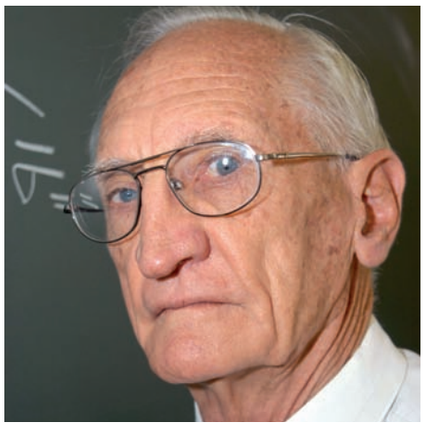

Leon Liebenberg

BETTER COLLABORATION BETWEEN INDUSTRY AND ACADEMIA

by G.T. van Rooyen

The core problem confronting most lecturers and professors in a comprehensive engineering faculty is associated with the nature of the subject they have to teach. In order to stay abreast of new developments, in most instances, requires a high degree of specialisation in one (or at most in two) related subjects. Research in engineering is of an applied rather than a basic nature and it requires a concerted effort by a large group of people.

To be effective it is imperative that the research activities be concentrated and channelled into a few directions with the view of establishing centres of excellence. Such centres of excellence can then result in the allocation of research funds from the university, the government as well as from private industry enabling them to acquire specialised research equipment and attract high-capacity staff members. However, this is in direct conflict with the teaching requirements of staff that require a high degree of specialisation in the subjects the staff members teach. The allocation of certain members to such centres of excellence then leaves the rest high and dry where they have to fend for themselves.

On the other hand it is also true that in order to teach effectively and to become a recognised expert it is imperative to actively do research as well as supervise research of postgraduate students. Research is such a vital and integral part of the job description of teaching staff that research outputs as measured by research publications is used in the assessment for promotion. In many of the new universities on the continent the problem has been "solved" by opting not to be inclusive faculties but to rather establish institutions where a high degree of specialisation already occurs at undergraduate level. This then allows such institutions to focus their activities in particular sectors of the engineering profession - usually those with the greatest potential to serve a particular industry thus enabling them to attract funding for both capital and running expenses. Invariably this also enables them to attract high-calibre academics who are involved in cutting edge technology. The prestige associated with such an institution or department in turn attracts bright students not only locally, but also from abroad. Inclusive faculties are then left with run-of-the-mill engineers.

Such a model would probably not be in South Africa's interest at this time. The country has too few faculties to go down this road although it may be a natural development in the future. Neither a high degree of undergraduate specialisation nor research in cutting edge technology is viable for a developing country such as ours. There is no sense in competing in the international market in, for example, the development of photovoltaic devices or in fuel cells to save the world from an energy crisis. We simply do not have the funds or the infrastructure for such ventures. Even if we have the best theories and original ideas we will always be overruled by the dominating commercial interest.

The Proposed Model

The model I propose essentially has two legs. The one involves interaction with the local industry in a meaningful way to add value and to enable it to compete successfully in the international market. The other leg involves interaction with students in all manner of research projects where the sky is literally the limit.

In spite of the explosion in the information available today there has not been a concomitant increase in vision. Without interpreting and understanding the data, information in itself is not worth much. Many industries still rely on models and explanations for phenomena that have no scientific basis. When a crisis develops due to an upset, engineers frequently frantically try to regain control by simultaneously applying all sorts of measures without considering the consequences or understanding what they are doing. Finally after expensive downtime the problem may be "solved" or may otherwise simply disappear.

If the same problem later reappears resulting in the application of the previously successful measures, the whole process starts all over again. Due to the lack of understanding it is common practice in the industry that when a process works to keep everything unchanged without knowing whether it is operating optimally or what the operating safety margins are.

In the long run the whole approach to let sleeping dogs lie can prove to be very expensive. While acknowledging that things in practice are usually more complicated than in a controlled laboratory experiment, most industrial production processes can benefit and be improved by a better understanding of the fundamentals and the application of advanced techniques such as mathematical modelling and finite analysis.

This is precisely where academics in an engineering faculty can contribute in a meaningful way. The financial rewards for even a modest improvement in production, quality and reduction in costs can potentially exceed the "investment" by orders of magnitude.

Many of the problems encountered in industry are old problems that people have learnt to live with without questioning whether there are better alternatives. Industrial research and development need not only concentrate on a better understanding of the problem but can also contribute greatly by way of new and innovative approaches by the application of lateral thinking.

Frequently, academics who are not so intimately connected with the daily operation and the very demanding constraints of production are better able to separate the wheat from the chaff. The current THRIP* programme where the Foundation for Research and Development contributes to research programmes where there are industrial partners, is an excellent example by which this type of co-operation can be fostered.
(* THRIP = Technology and Human Resources for Industry Programme).

The second leg of the proposed model for research in an engineering faculty is centred on students. To be successful, engineering students should be involved in innovative research projects right from the first year of study. Apart from searching for information and the application of information at an early stage, these projects should involve some experimental work to solve a practical problem. Engineering students are per se not people with a very strong intellectual interest but rather practically inclined people who learn by doing.

A typical project could for example be in the form of a competition to build the lightest bridge capable of carrying a load of say 10 kg between two supports 1 m apart using balsa wood and string. Involving students in the laboratory in research projects is really the boiler room where new ideas are frequently generated.

Once a student's imagination and fascination have been captured at an early stage it can act as a catalyst for the rest of his or her studies. The main aim would be to inspire the young and enquiring mind to become an entrepreneur. Our education should be centred on the development of a research approach to solve problems, rather than instruction of students in the current engineering practice to enable them to operate and maintain equipment however important that may be. To implement such a strategy not only requires total commitment but also active research by the teaching staff. Own research not necessarily integrated with other groups who are involved in industrial research is of paramount importance.

Prof. G. T. van Rooyen obtained a BSc (Mechanical Engineering) degree from the University of the Witwatersrand in 1950. He subsequently earned an MBA degree from the University of Pretoria, followed by the degrees SM and ScD from the Massachusetts Institute of Technology (MIT). Prof. van Rooyen was the first Head of the Department of Materials Science and Metallurgical Engineering at the University of Pretoria at its inception in 1960. He is currently Emeritus Professor in the department and teaches courses in Materials Science, Materials Processing and Mechanical Metallurgy. Prof. van Rooyen is active in the field of mechanical properties of materials and is the author of numerous scientific publications. He is widely consulted and has given expert evidence in numerous court cases.

***Professor G.T. van Rooyen**, Department of Materials Science and Metallurgical Engineering, University of Pretoria.*

gtrooyen@postino.up.ac.za