the only engineering education/training at the higher educational level in Jamaica was offered at the College of Arts Science and Technology (CAST), now the University of Technology, Jamaica (UTech).

Development of Industries in Jamaica

Under non-university status, the institution positioned itself to interface with the socio-political perspectives of the time, stressing its bias for the production of professional and technical men and women, with limited interdisciplinary and problem-oriented thinking. In contrast, the UTech now offers, inter-alia, advanced postgraduate study in engineering research. During the Institution's transformation period (1958-2005), Jamaica underwent a process of industrialisation with the introduction of new industries. The Institution participated in this process by training numerous professional and technical personnel.

The industries established were mainly as branches of parent manufacturing companies and remained dependent on hegemonic centres for new knowledge or improvements in the method of production, without making any demand for the knowledge developed locally.

Industrial Cells

In the year 2000, the School of Engineering at the University of Technology, Jamaica (UTech) designed and implemented a programme called *industrial cells* in order to create a more symbiotic strengthening for the new research paradigm under the industrial/academic linkages that had been realised over several years [6]. The programmes that have been undertaken have been very successful and are described in more detail below.

After several years of research at the UTech, in collaboration with the Sugar Industry Research Institute (SIRI), a new method of roughening sugar mill roller shells was developed to cope with the harsh tribological environment experienced by milling operations. The sugar industry stands to save millions of dollars from the results of this research. It should be noted that the Sugar Industry Research Institute (SIRI) and the UTech financed the research project.

The second case involves the national electric utility, the Jamaica Public Service Company (JPSCo), where, over the last two years (2003-2005), it has kick-started a number of research groups through funding to the extent of nine million dollars. One notable research topic in this regard is: the development of an Artificial Intelligence system to aid the economic dispatch of generating units, in Jamaica Power Plant (qualification level: Master of Philosophy).

The UTech and the Jamaica Public Service Company (JPSCo), have established an agreement for the continuation of this project, based upon a measured quality research profile similar to the one being discussed by the RAE 2008 [4].

RESEARCH FUNDING

Apart from the research funding strategic for industrial/academic links, very little financial support has been received from the Jamaican Government. The key question here is the extent to which the funding gap can be bridged. This can be addressed by way of collaboration with cross-border universities for the use of their equipment and laboratories, thereby attracting international funding via competitive research grants with other collaborating universities.

This type of paternalistic relationship carries its own challenges. Nonetheless, given the socio-political and economic landscape outlined in the introduction of this article, this strategic positioning is one way to enhance the quality of engineering research at the UTech.

Task Force on Educational Reform

The Task Force on Educational Reform Jamaica, a Transformational Education System 2004, chaired by the first author of this article, recognised that funding is one of the major forces for the development of research. This was recommended in its proposal under the heading of Governance and Management for a Tertiary Education and Research Commission [7]. It is hoped that this recommendation can be adapted for the engineering research programme at the UTech, so that it will be one of the main beneficiaries.

CONCLUSIONS

In advanced economies, industry plays a key roll in all phases of scientific research and in the production of technological innovation. This is carried out either by industry itself or in close relationship with universities, the latter being based on a complementary action that, in many cases, has been going on fruitfully for several decades.

On the other hand, there has traditionally been rather little interaction, or weak research relationships, between the University and local industry at the University of Technology, Jamaica (UTech). This is despite a great deal of research undertaken and the best intellectual resources concentrated in the University.

It should be recognised that some efforts are being made at the UTech to position quality engineering research output, particularly over the last few years, in order to establish better mechanisms to close this gap and to make a symbiotic relationship between the UTech and industry a reality. Nevertheless, these efforts are taking place at a slow pace and, in several cases, are still not strong enough to overcome the numerous issues involved as outlined in the introduction above. Important changes still have to be made in order to establish a real and healthy university-industry relationship.

Attitudinal, traditional and cultural factors that appear constantly in the road will have to be surmounted in order to facilitate this new vision. Furthermore, new successful examples of university-industry linkages will have to appear among in Jamaica, in order to convince leaders from both sides of the desirability and importance of this symbiosis.

In any event, it must be kept in mind that the real reason and, indeed, the final goal that can lead the UTech to building strong bridges between academia and the productive sector, is to strengthen the mechanisms available to societies so as to improve the standard of living and the welfare of all the inhabitants of the countries involved.

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