THE INSTITUTION OF ENGINEERS, BANGLADESH

BOARD OF ACCREDITATION FOR ENGINEERING AND TECHNICAL EDUCATION

TRANSFORMING EDUCATION FOR THE INDUSTRY: ENGINEER'S PERSPECTIVE IN ACHIEVING VISION 2041

SWAKKHAR SHATABDA

DIRECTOR, QUALITY ASSURANCE

BOARD OF ACCREDITATION FOR ENGINEERING AND TECHNICAL EDUCATION

PROFESSOR, UNITED INTERNATIONAL UNIVERSITY

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PREAMBLE

The educators in engineering programs prepare their graduates for the industry. The industry in Bangladesh is advancing to make up for its grave post-independence deficits. The foreseen national growth per the national visions needs to be visible in the international arena.

Vision 2041 highlights the need for accelerated developments at higher altitudes with the local customization of high-end up-to-date engineering and technological know-how, which must trickle down into the profession as the fruits of Industry 4.0 and the upcoming Industry 5.0.

Engineers from all disciplines will be the prime movers. Our current graduates enhance their knowledge and skills through lifelong learning while the educators prepare our future graduates with up-to-date knowledge. The academic arena and the industry floors need to be under the same roof for the acquisition and delivery of knowledge and skills and their enhancement. A transformation in the teaching and learning process is on the horizon. Engineering graduates will display their learning in the industry at home and abroad consistently over time. In the future, our industry will have to recruit more high-grade professionals from our accredited engineering programs, which are well recognized at home and abroad. The local availability of capable engineers is an attractive ingredient for foreign direct investments (FDIs). The contribution to the national economy from enhanced FDIs is unfathomable. The international job markets will see our graduates as active contributors to the causes of the world. The country can expect to see them as high-income wage earners to enrich our foreign-currency reserves. The visibility in circularity in investment in engineering education is imminent.

All these accomplishments are rooted in an internationally recognized accreditation system for engineering education, which the Board of Accreditation for Engineering and Technical Education (BAETE) of the Institution of Engineers, Bangladesh has been pursuing since 2003 for the entire spectrum of engineering in Bangladesh. BAETE's accreditation criterion, the "Program Outcomes and Assessment," focuses on the industry's needs and describes the industry's most sought attributes in engineering graduates. The "Interaction with Industry" criterion focuses on how the students are exposed to the relevant industries. The "Program Educational Objectives" provide a means to monitor the graduates' development for up to 5 years after graduation.

BAETE's accreditation has led to the formation of industrial advisory panels in many engineering programs to bring the industry closer to academia. Our continuous effort is to bring them even closer together. As BAETE updates its requirements for graduates with the incorporation of sustainable development goals, we must start with the right footing. Our goal is to set a guiding path for the programs to be on the right course, and we need the industry's close collaboration to do that.

With this aim, we are organizing the first national symposium with the theme "Transforming Education for the Industry: Engineer's Perspective in Achieving Vision 2041" to bring faculty members and industry personnel under the same roof.

Bridging the Gap: Effective Industry-Academia Interaction Models

Swakkhar Shatabda

Director, Quality Assurance
Board of Accreditation for Engineering and Technical Education
Professor, United International University

National Symposium on Transforming Education for the Industry: Engineer's Perspective in Achieving Vision 2041

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A Historical Perspective

- In ancient India, students used to stay at the farm with teacher and learned the skills needed (agriculture, medicine, etc).
- After graduation, they continued the path of their teacher or went on to contribute to the society or serve the fellow people.
- Similar systems were in place in China, Europe (ancient and medieval ages through guilds and workshops, etc).

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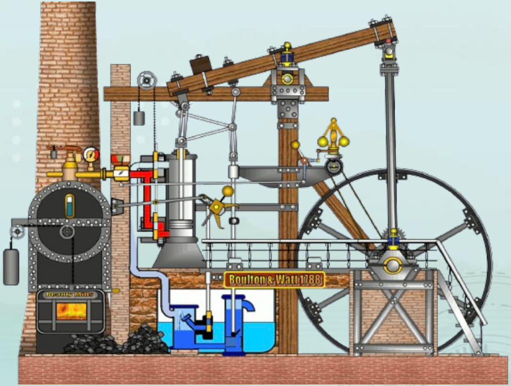
Example of an Early Collaboration

- Archimedes was an engineer from the ancient city of Syracuse in Sicily.
- Credited with designing innovative machines, such as his screw pump, compound pulleys, and defensive war machines to protect his native Syracuse from invasion.
- From his surviving written works, it is clear that he maintained collegial relations with scholars based in Alexandria, including his friend Conon of Samos and the head librarian Eratosthenes of Cyrene.

Archimedes (287-212 before J.-C.), Engraving (XVIth century).

Start of a Revolution

- The first steam engines was introduced by Thomas Newcomen.
- James Watt while working at the University of Glasgow when he was assigned the job of repairing a model Newcomen engine and noted how inefficient it was.
- He partnered with John Roebuck, a manufacturer, to develop a more efficient engine. Their collaboration resulted in a series of innovations that revolutionized power generation and laid the foundation for the Industrial Revolution.



The Steam Engine of James Watt and Mathew Bolton.

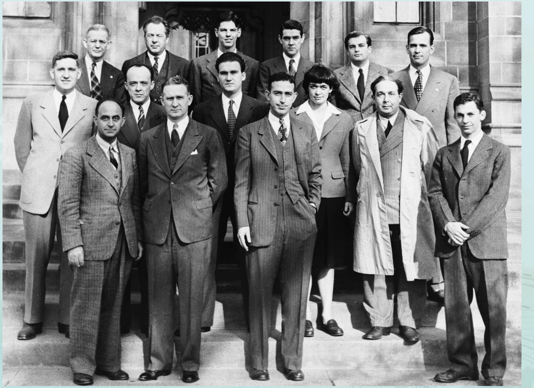
Rise of Research Universities

- The 19th century saw the rise of research universities in Europe and the United States.
- These universities placed a strong emphasis on scientific research and fostered closer ties with industry.
- The German university model, with its emphasis on applied science, served as a model for many institutions.

Humboldt University of Berlin.

The 20th Century: A Surge in Collaboration

- Significant increase in academia-industry collaboration.
  - **World Wars:** The need for technological advancements during World War I and World War II spurred collaboration between academics and industry.
  - **Government funding:** Increased government funding for research, particularly in science and engineering, fostered closer ties between universities and companies.
  - **Rise of new technologies:** The emergence of new technologies, such as electronics and computers, created new opportunities for collaboration.



University of Chicago team that worked on the Chicago Pile-1, the first nuclear reactor, including Enrico Fermi.

- **Silicon Valley Model:** Collaborations between universities and companies have led to ground breaking innovations and entrepreneurship.
- **Research Parks:** Universities with research parks have strong industry partnerships that drive research, development, and job creation.
- **Work-Integrated Learning Programs:** Institutions have co-op programs that integrate academic study with paid work terms, providing students with valuable industry experiences.

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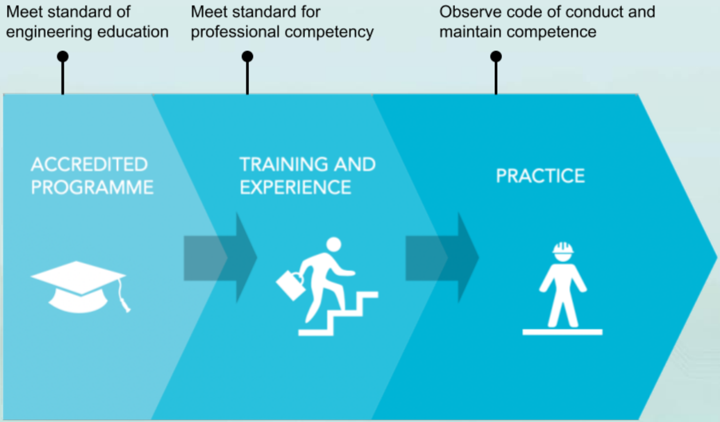
Accreditation Perspective



- Attainment of the program outcomes at the time of graduation
- Periodical assessment and review of program educational objectives

Program Outcomes

Analysis of problems and synthesis of solutions

Responsibilities

Required in workplace

Knowledge Profile

- PO a Engineering Knowledge (K1-K4)
- PO b Problem Analysis (K1-K4)
- PO c Design/Development (K5)
- PO d Investigation (K8)
- PO e Modern Tool Usage (K6)

- PO f Engineers and Society (K7)
- PO g Environment and Sustainability (K7)
- PO h Ethics (K7)

Complex Problem Solving (P)

- PO i Individual and Teamwork
- PO j Communication
- PO k Project Management and Finance
- PO l Life-long Learning

Complex Engineering Activities (A)

Complex Engineering Problem Attributes

- Complex engineering problems have a range of attributes. At least some (P1 and some or all of P2 to P7) of the following may be encountered within a professional engineering education program.

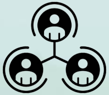
P1
Depth of Knowledge

P2
Range of Conflicting Requirements

P3
Depth of Analysis Required

P4
Familiarity of Issues

P5
Extent of applicable codes



P6
Extent of stakeholder involvement and needs

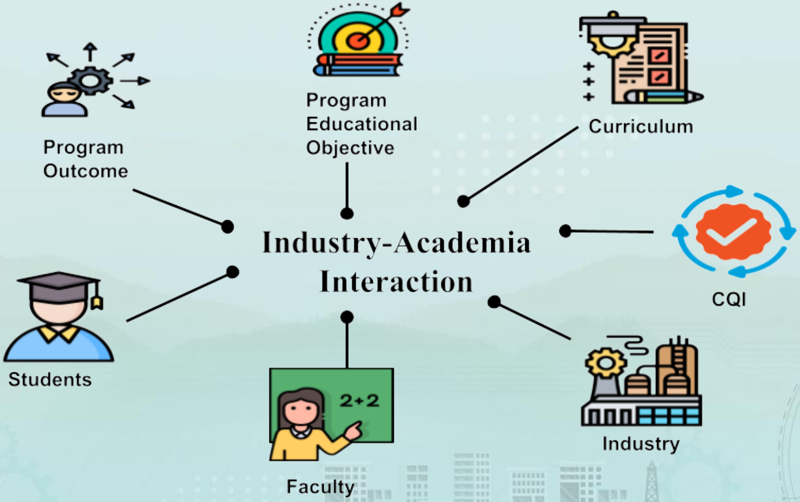
P7
Interdependence

Complex Engineering Activities

- The attributes of complex engineering activities, some of which might reasonably be encountered by a professional engineering undergraduate (eg. during capstone design or a period of industry experience).

A1	A2	A3	A4	A5
Range of Resources	Level of Interaction	Innovation	Consequences to society and the environment	Familiarity

Accreditation Criteria from BAETE Manual v2.1



Interaction Models - Higher Education Institution (HEI) Perspective

- Graduate recruitment
- Work/study programmes (e.g. internships)
- Assist in supervising/mentoring student projects
- Attend/sponsor student project exhibitions and Assist in the formal assessment of students
- Provide careers talks, guest lectures
- Provide ideas for student projects
- Involve industry in quality assurance, design and review of curriculum
- Field trips/visits to company
- Industry provide access to specialist equipment or sponsor equipment/labs

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Challenges for HEIs and Industry

- Lack of time to undertake collaboration
- Lack of financial resources to undertake collaboration
- Lack of awareness of benefits of collaboration
- Different motivations between university and business
- Bureaucracy within the universities / companies
- Companies lack awareness of university activities
- Differing time horizons for projects
- Difficulty in locating appropriate industry / university partner

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Challenges for HEIs and Industry

- Companies fear of disclosure of business knowledge
- Industry not interested in publishing results
- Lack of staff in companies with appropriate academic expertise
- Lack of staff in universities with appropriate industrial expertise
- Different mode of language and communication
- Interns / graduates lack the skills needed by the companies
- Lack of industry's influence in curriculum design and delivery

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Enabling Factors

- Employability / Access to talent pool
- Access to funding, R&D facilities and specialist equipment
- Industrial insight for the academic curriculum / Influence the university curriculum
- Ability to prototype/try out new ideas
- Increases profile of the faculty
- Access to industry knowledge and expertise of company staff / Access to research findings and scientific knowledge
- Close proximity of industry partner
- Commercial orientation of university
- Corporate social responsibility

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Case Study - I

- A case for final year design project
- Industry provides idea for the projects
- Two supervisors - one from industry / one from university
- A pool of companies to generate ideas for projects in each academic cycle
- Students meet industry supervisor for problem requirement analysis, design verification and validation.
- Financial responsibilities / Academic efforts required from companies - minimum!

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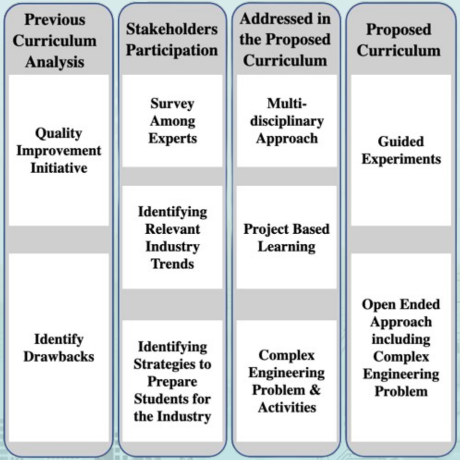
Case Study - II

- A case of curriculum design and review
  - Essential Continuous Quality Improvement (CQI) practice
- Microprocessor and Micro-controllers and Interfacing course for a Computer Science and Engineering Department
- Several experts from industry participated actively by providing feedback and assessing student projects
- A blend of guided and open ended design incorporating complex engineering problem solving and complex engineering activities



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SHORT BIO OF DR. SWAKKHAR SHATABDA

Dr. Swakkhar Shatabda works as a Professor in the Department of Computer Science and Engineering at United International University (UIU). He is the founding director of Bangladesh's pioneering undergraduate program in Data Science. His academic journey includes serving as the Director of the Institutional Quality Assurance Cell (IQAC) at UIU and presently, contributing as a member of the Quality Assurance Cell and as Director of Quality Assurance at BAETE. Dr. Shatabda earned his BSc in Engineering in Computer Science and Engineering from Bangladesh University of Engineering and Technology (BUET), followed by a PhD from Griffith University, Australia. His expertise lies in Artificial Intelligence and the applications of Machine Learning in Computational Biology. Dr. Shatabda has made significant contributions to the field, evidenced by his publications in leading conferences and journals. Additionally, he holds the esteemed position of Academic Editor at the PLOS One journal, further reflecting his dedication to advancing scholarly discourse.

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