UNIT V

AXIOLOGY OF ENGINEERING

ENGINEERING AND SOCIETY

Are you aware of the extent of the impact engineering has made on our society as a whole? In fact, engineers have completely changed the world we live in, from modern homes, bridges, space travel, cars and the latest mobile technology. Innovative ideas are at the heart of what engineers do, and they use their knowledge to create new and exciting prospects and solve any problems that may arise.

Health

The health industry has hugely benefitted from engineering. Advances in medical technology is solely down to engineers, and without it doctors would not be able to treat patients the way they do today; with fantastic success rates. Engineering has essentially allowed us to understand the medical issues in today's society.

Technology

Engineers are the reason for the phenomenal growth in technology of every generation. Just think about what the technological advances that are in our everyday lives; not only can we access the world with our fingertips, engineers have also allowed us to build satellites and machines that help us to understand the world we live and shape our lives on a daily basis.

Communication

Whilst on the subject of technology, the way we communicate has also vastly improved due to engineering. We can now get in touch with people at any time of the day in any part of the world. This has greatly improved the way we do business and how we talk to our friends, family and strangers on a daily basis.

Development

Steam engines, jet engines and aeroplanes are all down to hard work from engineers, and it has allowed businesses to work smarter and faster than ever before. Improvements to travel have changed the way humans connect with one another, opening trades for business and allowing us to literally travel to the other side of the planet in a mere 24 hours.

Space

Visiting Space may have been a mere dream in the past, but not anymore. The International Space Station is the largest and most complex science undertaking ever. It allows scientists, analysts and engineers from all over the planet to come together and conduct research that cannot be done elsewhere, finding answers to queries that have been unquestioned for years.

There are no aspects of the world we live in today that isn't affected by the work of engineers. The great thing is that engineering is continuing to affect society in a great and beneficial way.

ENGINEERS CODE OF ETHICS

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

II. Rules of Practice

1. Engineers shall hold paramount the safety, health, and welfare of the public.
    a. If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
    b. Engineers shall approve only those engineering documents that are in conformity with applicable standards.
    c. Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.
    d. Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise.
    e. Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.
    f. Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

Engineers shall perform services only in the areas of their competence.

. Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.
    a. Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.

b. Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment.

Engineers shall issue public statements only in an objective and truthful manner.

. Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.

a. Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.
b. Engineers shall issue no statements, criticisms, or arguments on technical matters that are inspired or paid for by interested parties, unless they have prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking, and by revealing the existence of any interest the engineers may have in the matters.

Engineers shall act for each employer or client as faithful agents or trustees.

. Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.

a. Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.
b. Engineers shall not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.
c. Engineers in public service as members, advisors, or employees of a governmental or quasi-governmental body or department shall not participate in decisions with respect to services solicited or provided by them or their organizations in private or public engineering practice.
d. Engineers shall not solicit or accept a contract from a governmental body on which a principal or officer of their organization serves as a member.

Engineers shall avoid deceptive acts.

. Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint venturers, or past accomplishments.

a. Engineers shall not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They shall not offer any gift or other valuable consideration in order to secure work. They shall not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

SUSTAINABILITY AND DIVERSITY :

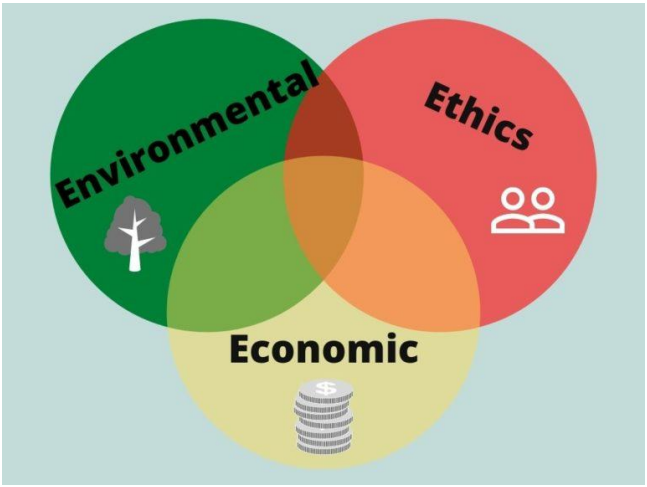
Sustainability is:

"Development which meets the needs of current generations without compromising the ability of future generations to meet their own needs."

In simple words: how we live today impacts the ability of our future generations to lead a good life. Our planet has many resources, some are finite while others can be replenished; however, in today's scenario, even our replenishable resources are depleting due to over consumption. Through sustainable practice we understand how to use our resources responsibly with a view to long-term consequences.

With this understanding, we could say that sustainability is about our resources and is mostly concerned with environmental issues. Therefore, often sustainability is interchangeably used for environmental sustainability. However, it is much more than that and can be explained by the **concept of 3Es**.

3Es stand for **environmental, economic and ethical** (also referred to as equity or social). Only a balance between all these three aspects could lead to sustainable development.



E #1: Environment

This is the **most discussed aspect of sustainability**. Companies are making huge efforts to reduce their carbon footprint, waste, water usage, non-environmentally friendly packaging and the overall negative impact on the environment. In order to achieve reduced carbon footprint, companies must consider their global operations, supply chain, factory or office locations, communities they operate in, and so on. To succeed in this task, they must effectively communicate and collaborate with individuals from diverse backgrounds and expertise.

A diverse, equitable, and inclusive workplace improves the environmental impact of a company. Here are **some ways of how it can be achieved**:

1. ***Equity and inclusion helps create equitable and inclusive processes:*** To successfully optimize the organization, it is important to include all the stakeholders and create processes that will enable each individual with the support they require. Without processes that include everyone and support individual needs, the company will miss out on a considerable segment of stakeholders participation.

2. ***Inclusive leaders possess higher cultural intelligence and skills to manage diversity:*** To improve the environmental footprint of a company, leaders need to effectively communicate with many individuals from different backgrounds, externally as well as internally. It is essential for them to understand how to manage diverse teams and possess cultural intelligence to succeed in their goals.
3. ***Diversity helps build better strategies:*** Having employees representing communities or locations the company operates in helps to better understand the positive or negative impact on the surroundings by the company's operations, this builds more trust and helps companies to build better strategies to support them.
4. ***Diverse teams are more innovative and better prepared to take bold actions*****:** Environmental efforts often require bold actions like rethinking the product design, supply chain, changing behaviours within the organization towards more sustainable choices. It has been proven that ethnic & gender diverse companies are 20% more innovative and 35% more likely to outperform homogenous teams (McKinsey, 2017); when the time comes to take bold actions and solve challenges, diverse teams are simply more prepared.

E #2: Ethics (Equity/Social)

Ethis is, unfortunately, one of the most overlooked aspects while developing sustainable strategies. Ethics is measured by the concept of **social license**, meaning that the company and its measures should be supported by its employees, stakeholders, and the community it operates in. To have an **ethical social impact,** companies need to work on **treating their employees fairly**, promoting **no discrimination policies**, supporting **flexible working hours**, **investing in local communities**, implementing **fair wages**, **ethical sourcing**, understanding the **supply chain**, and so on.

A diverse, equitable, and inclusive workplace improves the ethical or social impact of a company. Here are some ways of how it can be achieved:

1. ***Promoting Equity in the company***, ***ensures that everyone has access to the same opportunities and treatment.*** It also enables each individual to participate fully in the company's sustainability efforts. Employees feel valued and heard, therefore, they are much likely to support the measures of the company, and work towards a shared goal.
2. ***Inclusion leads to conscious decision making:*** Leaders who understand the dynamics of inclusive leadership and are aware of their own unconscious bias and privilege, make more conscious and fair decisions.
3. ***Inclusive workplaces have better psychological safety:*** Feeling safe is one of the key human requirements to perform efficiently. When employees feel safe within the company, they can bring their authentic selves to work, share vulnerabilities without fear of repercussions and are not afraid to fail. Thus, increasing the team performance, risk-taking ability and overall employee satisfaction level.
4. ***Diversity and Inclusion help the company reach a wider audience and avoid discriminatory pitfalls*****:** Having people from different backgrounds and including minority stakeholders gives the company an insight into the untapped markets, helps identify discriminatory (for example, racist or sexist) products, services marketing campaigns or practices; making the company a responsible brand for its customers and employees.

E #3: Economic

The economic aspect of sustainability is not just about being profitable, but also about **having good governance within the company**. This means that the management and other stakeholders like end-users, value chain, etc. are aligned on common interests. The company is transparent and avoids conflict of interests.

A diverse, equitable and inclusive workplace improves the economic impact of a company. Here are some ways of how it can be achieved:

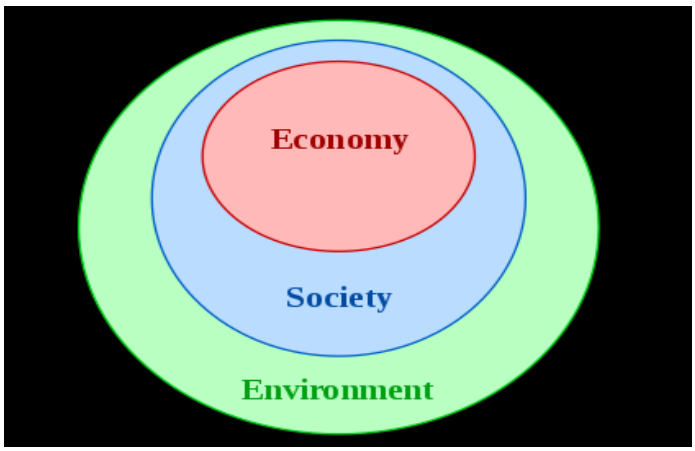
1. ***Diversity with inclusion is profitable for the business:*** Well-managed culturally diverse boards worldwide make 43% higher profits than homogeneous boards. This shows a direct correlation of why diversity is profitable for the business.
2. ***Inclusive organizations promote transparency:*** Inclusive organizations promote equal opportunities and a safe space for everyone, this ensures transparent communication leading to good governance.
3. ***Teams with higher empathy are better equipped to deal with conflict of interests and confrontations*** essential to maintain a fair governance and strong leadership.
4. ***Diverse and inclusive teams promote a trustworthy brand image:*** More diversity and representation within the company means that it is better able to understand different opinions from stakeholders, end-users, value-chain, customers etc. It is, therefore, easy to maintain trust and gain support from others.

To summarize, it is clear how **Sustainability and Diversity, Equity & Inclusion (DEI) are strictly intertwined**. The first step towards implementing a sustainability strategy is to ensure you work on providing your people a workplace where they can be themselves and contribute to their best abilities. Inclusive workplaces ensure that employees have a safe environment to undergo big structural changes and behavioral shifts, turning your sustainability efforts into success.

ENGINEER'S ROLE TO ACHIEVE SUSTAINABLE DEVELOPMENT:

Engineers should carryout their role in abroad context that encompass social, ethical, environmental and economic challenges. These six principles will guide an engineer to achieve sustainable development (Dodds and Venebles, 2005). They will help engineers meet their professional obligations to seek to achieve sustainability, and ensure that this goal is integrated into all their engineering activity. Contribute to building a sustainable society, present and future Engineers have a responsibility to maximize the value of their activity towards building a sustainable world. This requires an under standing of what society demands and what is achievable, and are cognition that these change overtime. They should.

- Recognize that though their activity may be local and immediate, the potential impacts of their work may be global and long-lasting
- have an understanding of other relevant social and cultural structures outside their own normal community of practice
- understand their important role in the sustainable development of communities
- recognize the impacts of an engineering project on communities, global or local, and incorporate the views and concerns of the communities



Apply professional and responsible judgment and take a leadership role Engineering is a profession with a strong ethical dimension. Engineers have an important role in providing solutions to the problems such as poverty, under-development and environmental degradation. Therefore the professional engineers should:

- look at the broad picture
- ensure that their knowledge about sustainable development is up-to-date
- be prepared to influence the decision-maker for a project
- Identify all the issues and options to the decision-maker about a projects of that decisions are soundly based
- Identify options that take account of economic, social and environmental outcomes
- Ensure that offered solutions and options will contribute to sustainability
- Be aware that there are inherently conflicting and un-measurable aspects of sustainability Do more than just comply with legislation and codes In seeking sustainable solutions, complying with current legislation, codes and environmental protection regulations may not be sufficient.

Therefore engineers should:

- Go beyond the minimum wherever possible, anticipating future legislation which may be stronger
- By their example, help others improve their performance
- Alert the relevant authorities if there are deficiencies in legislation and if sustainable solutions and outcomes could been dangered by regulatory change
- Use their technical expert is to drive new legislation and codes Use resources efficiently and effectively Engineers have as towards hip role with respect to planetary resources, and a responsibility to society to create more useful products and services with the lowest possible consumption of raw materials, water and energy.

This requires them to:

- Understand that there are environmental limits and finite resources
- Reduce resource demand by using less in the first place

- Reduce waste production by being efficient with resources that are used
- Use systems and products that reduce embedded carbon, energy and water use, waste and pollution
- Adopt strategies for re-use, recycling, decommissioning and disposal of components and materials
- Minimize any adverse impacts on sustainability at the design stage
- Work to repair any damage

Seek multiple views to solve sustainability challenges :

The increasing complexity of sustainability challenges means that engineers working alone cannot solve all the challenges that we face. Therefore it is important for engineers to:

- Engage with stakeholders, listening and recognizing the value of the perspectives of others, including non-specialists
- Avoid working in isolation, involving other professionals at all stages of a project
- Utilize cross-disciplinary knowledge and diverse skills
- Promote the important leadership role of the engineer in finding solutions to sustainability challenges for the benefit of society
- Seek a balanced approach

Manage risk to minimize adverse impact to people or the environment

Engineers are routinely involved in planning and managing projects where they should:

- Harness their skills to minimize damage to people or the environment from engineering processes and products
- Undertake a comprehensive risk assessment before a project begins
- Ensure that the risk assessment includes the potential environmental, economic and social impacts, beyond the lifetime of the engineering project

PROFESSIONAL ORGANIZATIONS FOR ENGINEERS

Engineering professional organizations provide important support to engineers. These groups work to advocate on behalf of engineers, provide professional development opportunities, publish updates on the latest innovations, and connect engineers to the community. Anyone pursuing a Master of Engineering Management degree would benefit from becoming a member of at least one of these organizations. Below find the top 5 engineering associations, which serve both the general profession of engineering as well as specific industries within the field.

- National Society of Professional Engineers
- IEEE
- American Association of Engineering Societies
- Society of Women Engineers
- International Engineering Consortium

Learning about five great professional organizations for engineers is the first step that any engineering graduate should undertake after graduating from college. Whether a professional is a man or a woman, looking for a nontechnical organization or a global consortium with international work opportunities, there is an organization that will fit the needs of every engineering. Here are some of the top organizations that are highly rated by current professionals in the field.

1. National Society of Professional Engineers

The National Society of Professional Engineers was established in 1934 and is one of the only professional organizations for engineers that has stated goal of addressing the non-technical concerns of professional and licensed engineers. It is a multidisciplinary national organization that encourages its members to discuss and critique its ability to create change for them within the field as well as providing continuing education and networking opportunities to support better career mobility. It is currently one of the only nontechnical organizations in the country to support engineers.

2. IEEE

The IEEE is noted for being the world's largest technical professional organization that prides itself on the advancement of technology in all fields of engineering. With over 420,000 members spanning 160 countries, it is an international organization that is active in corporate identity, governance, global public policy, and education. The IEEE is also renown for its collection of publications and conferences that often lead to employment opportunities for its members; professional engineers often cite the society as one of the first memberships they obtain after graduating from college, reinforcing the idea that a global network of engineers is a necessary step in evolving the field of engineering.

3. American Association of Engineering Societies

The American Association of Engineering Societies was established in 1979 is one of the five best professional organizations for engineers; it is a multidisciplinary organization that is dedicated to the knowledge and practice of the field. It is also known for providing access to all professionals in the field, including educators, government workers, and researchers. It is a nonprofit organization that aims to be a collective voice for the engineering community within the United States. The group also has a stated goal of working with international engineering societies, enabling the free flow of information and technology between countries, making it an exciting network for any professional.

4. Society of Women Engineers

The Society of Women Engineers focuses on women within the field; it is an association that delivers continuing education as well as networking opportunities to its members. It is one of best professional organizations for engineers because it provides leadership workshops, educational programs, and more in an inclusive manner for women who are interested in becoming the best in the field. Membership to the society includes resources, debate forums, awards and recognition programs, publication opportunities and more, enabling women engineers to do everything from further their career to opening up discussions about diversity in STEM.

5. International Engineering Consortium

The International Engineering Consortium was established in 1944 and is the leading nonprofit organization that brings together both universities and engineering societies for the purpose of the continuing education of engineers. By offering engineers the chance to take on post-professional education through its programs, the consortium is ensuring that the field continues to evolve as the understanding of engineering changes with new advancements and technologies. The IEC is also the head of the Electrical and Computer Engineering Department Heads Association, which is dedicated to sharing information among American Universities about the industry and any changes it encounters, passing that information down to students at the undergraduate and graduate levels.