The role of the institutes of higher learning in modernization of the industry

TITTAGALA, Sunil <http://orcid.org/0000-0003-0783-1088>

10. Role of the Institutes of Higher learning in modernization of the industry

Presenter: Dr. S. Rohan Tittagala

Irrespective of the sector and the level of education and manpower training the respective institutions are involved in, the challenge facing the Institutes of Higher Learning in the future would be to develop an appropriate response to the rapid advances in technology and future needs of the industry in implementing modern technologies. A complete change in the current methodologies of teaching / training would be necessary and the emphasis in all programmes should be on appropriate mechanisms built into the curriculum which enable students to be involved in real industrial projects leading to a definite outcome.
The teaching strategies and teaching methodologies may vary from institution to institution but the need to teach the technologies in a practice orientated environment is foremost. Apart from the institutional objectives, the available resources, primarily the state-of-the-art equipment, would be a controlling factor. Thus not only initial support, but a continuing commitment from appropriate agencies such as the GTZ to sustain modernization programmes, recognizing them as long-term, mutually beneficial partnerships rather than simply donor exercises, is imperative.

The current tendency to work in 'compartments' of persons subjected to different strata of training is highly detrimental to the modernization of industry. A culture of 'team approach' where each other's true potential and capabilities and the level of knowledge and skills are mutually recognized and respected must be created preferably during the internship itself, hence the need for these institutions to work together towards a common goal. The current scenario of all such institutions being under one key ministry (i.e. the 'Ministry of Tertiary Education and Training) is highly conductive to identifying potential areas of interaction and formulating appropriate mechanisms.

Extension of the 'Teaching Factory' concept beyond the apprenticeship training level is proposed. This 'Teaching Factory', being a university facility, will be an attractive further training ground for apprentices (from apprentice training institutes) who already received their basic skill oriented training in-house. They will operate under the supervision of a few senior technical staff attached to the centre. For industry projects undertaken by the centre, design inputs will come primarily from the undergraduates working under the guidance of academic staff and senior technical personnel in industry, and the skill dominant activities (such as manufacturing functions) will be performed by the apprentices. Such a centre with live activity is expected to provide a semi-industrial atmosphere. Students and the industry will stand to benefit from such a partnership.

SEMINAR ON MODERN TECHNOLOGIES
The need for Modern Technologies and the relevant Competencies in the Local Industry

Organized by the TiAT (Training in Advanced Technologies # Project)

Sponsored by GTZ, Ceylon National Chamber of Industries and
Institution of Engineers, Sri Lanka.

11 – 12 th November, 2003. Colombo.

The Role of the Institutes of Higher Learning in Modernization of the Industry

DR. S. ROHAN TITTAGALA
Director - Career Guidance & Senior Lecturer in Mechanical Engineering,
University of Moratuwa

Introduction

Availability of adequate and competent human resources to operate the technology at all levels is an absolute necessity for modernization of industry [1]. The task of the Institutes of Higher Learning is to ensure a regular supply of quality, trained manpower at different levels to facilitate and sustain the processes of introduction and implementation of advanced technologies. Thus there is an urgent need for strategic changes in the curricula and methods of delivery, and the evolution of an effective training system. A further responsibility of these institutes is to develop appropriate CPD porogrammes for industry personnel to meet the challenges of the modernization process and bridge the technology gap.

Modern Technologies

Modern Technologies have no real identity. These are broadly interdisciplinary systems which bring together elements of mechanical engineering, electrical and electronic engineering and, telecommunication and computer technologies. The traditional discipline-oriented boundaries of engineering no longer apply and the implementation of modern technologies invariably involves multidisciplinary activity and a team approach. There will be a need to understand analog and digital control, computer architecture and interfacing, sensor and instrumentation technologies and, drive and actuator technologies in combination with mechanical systems.

Present Status

As regards the objectives of this seminar, the Institutes of Higher Learning are taken as to constitute of those offering apprenticeship level programmes upward. Three levels of training could be identified, viz. the apprenticeship training courses where the current emphasis is on developing skills in a particular craft ('trade') with a modest input of theory, the mid-level technician training courses which are generally expected to give a reasonable balance between theory and practice, and the university-based engineering degree programmes which are mainly advanced knowledge-based. Although the broad institutional framework is this, the actual delivery of programmes at individual institutes depends to a large extent on the available staff and equipment resources. In the context of introducing modern technologies the current situation, in general, is far from satisfactory.

Teaching and Training Strategies

Given the practical nature of modern technologies, they cannot be introduced with a classical academic approach even in the universities, where the normal tendency may be to teach in depth the technologies, with relatively less attention to develop skills and practical expertise [2]. Such an approach is bound to fail. A more balanced approach of teaching background technologies to a required depth commensurate with the level of manpower training envisaged in the particular higher learning sector, supported by a programme to develop related skills through practice and project work must be aimed at. As the industrial activity enhances and becomes more vibrant, a high degree of competence will be expected by the industry even from the fresh recruits in implementing new technologies.

Teaching Style and Methodology

It is very important to stimulate interest and motivate the students, and allow the inquiring student to see the scope and the variety of hi-tech applications in industry. To this end, visual methods such as video clips and multimedia presentations must be extensively used in teaching programmes.

Exposure to the industrial environment and a variety of real life situations through plant visits must be a built-in feature of a programme of study. It is encouraging that at least a few hi-tech companies currently operate in Sri Lanka and significant advances have been made in the area of automation, particularly in the food processing industries.

Computer technology advancing at a rapid pace has revolutionized the teaching process itself. Computers have enabled teaching curriculum to be condensed by effective integration of different subject areas and demonstration of their inter-relation leading to a final outcome. For example, beginning with computer graphics and modeling, through computer-aided design and analysis, to CNC programming and manufacturing, the CAD-CAM route provides an alternative very effective solution to conventional Engineering Drawing and Workshop Practice oriented teaching in product realization.

Learning Environment

In this era of information technology and automation, youngsters are attracted by modern technologies and at the initial stage of grooming it is mainly necessary to provide the correct learning environment and guidance to enable the student to grasp the fundamentals and gain confidence. Thereafter a high degree of carefully monitored self-learning has to be facilitated. The Institutes of higher Learning will necessarily have to cater to this. State-of-the-art teaching equipment which is geared for interactive student-based learning must be used [2]. These provide a 'fast track' learning opportunity to the motivated student and are particularly useful in circumstances where the staff resources are limited.

The ground situation is that that there is a dearth of staff at all levels who are themselves competent in the advanced technologies. Therefore, cooperative group learning and problem solving activities where the students benefit from interaction with each other must be promoted. This self-learning objective could be accomplished by assigning students tasks they actually enjoy, such as computer simulations to solve realistic problems. However, since technological studies involve a particularly rigorous programme requiring more self-discipline than most young people have, the academia has the responsibility of putting into place rigid, fool-proof and effective monitoring and evaluation systems.

Laboratory scale hi-tech equipment is expensive and setting up state-of-the-art teaching laboratories which simulate industrial systems involves much capital expenditure. Moreover there should be avenues for continuous updating of such facilities considering the rapid pace at which technology advances. Whatever the constraints are, such equipment/systems are a must for introducing modern technologies. This seminar may not serve its objective unless this issue is fully addressed.

Project-based Learning

('Teaching Factory Concept')

The principle of training students through project work with industry is now widely regarded as an effective mechanism which gives the much needed exposure to real projects and builds up the

student confidence [3,4]. As regards the universities, the traditional academic department structure is not suitable for this purpose and innovative restructuring of the academic environment to incorporate certain features of a business enterprise has become necessary [4]. This may well be true for the other categories of local Institutes of Higher Learning, viz. the mid-level 'Technician Training Institutes' and 'Apprenticeship Training Institutes'.

For the purpose of this paper such restructured facilities may be termed 'Technology Centres.' These are activity-based centres which can operate in conjunction with several traditional engineering departments/divisions as may be required by a particular project. For such a facility to be sustainable it has to generate its own revenue and therefore appropriate mechanisms for existence and operation within a familiar, well established traditional institutional framework should evolve. The primary objective is that such centres should contribute substantially to the learning process.

Role of Academic Administration

The academic administration in the Institutes of Higher Learning needs to have a clear strategy to promote these multi-faceted technologies. As already stated, modern technologies have no real identity. Thus if a successful programme is to emerge, it will necessarily have to be a cross-disciplinary effort. It may not be that easy to promote such collaborative effort and harness resources unless there is a collective responsibility of the academia towards such a progrmme.

The employment potential of personnel adequately trained in modern technologies would, however, be the driving force for such change. The Institutes of Higher Learning can be guided by a rigid 'Industry Consultative Board structure' in place [5]. In any event, a strong commitment will be required from academic administration if inter-department/division boundaries are to be overcome and a truly interdisciplinary, flexible programme is to emerge.

Interaction between Institutes

There are two facets to the effective implementation of modern technologies, viz. the design-development activity and the execution activity. The nature of resources and the effort that goes into these two broad areas are distinctly different. The former is more knowledge based and the latter is more skill based. The former would be supported mainly by state-of-the-art software and computer facilities and the latter would involve sophisticated hardware, ie. a wide range of modern machinery and equipment. However, the two functions are complementary and for the realization of the objective, trained manpower at different levels is needed.

The model proposed in this paper, as may be applicable to Sri Lanka, is to harness the potential of both categories of students to provide the manpower resource for effective operation of Technology Centres, preferably within a university set-up. A centre, being a university facility, will be an attractive further training ground for apprentices (from apprentice training institutes) who have already received their basic skill oriented training in-house. They will operate under the supervision of a few senior technical staff attached to the centre. For industry projects undertaken by the centre, design inputs will come primarily from the undergraduates working under the guidance of academic staff and senior technical personnel in industry, and the skill dominant activities (such as manufacturing functions) will be performed by the apprentices. Such a centre with live activity is expected to provide a semi-industrial atmosphere. Both categories of students and the industry will stand to benefit from such a partnership.

Moreover, such a programme could serve as a regular source of manpower provision to industry by producing persons competent in modern technologies at different levels. Apprentice level inputs are currently sought and appreciated by local hi-tech industries, and the situation is often mis-represented as the requirement of the industry. As the modernization process gathers momentum, the need for higher level manpower inputs will be felt and this will necessarily have to come from the universities.

Examples of technology centres that have evolved within a traditional university framework can be found world over. For example, at the University of Warwick, UK, there is a strong tradition of working in close cooperation with industry in multi-disciplinary research and development work through the 'Advanced Technology Centre' and the 'International Manufacturing Centre' which operate under the Warwick Manufacturing Group. This proposal goes a step beyond in promoting the idea of interaction between different categories of institutes to support the activities of such a centre.

Conclusions

Irrespective of the sector and the level of education and manpower training the respective institutions are involved in, the challenge facing the Institutes of Higher Learning in the future would be to develop an appropriate response to the rapid advances in technology and future needs of the industry in implementing modern technologies. A complete change in the current methodologies of teaching/training would be necessary and the emphasis in all programmes should be on appropriate mechanisms built into the curriculum which enable students to be involved in real industrial projects leading to a definite outcome.

The teaching strategies and teaching methodologies may vary from institution to institution but the need to teach the technologies in a practice oriented environment is foremost. Apart from the institutional objectives, the available resources, primarily the state-of-the-art equipment, would be a controlling factor. Thus not only initial support, but a continuing commitment from appropriate agencies such as the GTZ to sustain modernization programmes, recognizing them as long-term, mutually beneficial partnerships rather than simply donor exercises, is imperative.

The current tendency to work in 'compartments' of persons subjected to different strata of training is highly detrimental to the modernization of industry. A culture of 'team approach' where each others true potential and capabilities and the level of knowledge and skills are mutually recognized and respected must be created preferably during the internship itself, hence the need for these institutions to work together towards a common goal. The current scenario of all such institutions being under one key ministry (i.e. the 'Ministry of Tertiary Education and Training) is highly conducive to identifying potential areas of interaction and formulating appropriate mechanisms. Extension of the 'Teaching Factory' concept beyond the apprenticeship training level is proposed.

REFERENCES

1. R. I. Samaratunga, "Keeping Abreast of Changing Technologies", Guest Lecture delivered at the Inauguration of the MEng./PGDip. Programme in Manufacturing Systems Engineering, University of Moratuwa, Sri Lanka, November 15. 2002.

2. S. R. Tittagala and P. D. R. S. Senadeera, "Integration of Mechatronics: Strategies and Some Case Studies", *Proceedings of the Conference on 'Future Directions & Strategies in Mechanical Engineering Education – Beyond 2000'*, University of Moratuwa, Sri Lanka, July 2001.

3. Mark R. Henderson and Mark J. Stratton, "Recommendation for Curricular Change for Product Realization", *Mechanical Engineering Education Conference*: *Drivers and Strategies of Major Program Change*, ASME, Ft. Lauderdale, March 2000.

4. John S. Lamancusa and Jens E. Jorgensen, "Putting Design and Manufacturing back into the Engineering Curriculum", 1996 ABET Annual Meeting San Diego, CA, October 31- November 1, 1996.

5. S. R. Tittagala, "Setting up Industry Advisory Boards at Universities – Moratuwa University Experience" (Discussion paper), University Grants Commission (UGC) – Asian Development Bank (ADB) (Science & Technology Personnel Development Project) joint Workshop, Colombo, December 13, 2001.