Mutual recognition of qualifications in engineering and technology education: a strategic proposal for Australia and India

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ABSTRACT

The literature search shows that, across the world, there are several difficulties in the recognition of qualifications in higher education, including engineering and technology professions. The recent developments in the mutual recognition of professional courses have been evidenced within the USA and Europe; however, these are very small in number as compared to the strength of higher education worldwide.

India's vast and diverse higher education system, including engineering and technology, provides a daunting task for Australian universities to develop a bilateral credit transfer or twinning relationships for various degree and diploma programs. The mutual recognition of qualifications in higher education of various accreditation and quality assurance agencies in Australia and India will add to their credibility among the education providers in both countries.

A strategic proposal for a mutual recognition of qualification in engineering and technology education between the National Board of Accreditation (NBA), India and the Engineers Australia (IEAust), Australia, has briefly described in this paper. Several benefits of the proposed collaboration are listed in the paper. The programme evaluation strategy applied to this proposal has also briefly described with a short summary of coast and benefit analysis in this paper.

INTRODUCTION

Although the global mobility of professions has become mandatory due to the process of internationalisation of higher education and changing workplace environment, the mutual recognition of higher education, including the engineering and technology programmes is still complicated. For example, several engineering programmes taught in Asia and Africa are not easily recognised in the developed countries. The first and most far-reaching mutual recognition agreement was initiated in 1989, when representatives of engineering accreditation agencies from six countries signed Washington Accord (Washington Accord, 2005). The literature search also shows an evidence of several other developments in the mutual recognition of professional courses between US and Australia, or within the Europe. However, these developments are very small in number considering the growth of engineering education worldwide. Also, these developments are limited to specific programmes and also based on particular collaborations.

India has a vast and diverse higher education system which comprises of nearly 310 universities. There is a substantial growth of engineering and technology education in the last three decades. The current statistics indicate that there is tremendous growth in higher and technology education nationally. However, the higher education in India is facing several

difficulties in generating competitiveness in the world-class market. India's technical workforce is very large and India is home to the largest pool of English speaking scientific workers, next to the USA. Mutual Recognition for various professions is becoming increasingly popular among many countries entering Free Trade Agreements. Countries such as US, Australia, Japan, Canada, etc have developed bilateral agreements for higher education. Many Australian universities are embracing to develop twinning partnerships in teaching with Indian education providers. It is a time to devise a mutual recognition agreement between Australia and India for engineering and technology education.

INDIAN HIGHER AND TECHNICAL EDUCATION SYSTEM

With the second largest population in the world, India is characterised as one of the rapidly expanding economies of the world, with its stable and democratic political system. Apart from steady economic growth at the national level, it has been also observed that India has made considerable progress regarding the development of higher education in general, and engineering and technology education in particular, over the last five decades. India's vast and diverse higher education system comprises of nearly 310 universities, which are either unitary or affiliating. Out of these, 131 universities in the country are affiliating type and they together affiliate around 15,500 colleges with the total student enrolment around 9.5 million. In addition, there are 16 'Central Universities' in the country which are funded by the Union Government with one more is being planned. Besides, there are 37 institutions which have been accorded university status and are called "Deemed Universities". The state governments, under law, are entitled to establish their own universities, funded by the state whereas the coordination and cooperation between the Union and the States is brought about by the Central Advisory Board of Education (CABE) (UGC, 2005).

The engineering and technology education is provided at three different levels, namely; diploma, undergraduate and postgraduate courses.

The engineering diploma courses are mostly of three years' duration after 10 years of formal education. Recently, the state governments have granted academic autonomy to many government-aided polytechnics, which have designed and introduced their own curricula. The remaining institutions have a common syllabus that is formulated, designed and controlled by the individual states. Diploma holders tend to be middle level technocrats and are mostly suitable on the production floor or in the maintenance department, mostly at a supervisory level.

The undergraduate engineering courses in the country are of four years' duration after 12 years (10+2) of higher secondary education. Several states governments have introduced Common Entrance Test for the admission of undergraduate engineering courses.

The statistics show that, at the time of independence, there were only 38 degree-level institutions and 53 diploma-level institutions in India, with an intake capacity of 2,940 and 3,670 students respectively. The current statistical figures published by the All India Council for Technical Education (AICTE) indicate that there are 1,346 degree-level institutions with a student intake 439,689 students as well as 1,244 approved diploma-level engineering institutes with an intake of 265,416 students as of March 2005 (AICTE, 2005).

QUALITY IN INDIAN HIGHER AND TECHNICAL EDUCATION

Although there is astonishing growth in higher and technology education nationally, Indian higher education in general and technical education in particular, has difficulties in generating competitiveness in the world-class market. This is due to several factors that affect the quality of engineering and technology education. The quality management of educational institutes is the essential requirement in order to enhance effective investment and methodology in higher and engineering education of the country. In order to produce world-class competitive

students, several positive major strategies are needed, such as revamping economic and industrial policies, mutual recognition agreements and international collaborations.

There are several accreditation, controlling and quality assurance agencies functioning in India which can be entrusted the responsibilities for maintaining the quality of higher education. These include; Universities Grant Commission (UGC), All India Council for Technical Education (AICTE), Association of Indian Universities (AIU), National Accreditation and Assessment Council (NAAC), National Board of Accreditation (NBA), etc.

University Grants Commission

The University Grants Commission (UGC), formally established in 1956 as a statutory body of the Government of India through an Act of Parliament, coordinates and maintains standards of university education in India (UGC, 2005).

NAAC

The National Accreditation and Assessment Council (NAAC), established in 1994, is an autonomous body established by the University Grants Commission (UGC) on the recommendations of National Education Policy of 1986 (NAAC, 2005). The NAAC has 7 major criteria for the assessment procedures of higher education. These criteria are curriculum aspects, teaching and learning and evaluation, research and consultancy, infrastructure and learning resources, student support and progression, organisation and management, and best practices. The overall quality assurance framework followed by NAAC has three basic approaches- accreditation, assessment, and academic audit. Added to the holistic approach to assessment, the criterion based assessment of NAAC which is the backbone of the whole assessment exercise promotes judgement based in values. In total, the NAAC has accredited 122 universities and 2560 colleges till 2004.

AICTE

The engineering, architectural and pharmacy colleges in the country are monitored and accredited by the All India Council for Technical Education (AICTE). The State Directorate Offices of each state are responsible for managing and monitoring these approved institutes within the state. The main objectives of the AICTE include; the coordination for development of technical education, the promotion of qualitative improvement in technical education and the maintenance of norms and standard in technical education (AICTE, 2005).

NBA

The National Board of Accreditation (NBA) is an autonomous body constituted in 1987 by the AICTE. The NBA is responsible for the assessment and accreditation of technical education including engineering and technology, management, architecture, pharmacy, town and country planning, applied arts and crafts, etc. So far, NBA has accredited 1025 engineering and technology programmes in the country but compared to the large volume of technical education in India it is a still a small percentage. The NBA has also introduced the strategy of internal institutional evaluation for engineering colleges in order to accelerate the process of accreditation (NBA, 2005).

QA IN AUSTRALIAN HIGHER AND TECHNICAL EDUCATION

Universities in Australia are public or private autonomous bodies and ‘self-accrediting'; that is, they are authorised to accredit their own courses and are responsible for their academic standards. Universities are established by State or Territory legislation following a detailed assessment of their academic and financial credentials. These institutions typically have in place a system of formal, cyclical reviews involving external assessors for the development/evaluation of programmes and organisational units. The term 'university' is protected by legislation in Australia. They must have appropriate quality assurance processes in place, including peer assessment processes, external examination of higher degrees and the

involvement of professional bodies in the accreditation of particular courses. Reflecting particular historical circumstances, there are also a small number of self-accrediting higher education institutions which are not universities. Some of the important developments in the direction of quality of higher education in Australia is the establishments of several quality assurance and accreditation agencies such as; Australian Qualification Framework (AQF), Australian University Quality Agency (AUQA), Australian Vic-Chancellors' Committee (AVCC), etc. These are discussed in the following sections.

The Australian Qualification Framework

The Australian higher education quality assurance framework has been developed and supported by Australian State, Territory and Commonwealth governments as well as the Australian Vice-Chancellors' Committee (AVCC). It consists of interlinking university and government quality assurance processes and implements national policy.

The Australian Qualifications Framework (AQF), a key national policy instrument to protect the quality of Australian education and training, was developed under instruction from the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA). It is a unified system of national qualifications in schools, VET and the higher education sector AQF, 2005). The AQF comprises of approved national guidelines for each of the current national qualifications issued in the schools, vocational education and training and higher education sectors and also devise and implement principles for articulation and credit transfer.

National Protocols for Higher Education Approval Processes

Recently, the national protocols have been set to ensure consistent standards across Australian higher education in such matters as the recognition of new universities, the operation of overseas higher education institutions in Australia, and the accreditation of higher education courses to be offered by non self-accrediting providers.

AUQA

The highlight of new Australian quality policy is the Australian Universities Quality Agency (AUQA) which conducts quality audits of Australia's 38 publicly funded universities of Higher Education. AUQA, established in 2001, is an independent company established by MCEETYA to audit teaching, learning, research and administration in Australian universities on a five yearly cycle. AUQA appoints auditors to conduct its assessments of each institution every five years. Any institution found to be deficient will be required to produce improvement strategies and Commonwealth Government funding may be withdrawn if improvements are not forthcoming (AUQA, 2005).

National Performance Monitoring and Approval

In addition to the activity noted above, the Commonwealth Department of Education, Science and Training (DEST) publishes a range of comparative data to inform both students and institutions about the characteristics and performance of universities. DEST publishes university quality assurance and improvement plans annually, provides awards for innovative teaching practice and funds projects which promote quality and excellence in teaching and learning through the Australian Universities Teaching Committee (AUTC) (DEST, 2005).

Australian Vice-Chancellors' Committee

The Australian Vice-Chancellors' Committee (AVCC) have a long-standing role in devising policies and developing guidelines relevant to quality assurance. The AVCC also provides information and advice on degree, post-graduate and higher degree qualifications, and development of access policies including recognition of prior learning and credit transfer. However, the recent developments in the Australian higher education policy show that the AVCC has slightly diverted from its original position on quality (AVCC, 2005).

QA in VET Sector

A national system of vocational education and training has developed during the past decade through the Australian National Training Authority (ANTA). Under this system, State and Territory governments have agreed to implement a series of national policies. One of these policies is that in order to issue an AQF qualification in the vocational education and training sector, the institution or agency must be registered by a State or Territory government recognition authority as a registered training organisation (RTO) and all RTOs are publicly listed on the Internet via the National Training Information Service (NTIS). The quality assurance processes in the VET sector rely on a robust tradition of self-regulation at institutional level, with the recent introduction of a deregulated training market. There is increasing diversity of providers and a corresponding need for more explicit and comprehensive quality assurance procedures and processes. Furthermore, the responsibilities and functions of the ANTA have now been transferred to the DEST by the Prime Minister's announcement in October (ANTA, 2005).

IEAust

The Engineers Australia, (formerly known as Institution of Engineers, IEAust) is responsible for the accreditation of undergraduate engineering courses in Australia. The IEAust accredits programmes in engineering and technology which meet the academic requirements for Engineers Australia membership in the professional engineering category. The recent guidelines produced by the Engineers Australia in the competency standard for professional engineer also contain important engineering ability and professional attributes for the accreditation of education programmes (IEAust, 2005).

Mutual Recognition

Mutual recognition of any quality assurance agency is essential for the growth of transnational education. In order to facilitate the free mobility of various professionals within the globe, several countries are instigating new methodologies in the direction of mutual recognition of qualifications and professions such as engineering. For example, the European Union is trying to implement new method to simplify different existing directives used in the recognition of professional qualifications, and foster the goals in the direction of the EU's 'Lisbon Strategy'. However, at this stage, the only leader in developing several projects in this direction is the Engineering Council UK (ECUK, 2005).

International networking, academic collaborations and mutual recognition agreements are key factors in developing engineering education, as well as sharing physical, human and other resources for mutual benefits and the technical workforce development of any nation. This also helps in the transfer of information and knowledge between two countries, such as Australia and India. It has been observed that several universities in developed countries, such as Australia, New Zealand, Canada, etc, consider international collaborations as a potential source of additional income. Since financial benefits to the university/institutions and technology benefits to industry are positive outcomes from international collaborations and networking (Patil & Pudlowski, 2000). Therefore, it is important to develop institute to institute credit transfers or qualification recognition on national and international level by various bilateral and cross border agreements. The NQF in two countries would have to have some common benchmark for quality equivalence for mutual recognition of qualifications. They can be based on holistic education outcomes or program level recognition based on skills and other mutually agreed graduate capabilities.

A Comparison between Australian and Indian QA System in Engineering Education

The Table 1 presents a brief comparison of the existing QA and Accreditation systems for engineering and technology education in Australia and India. There are several similarities between Australian and Indian engineering education systems. Both countries have a similar

higher education pattern, especially for engineering and technology education and also having similar degree awards.
Table 1: An outline of accreditation and QA systems in engineering education in Australia and India (Source: IEAust and NBA).

	Australia	**India**
Education System or Pattern	10+2+3 or 4	10+2+3 or 4
Accreditation Agencies and the Year of Establishment	Australian University Quality Agency (AUQA) (2001) Engineers Australia (IEAust) (1919)	National Assessment and Accreditation Council (NAAC) (1994) National Board of Accreditation (NBA) (1987)
Undergraduate Award (Engineering)	BE , BEng + BABE, BComBE (double degree) (4 Years)	BE /BTech (4 years)
Highlights	IEAust is a founder signatory for Washington Accord and Sydney Accord. IEAust has signed several bilateral and cross border agreements.	NAAC is a member of INQAAHE and co-convener of APQN. AICTE has issued regulations to control the entry and operations of foreign institutions.
Important Features	• Focus on program accreditation • Awards professional recognition in eng. and tech • Accredits overseas qualification	• Focus on institutional accreditation • Yet not authorised to award professional recognition • Planning to implement international accreditation

The existing quality policy in Australian higher education system is embedded in terms of providing a mechanism to inform customer choice, including enhancing market credibility for Australian higher education on the international scene (Vidovich, 2002), whereas Indian policy of quality assurance focuses mostly on the national scene. The Australian QA system for engineering courses is well developed and rigorous whereas Indian system is quite new and in its developing phase. Unlike most Indian universities, Australian universities are all self-accrediting, devise their own courses and award their own degrees without any special approval. The diploma courses in India lack of QA and accreditation process. Australia's IEAust is the founder signatory to the Washington Accord, whereas, recently, India has missed joining the Accord (Deccan Herald, 2005). The major concern of QA in Indian higher education system is the large volume as compared to Australian strength.

Recent Developments

Recent efforts of Indian government have brought greater uniformity to the structure of academic qualifications within the country despite the regional disparities and standards of qualification. The Government of India has already boosted the quality and efficiency of higher education, including the engineering and VET, through World Bank-supported projects and various collaborative programmes. India has become a global centre for software R&D, along with other disciplines in engineering and technology. Recently, various projects announced by the Indian Government to internationalise and standardise higher education in the country. Some of these developments are listed below:

- At the end of 2002, India announced a programme to improve technical education within the country. The programme includes Rs 15.5 billion from World Bank aid, which will be utilised to upgrade engineering institutes to international standards (Education India, 2003). Under this programme, about 17-20 engineering institutions will be developed as centres of excellence or lead institutions. It is envisaged that these lead institutions will be networked with local institutions for further improvement of technology education in the neighbouring regions of the lead institutions (ISTE, 2002).
- The government of India has introduced and implemented the concept of autonomous colleges with autonomy in designing curricula, evolving new methods of teaching, research, learning, framing rules for admission, prescribing courses of study, setting examination papers and conducting examinations, etc.
- The National Assessment and Accreditation Council (NAAC) has formed new *centres of excellence* in the country (NAAC, 2005).
- The NAAC is an active member of the International Network of Quality Assurance Agencies in Higher Education (INQAAHE) and also the co-convener of Asia-Pacific Quality Network (APQN). The APQN is a regional sub network of the INQAAHE (Prasad and Stella, 2004)
- Recently, IEAust has implemented the Accreditation Management System which is an important step towards the international developments and mutual recognition Agreements.
- Engineers Australia (IEAust) had signed a MoU with the ABEEK, Korea (IEAust, 2005).

A PROPOSAL for MRA

It is envisaged to propose a strategic proposal for the mutual recognition of engineering and technology professions between India. This methodology is initially implemented for undergraduate engineering programs and can be extended for diploma (TAFE) courses in future. Table 2 shows the implementation and a course of action in three phases.

Table 2: Proposed course of action for the MRA.

Phase	Activities
Phase 1 (2006)	• Signing MoU and the formation of Joint Board of Mutual Recognition and Accreditation (JBMRA) • Formation of the Advisory Committee • First joint meeting of JBMRA and Advisory Committee • Strategy for the course of action and implementation • First meeting of the JBMRA • Formulate course curricula • Devise accreditation criteria for the mutual recognition
Phase 2 (2007)	• Second meeting of the JBMRA • Implementation of the pilot project on mutual recognition assessment • Forma agreement and decision
Phase 3 (2008 - 2010)	• Second joint meeting of JBMRA and Advisory Committee • Third meeting of JBMRA • Evaluation and Recommendations • Extension of pilot project to other courses in engineering and technology

The important features of the proposal are:

1. A Memorandum of Understanding (MoU) between the IEAust and NBA/AICTE.

2. Establishment of a Joint Board of Mutual Recognition and Accreditation (JBMRA) (the structure of which is shown in Table 2), which should include:
   - Regular review meetings for policy updating (once in a year).
   - The President and Vice-Presidents should be elected on a rotation basis for two years from two countries.
3. The proposed MRA should exhibit all required elements for the mobility of engineering professions by the process of internationalisation of engineering education.
4. The MRA should facilitate multicultural workplace environment in both countries, giving the opportunity for the exchange of engineering professions between Australia and India.
5. There can be regular workshops and seminar arranged in both countries for the review and feedback on the MRA.

METHODOLOGY

The Joint Board of Mutual Recognition and Accreditation (JBMRA) can be formed in the beginning of the agreement. These may comprise of the representation from accreditation and quality assurance agencies as well as senior academics from Australia and India. The structure of the JBMRA and Advisory Committee is given in Table 3.

Table 3: A proposed structure of the JBMRA and Advisory Committee.

Joint Board of Mutual Recognition and Accreditation (JBMRA)		**Advisory Committee**
President/ Chairman	Senior Executive from all members (by rotation)	Senior Academic (eg. Chancellor, VC, ProVC, etc)
Vice-Presidents (2)	Director, IEAust, Australia Chairman, NBA, India	-
Members (nominee) (4)	1 from AUQA, Australia 1 from IEAust, Australia 1 from NAAC, India 1 from NBA, India	1 from DEST, Australia 1 from AVCC, Australia 1 from MHRD, India 1 from UGC, India
Members (4)	2 Senior Academics from Australia 2 Senior Academics from India (At least of Dean's level from engineering faculty)	2 Senior Academics from each country

The JBMRA would comprise of 10 members whereas the Advisory Committee would consist of 9 members. Both, JBMRA and the Advisory Board, are expected to monitor the activities of the agreement and may also have the sanctioning authorities including financial and budgetary powers. It is projected that the competition of all three phases of the proposal may span four years: between 2006 and 2010. In future, the MRA may be further extended to diploma and TAFE courses in India and Australia.

Course structures

The MRA will include the design of undergraduate course curriculum for engineering courses, contents development and the development of specific course modules, with industrial training envisaged in both countries. This course will lead to the award of the joint degree of Bachelor of Engineering (BE) or Bachelor of Technology (BTech) in the field of engineering and technology. The course curricula can be designed and formulated in the first meeting of the JBMRA as given in Table 2.

Joint Accreditation Criteria

In order to recognise the engineering and technology undergraduate qualifications in both countries, it is envisaged to devise standard criteria of accreditation for joint professional awards. The fundamental process of incorporating generic attributes along with the *global* attributes into the course curricula is one factor whereas the proper assessment of these attributes is the second important issue. The essential components of the *Global* skills can be included in the joint criteria and also taught during academic exchange programmes with the overseas university or institutions (Patil, 2005).

Programme Evaluation

Under this proposal of mutual recognition of engineering qualification, students enrolled for this programme will need to obtain an accreditation from both, Australian and Indian engineering professional institutions. This can be clearly decided upon by, and finalised with, JBMRA and Advisory Committee at a joint meeting in the third phase. It is also necessary to design the common global assessment tools to assess the *global* skills related to the engineering professions.

Furthermore, the awarding of the final grades to students, their performances in theoretical and practical assessments, as well as evaluations of project reports and thesis, should be considered. The successful candidates may then be awarded the undergraduate degree in engineering and technology. As the recognition of credits is the most important and integral part of the proposed MRA, it is envisaged to award a combined undergraduate degree from partner institutions with recommendations of JBMRA and Advisory Board.

Cost-Benefit Analysis

The investment on the proposed MRA may be shared between accreditation agencies, national governmental agencies and the educational institutions involved. Furthermore the clear-cut strategy of the cost-benefit analysis can be formulated in the first joint meeting of JBMRA and Advisory Board. All financial settings must be approved in this meeting for the span of project.

BENEFITS OF MRA

A successful implementation of one such exchange programme is academic practice abroad for the internship of students between Hochschule Wismar - University of Technology, Business and Design, Wismar, Germany and Higher Education Professional School (HEPS), Tarnów (Lisowska-Lis, et al, 2004). The case study shows that the bilateral collaboration between two academic institutions in Wismar, Germany and Tarnów, Poland facilitated several collaborative activities for engineering diploma students, teachers and academic staff. This include, study visits, educational exchange, cultural exchange, teacher training and international mobility. Some of the important benefits of the Mutual Recognition Agreements between Indian and Australian engineering education system are listed as below:

- **Curriculum Reform**

The curriculum reform such as the design, development and implementation of adaptive, flexible curriculum practices for engineering and technology courses in multidisciplinary areas will be achieved.

- **Transfer of Knowledge and Technology**

The promotion of the transfer of knowledge and technology by developing a close scientific and cultural cooperation between Australian and Indian higher educational institutions will be fostered. Due to technology transfer plus the transfer of information in the field of engineering education, it may help to improve the standardisation process of engineering and technology in both countries.

- **Long-Term Interaction**

It is envisaged that the MR agreements would accelerate sustainable long-term dynamic interactions among Indian and Australian engineering and technology institutions in order to develop mutually beneficial intellectual capacities, knowledge bases, educational credits and joint services.

- **Mutual Networking**

The promotion of mutual networking and the dissemination of knowledge would improve equitable access to each other's programmes and services, irrespective of language barriers, skills sets, and socio-economic and socio-cultural relevance.

- **Students and Staff Mobility**

The enhancement of the mobility of students as well as staff from two countries would be achieved by the formation of networking among the partner institutions. Also, the mobility of Australian students and teachers in the direction of Indian institutions would be encouraged.

- **Academic Excellence and Cultural Understanding**

This will also help in enhancing the culture and values through the process of exchange between two countries. It has an impact on the economic relations and upgrading by currency exchange and policy implementations between countries.

CONCLUDING REMARKS

Mutual recognition agreements and International academic collaborations are the key factors in developing engineering education, as well for sharing physical, human and other resources for mutual benefits and the technical workforce development between any two nations. The objectives and benefits of mutual recognition agreement for the engineering and technology education between Australia and India are described in this article. The article also briefly outlines a methodology and course of actions for the proposed international model for the mutual recognition agreement in engineering education.

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