A strategy for incorporation of ISO 14001 in accreditation process of engineering degree programs

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Abstract

Sustainability of engineering programs in Pakistan remains in jeopardy due to different approaches used for degree programs. Whilst most institutions follow semester system and fulfill the relevant requirements, a few still insist in annual system. Pakistan engineering Council has developed an accreditation program which is currently being implemented at all institutions offering BE Environmental Engineering Degree. This paper highlights the facts that incorporation of ISO 14001 requirements into the existing accreditation program will not only help bridging the gap between institutional approaches but also make all the programs in conformity with international programs and our graduates will have better prospects of success in industry as well as in graduate studies at renowned international institutions. This will not only facilitate communication amongst similar institutions but exchange of faculty as well as students at any stage will also be promoted.

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Keywords: Accreditation; ISO14001; Communications; Environmental Management Committee.

1. Introduction

Environmental management in academic institutions is relatively new concept in developing countries. Overpopulated class rooms devoid of basic life amenities and shortage of qualified and properly trained teaching staff leaves no room for an extra step for environmental management. Mostly public, but a few private universities offering engineering degree programs are somehow maintaining a minimum discipline under some government bodies. Yet the main focus is how to equip their product to have a greater edge in the employment market. All policies and procedures focus on this single objective. BE Engineering education in Pakistan, is monitored by Pakistan Engineering Council (PEC) and curricula for the same is designed by a national committee of experts from all around the country under the auspices of Higher Education Commission(HEC). PEC “accredit” all private and public degree programs for a maximum of 3 batches beyond which the program needs re-accreditation.

According to PEC’s accreditation manual [1]
“Acreditation is an important aspect of ensuring quality according to the national and international criteria and bench marks. Accreditation involves an evaluation of undergraduate and post graduate programs offered by universities and educational providers, through a well defined, peer review process in which endorsements based on three broadly designated parameters and eight criteria are rendered.
An accredited engineering program is judged as providing satisfactory preparation of graduates to initially enter the profession as registered engineers and subsequently develop their skills to the level of professional engineers. The
The accreditation process is designed to publically assure the competence of graduates independent of the certification and credentials provided by the institutions of engineering education. The accreditation parameters and detailed criteria included in the accreditation manual are a critical component to government, prospective employers and the industry about the professional knowledge and skills of the engineering graduates.”

Components of the existing accreditation program in Pakistan, higher education commission’s self-assessment criteria and the ultimate America’s ABET’s accreditation program are given in Table-1.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Sub Sect.</th>
<th>Points</th>
<th>PEC’s Accreditation Criteria</th>
<th>HEC’s Self-Assessment Criteria</th>
<th>ABET’s Accreditation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Management &amp; infrastructure of the institution</td>
<td>3</td>
<td>25</td>
<td>Program mission, objectives and outcomes</td>
<td>Students</td>
</tr>
<tr>
<td>2A</td>
<td>Finances</td>
<td>1</td>
<td>25</td>
<td>2. Curriculum design and organization</td>
<td>2. Program educational objectives</td>
</tr>
<tr>
<td>3A</td>
<td>Faculty</td>
<td>11</td>
<td>250</td>
<td>3. Laboratories and computing facilities</td>
<td>3. Program outcomes</td>
</tr>
<tr>
<td>4A</td>
<td>Academic program</td>
<td>6</td>
<td>100</td>
<td>4. Student support and advising</td>
<td>4. Continuous improvement</td>
</tr>
<tr>
<td>5A</td>
<td>Laboratory and allied staff</td>
<td>6</td>
<td>110</td>
<td>5. Process control</td>
<td>5. Curriculum</td>
</tr>
<tr>
<td>6A</td>
<td>Library</td>
<td>5</td>
<td>100</td>
<td>6. Faculty</td>
<td>6. Faculty</td>
</tr>
<tr>
<td>7A</td>
<td>Standard of instructions</td>
<td>4</td>
<td>90</td>
<td>7. Institutional facilities</td>
<td>7. Facilities</td>
</tr>
<tr>
<td>8A</td>
<td>Students</td>
<td>3</td>
<td>90</td>
<td>8. Institutional support</td>
<td>8. Support</td>
</tr>
<tr>
<td>9B</td>
<td>Academic building and other allied facilities</td>
<td>3</td>
<td>40</td>
<td>9. Program criteria</td>
<td></td>
</tr>
<tr>
<td>10B</td>
<td>Annual cost per student</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11B</td>
<td>Financial support to students</td>
<td>1</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12B</td>
<td>Class size</td>
<td>2</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13B</td>
<td>Office hours for academic counselling</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14B</td>
<td>Other facilities for students</td>
<td>4</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15B</td>
<td>Yield</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16B</td>
<td>Dropouts</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17B</td>
<td>Average duration</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18B</td>
<td>Internship</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19B</td>
<td>Quality of product</td>
<td>6</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20B</td>
<td>Operational budget</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21B</td>
<td>Development budget</td>
<td>2</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22B</td>
<td>Investment and internal resource generation</td>
<td>2</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23B</td>
<td>Research and publications</td>
<td>9</td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24B</td>
<td>24. Industrial linkages</td>
<td>2</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25B</td>
<td>Websites</td>
<td>1</td>
<td>20</td>
<td></td>
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</tbody>
</table>

PEC’s accreditation program comprise of the following seven criterion spread over two sections (A & B) and a total of 25 articles.

Criteria-I: Management, Mission and Integrity
Criteria-II: Financial Resources
Criteria-III: Physical Resources (Central Facilities)
Criteria-IV: Human Resources: Faculty and staff
Criteria-V: Human Resources: Students
Criteria-VI: Teaching-Learning Processes
Criteria-VII: Research and Development and Interaction Effort

Column-1 of Table-1 represents the 25-point Pakistan Engineering Council’s requirements. These two-tiered (A & B) requirements are explained in the manual of operation for accreditation of the engineering degree program. A minimum of 65% score is required in each section (A and B). Almost all of the academic institutions use chemicals and various energy consuming gadgets in their labs and classrooms but hardly any one conducts the environmental and energy audit. None of this PEC criterion helps development of an academic and environmental policy that would reflect the scale and size of the institution, objective, targets for the year or its commitment to continuous improvement in academic and environmental upkeep.

ISO 14001 certification for academic institutions is gaining momentum in Europe, America and Australia. Keeping in view the expenditure involved and documentation required for getting and maintaining an ISO 14001 Certification, it is not
possible for every institution in the developing world. It would therefore be wise to embed the relevant requirements into the existing accreditation requirements. Major requirements of ISO 14001 certification include:

<table>
<thead>
<tr>
<th>Table-2: Linkage between PEC’s Accreditation conditions and ISO14001:2008 Requirements[3]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Environmental Review</strong></td>
</tr>
<tr>
<td>Management &amp; infrastructure of the institution</td>
</tr>
<tr>
<td>Finances</td>
</tr>
<tr>
<td>Faculty</td>
</tr>
<tr>
<td>Academic program</td>
</tr>
<tr>
<td>Laboratory and allied staff</td>
</tr>
<tr>
<td>Library</td>
</tr>
<tr>
<td>Academic building and other allied facilities</td>
</tr>
<tr>
<td>Class size</td>
</tr>
<tr>
<td>Other facilities for students e.g., hostels, medical, transport, etc.</td>
</tr>
<tr>
<td>Quality of product</td>
</tr>
<tr>
<td>Research and publications</td>
</tr>
<tr>
<td>Industrial linkages</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Implementation &amp; Operation</th>
<th>Checking</th>
<th>Management Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of documents</td>
<td>Monitoring and measurement</td>
<td>Steps for Accreditation and ISO 14001:2008 Integration</td>
</tr>
<tr>
<td>Operational control</td>
<td>Non-conformity, corrective</td>
<td>Must continue through the year</td>
</tr>
<tr>
<td>Emergency preparedness and response</td>
<td>Internal Audit</td>
<td>An annual report be circulated amongst all stakeholders</td>
</tr>
</tbody>
</table>

**Management & infrastructure**
- Display policy and promote electronic communications.
- Hire HR for Doc. Control
- Make an environmental management committee.
- List staff trained in first aid and EHS.
- Add environmental due diligence to the existing routine.
- EME to focus on goals/targets achieved.
- EME to keep record of losses, actions, and effectiveness.
- Must continue through the year.
- An annual report be circulated amongst all stakeholders.

**Finances**
- As above

**Faculty**
- As above
- Faculty reports all env. shortcomings.
- Add first aid and fire fighting as preferred qualification.
- EME to suggest appropriate budget for env. management.
- Review of budget and expenditure on quarterly basis.
- As above
- As above

**Academic program**
- Communicate electronically to save time and paper.
- Train staff in document management and retrieval.
- Regularly review impacts of policy changes.
- As above
- As above
- As above
- Ensure regular review of the curricula and market demand.
- As above
- As above

**Laboratory and Allied staff**
- As above
- As above
- Regularly review impacts of policy changes.
- Ensure safety precautions are followed in the lab.
- And hood, eyewash, etc. work.
- Monitor lab staff health and performance.
- Conduct yearly risk management audit.
- As above

**Library**
- As above
- As above
- As above
- Display emergency exit and keep them obstruction free.
- Regularly check integrity of library materials & functioning of sprinklers and fire.
- As above
- As above

**Academic building and other allied facilities**
- N/A
- Keep records of occupancy and capacity enhancement.
- As above
- Conduct emergency drills.
- Check lights, fire extinguishers and other life amenities.
- Keep records of all changes and their impacts.
- As above
- As above

**Class size**
- Communicate electronically and through colorful displays.
- Remove expired keep records of occupancy and capacity enhancement.
- Keep all teaching aids and seating up-to-date.
- As above
- As above
- As above
- As above

**Other facilities for students e.g., hostels, medical,**
- Keep sign boards posted for guidance.
- Keep records of occupancy and capacity enhancement.
- Keep emergency guidelines posted, fire extinguishers operational & emergency drills alive.
- As above
- As above
- As above
- As above

**Quality of product The Student**
- Ensure student is fully equipped with two communication skills.
- N/A
- N/A
- Must know develop response in an unforeseen situation.
- Keep track of alumni activities.
- N/A
- N/A

**Research and publications**
- Communicate electronically to save time and paper.
- Develop an electronic library of institutional publications.
- N/A
- N/A
- Control duplication of research.
- Encourage institutional policies on quality research work.
- Make faculty as part of the internal audit.
- N/A

**Industrial linkages**
- Keep dialogue between industry and academia alive and pleasant.
- N/A
- N/A
- Always keep an honorable exit strategy in industry-academia projects.
- Encourage a two-way monitoring on the progress of the project.
- Keep budget and room for minor repetition of work and corrective measures.
- Include industrial projects as part of the internal audits.
- N/A
New Integrated Strategy

A new proposed strategy, integrating HEC’s accreditation requirements and basic requirements of ISO 14001:2008 certification, is presented in Table-2. It is neither required nor possible for each engineering institution to get ISO 14001 certification. However, integration of environmental values into the overall accreditation process would not only embed environmental values into academic activities but also add to the professional strength of the graduating engineers ultimately helping to inculcating these values into engineer’s lifestyle. He or she will not only be able to incorporate environmental aspects, impacts, and corrective measures, non-conformance reporting and frequent reviews leading to continuous improvement into the existing projects but also keep such criterion as part of every new project that he/she develops. Poor indoor air quality, insufficient light, non-ergonomic furniture, indecent amenities and overpopulated classrooms are common issues of most degree awarding institutions in Pakistan. Such issues can properly be addressed by incorporating ISO 14001:2008 requirements in the accreditation criteria. Development of a campus-wide integrated environmental & OHS Policy, and constituting an environment management committee with its leader as MR would help institutions in conducting frequent internal audits. The same committee can organize First Aid, OH&S, hazard management, cleaner production and fire fighting courses for the faculty as well as students. A system of emergency drills would help keeping all the safety equipment updated and functional. With incorporation of these activities as suggested in Table-2, the campus will be a lot more safer place and graduating engineers would have unknowingly learnt environmental due diligence as a life style for all future endeavours. Academic and environmental values can be particularly integrated in sections 1A-6A, 9B, 12B, 14B, 18B, 22B-24B of the table-1 in the light of recommendations outlined in Table-2.

Conclusions

Major focus of sustainable development is to ensure environmental due diligence in all kinds of activities and developments within organization’s means, and to maintain as well as enhance resources where possible so that future generations can enjoy the same or better quality of life. The strategy proposed in this paper would:

- Help bringing resource conservation at every step of engineering education
- Reflect environmental due diligence in all aspects of engineering degree programs
- Inculcate environmental care in academic as well as non-academic activities of future generations
- Incorporate environmental education in all engineering and non-engineering subjects leading to a new lifestyle based upon environmental due diligence as key performance indicator.

References