Impact of engineering research at the University of Technology, Jamaica on sustainable development in a small island state

Gossett D. Oliver

University of Technology, Jamaica
Kingston, Jamaica

ABSTRACT: The traditional way in which universities worldwide measure and assess research does not usually go beyond counting the number of publications and the money received by way of research, grants and patents. This article suggests a model, the Research Impact Assessment (RIA), as being more suitable for universities in small developing island states such as Jamaica. Furthermore, embedded in the model is an *Engineering Infrastructure for Sustainable Development*. The model is based upon measuring the *impact* as a primary research quality measure. Two case study trials in engineering research are given, which demonstrate how the RIA can be achieved.

INTRODUCTION

The University of Technology, Jamaica (UTech), is at a crucial point in its history where it aims to contribute to national growth and development by soliciting answers to some of the societal problems facing the nation, through graduate studies and applied research.

In April 2007, the University established the *virtual* School of Graduate Studies, Research and Entrepreneurship (SGSRE) to replace the Office of Research and Graduate Studies (ORGS). SGSRE's role is to ensure that graduate programmes are of an excellent standard. In addition, SGSRE aims to provide support in research publication and is one of the University's income-generating centres.

For benchmarking purposes, the University of Technology, Jamaica, carried out a situational analysis exercise on how universities in the United Kingdom, Canada and the United States of America assessed their research activities. It was found that in most cases, the traditional assessment of research did not extend beyond publications, citations and the amount of grant funding secured for research projects. As an example, the Research Assessment Exercise (RAE) 2008 in the United Kingdom used a four point quality scale, and returned a profile, rather than a single aggregate quality score for each unit. The quality levels – based on assessment of research outputs, research environment and indicators of esteem – are defined in Table 1.

Table 1: The quality levels based on assessment of research outputs, research environment and indicators of esteem.

Rating	Description
4*	Quality that is world-leading in terms of originality, significance and rigour.
3*	Quality that is internationally excellent in terms of originality, significance and rigour but which nonetheless falls short of the highest standards of excellence.
2*	Quality that is recognised internationally in terms of originality, significance and rigour.
1*	Quality that is recognised nationally in terms of originality, significance and rigour.
Unclassified	Quality that falls below the standard of nationally recognised work. Or work which does not meet the published definition of research for the purposes of this assessment.

The RAE has not been without its critics. In the view of the University and College Union, the RAE has had a disastrous impact on the UK higher education system, leading to the closure of departments with strong research profiles and healthy student recruitment [1]. It has been responsible for job losses, discriminatory practices, widespread demoralisation of staff, the narrowing of research opportunities through the over-concentration of funding and the undermining of the relationship between teaching and research.

The official *Review of Research Assessment*, the *2003 Roberts Report* commissioned by the UK funding bodies, recommended changes to research assessment, partly in response to such criticisms [2].

The House of Commons' Science and Technology Select Committee, considered the Roberts report, and took a more optimistic view, asserting that *…the RAE had had positive effects: it had stimulated universities into managing their research and had ensured that funds were targeted at areas of research excellence*. It concluded that *there had been a marked improvement in universities' research performance* [3]. Nevertheless, it is argued that the RAE in its present form had had its day, and proposed a reformed RAE, largely based on Roberts' recommendations.

The proposed UTech model – RIA – differs from most internationally developed economies' research assessment methods, by considering primarily, research impact. The inclusion of the more conventional quality measures are also added features, but have not been given prominence in the model. The model purports to increase the importance placed on national development priorities of small island developing states such as Jamaica.

The model has been crafted around the validation of research impact on economic, commercial, social, cultural, environmental and sustainability indicators.

DEFINITION OF RESEARCH AND IMPACT ASSESSMENT

RIA
A + B + C = RIA

Where C > than A + B in weighting

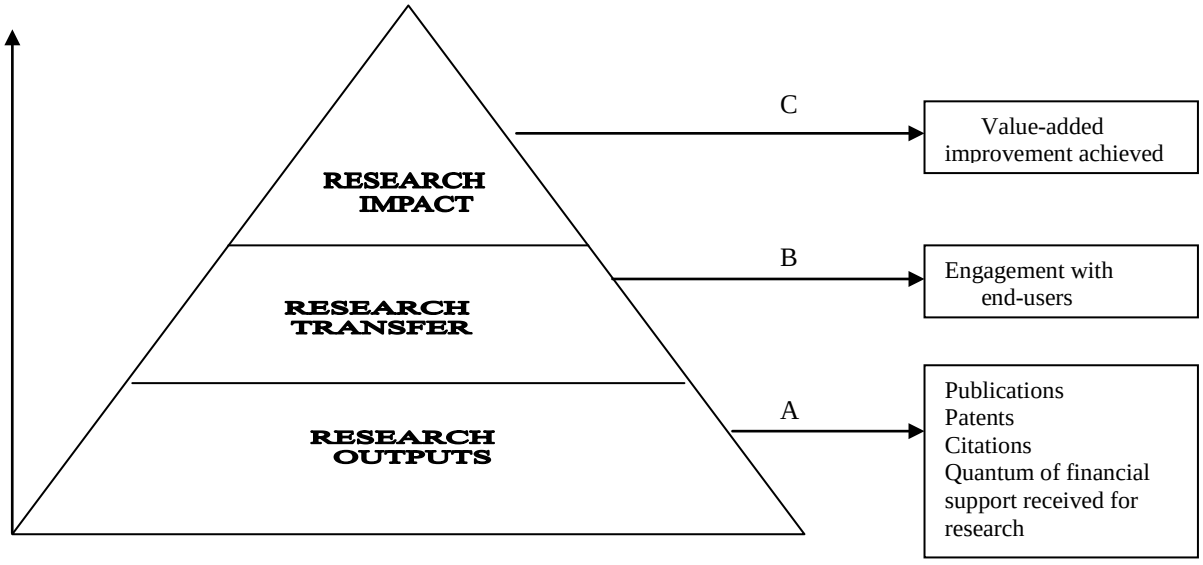

Figure 1: Hierarchical triangular Research Impact Assessment (RIA).

UTECH'S APPLIED RESEARCH FOCUS

The University of Technology, Jamaica, has an applied research focus and has developed a policy for programme offering, leading to higher degrees by research. Critical to this policy is the programme philosophy that states, in part, that it is expected that the majority of the students pursuing research degrees should be sponsored by an end-user of the likely outcome of the project.

In this regard, the University was particularly keen to explore methods for the assessment of research impact, appropriate to this focus. An objective was to develop and test a robust and efficient mechanism for the RIA, which was informed by relevant national and international approaches.

In the trial, the engineering tribological group was asked to include impact in the contextualisation of their research projects, two case study examples of RIA that were selected. The impact indicators used were based upon the negotiated research project agreements between the end-users and the researchers. The verification of the impact assessment was carried out solely by the end-users, who funded the research project.

MEASURING RESEARCH IMPACT

The Research Impact Assessment (RIA) model employed a scale designed to benefit the end-user, which is embedded in the research contract between the researchers and the end-users. The scale infuses impact types – economic and social, rather than placed on an impact process continuum. Table 2 gives some indicative examples.

Table 2: Research Impact Types (RIT*) and Research Impact Ratings (RIR**).

	Research Impact Types	Research Impact Ratings
a	Reduced risk	A
b	Increased productivity	A-
c	Improved process efficiency and profitability	B+
d	Increased employment	B
e	Improved health and/or well-being	B-
f	Reduced waste	C+
g	Reduced consumption of natural resources	C
h	Increased import substitution	C-

* RITs are typically agreed upon before the research contract is signed between researchers and end-users.

**RIRs are assessed by the end-user using Table 3 - Designated Research Impact Rating and Research Impact Point (RIP) - for guidance. Percentages are used to facilitate the stakeholders (researchers and end-users) in assessing the assignments but are not used to express the final Research Impact Point Average (RIPA).

The designated Research Impact Ratings (RIR) are as indicated in Table 3.

Table 3: Designated Research Impact Ratings (RIR).

RIR	Percentage Scale	Research Impact Point
A	90-100	4.0
A-	80-89	3.7
B+	75-79	3.5
B	70-74	3.0
B-	65-69	2.7
C+	60-64	2.5
C	55-59	2.0
C-	50-54	1.7
D	45-49	1.5
F	Below 45	0

The quantitative assessment of the Research Impact Point Average (RIPA) is carried out as shown in Table 4.

Table 4: Quantitative assessment of Research Impact Point Average (RIPA).

RIT	a	b	c	d	e	f	g	h	TOTAL
Credits	3	3	3	3	3	3	3	3	24
RIR	A	A-	B+	B	B-	C+	C	C-	
Grade Point	4.0	3.7	3.5	3.0	2.7	2.5	2.0	1.7	23.1
Grade Point Earned	12.0	11.1	10.5	9.0	8.1	7.5	6.0	5.1	69.3

RIPA = 69.3/24 = 2.88
Number of RIT assigned i.e.8 x 3 credit types = 24 credits

RESEARCH IMPACT POINT AVERAGE

The RIPA is a quantitative measure of the researcher's performance. It is the average obtained by dividing the total number of grade points earned by the total number of credits assigned. The credits assigned forms part of the contractual agreement between the researchers and end-users.

UTECH'S RESEARCH IMPACT POINT AVERAGE (RIPA) EXAMPLES

The following two case studies are examples from trials that demonstrate the RIPA achieved. The *treated* blade proved to have enhanced the *life* of the blades between shaping, thus reducing the cost of production and improved overall efficiencies.

Enhancing the Life of Sugar Cane Rollers

Research into reducing the wear on the diameter of sugar cane rollers led to substantial reduction in health problems for welders who had to *arc the rollers*. Furthermore, the intervals between re-arcing of the rollers were substantially increased, thus improving productivity and financial benefit in the production of sugar from grinding the prepared sugar cane.

As reported by the end-users, the agreed RIPA (in this case 2.88, Table 4) was achieved. The direct benefit realised in the period 2003 – 2006 was JA$6 million.

Enhancing the Life of the Mechanical Harvester Blades (MHB) Used in the Jamaican Sugar Industry

The treated MHB as per the agreed research contract, proved to have benefited the sugar cane farmers, which has led to new and improved locally manufactured blades by a new start-up company – Surface Engineering Ltd.

CONCLUSION

In summary, the University of Technology, Jamaica, found that impact as defined above, as follows:

- Is an important element in understanding the value of research;
- Requires a clear agreed impact types relating to measurable benefits;
- Can be described accurately through research group level case studies;
- Can be measured reliably by RIPA applying judgement to a combination of the quantitative indicators.

The UTech trial has shown that the RIPA provides an opportunity for Jamaican researchers to demonstrate the value of both excellent and relevant research. The remaining questions will be the extent to which the inclusion of research impact measures in a national research assessment affects the research landscape in the future. Whatever the outcome, a robust, balanced and sustainable development approach to assessing research impact has been shown to be feasible.

REFERENCES

1. RAE 2008 University and College Union; http://www.ucu.org.uk/index.cfm
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3. Science and Technology Committee, Eleventh Report, 15 September 2004; http://www.publications.parliament.uk/pa/cm200304/cmselect/cmstech/586/58602.html