

TECHNICAL REPORT

ON

INPUT OF MECHANICAL ENGINEERING IN THE ACHEVEMENT OF SUBTAINABLE

DEVELOPMENT GOALS

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CERTIFICATION

# This is to certify that this work was undertaken by ONUOHA STEVE IKENNA, prepared and presented to the department of MECHANICAL AND MECHARONTICS ENGINEERING, Afebabalola university, Ado-Ekiti (ABUAD), Ekiti state, Nigeria.

DEDICATION

# This report is dedicated to my family, friends, The department of mechanical Engineering and to my colleagues

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Firstly, I would like to appreciate God almighty for giving me this rare and wonderful priviledge/opportunity to increase my knowledge, discipline, understanding and experience in my discipline

My profound gratitude to the college of engineering, Provost of the college of engineering Engr . Prof Dada and I want to appreciate the members of the academic and non-academic staff of this AfeBabalola University (ABUAD)

I would also like to say a big thank you to my parents and siblings for always being there for me and always supporting me with their prayers,I pray that god will continue to bless you.

# ABSTRACT

problems facing the development of technology were discussed as well as the way forward. Based on the challenges of our immediate society, the level of our technology can only be improved when our teaching and curriculum is reviewed. Hence, the study suggested that our approach as mechanical engineers towards research must change from the basic research concept to applied research concept. This would not only improve the academic sector but hasten the rate at which problems are solved by the mechanical engineers in the society, thereby bringing sustainability. More so, failure of engineering component is always attributed to design. This study further suggested on the need to improve the design of engineering systems to improve its sustainability while in service. The impact of the developed product must be felt in terms of green technology.

# WHAT IS ENGINEERING SOCIETY

# . Introduction

# On becoming a contemporary mechanical Engineer: everything changes, everything is connected, engineering and engineers have never mattered more.

# An engineering society is a professional organization for engineers of various disciplines. Some are umbrella type organizations which accept many different disciplines, while others are discipline-specific. Many award professional designations, such as European Engineer, professional engineer, chartered engineer, incorporated engineer or similar. There are also many student-run engineering societies, commonly at universities or technical colleges.

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IMPORTANCES OF ENGINEERING SOCIETY

Engineering is a very important discipline in the world of today. The importance of this area of specialization by many people is felt all over the world. In the current world we exist in, no country will succeed without the adoption of engineering practices. The importance of engineering in our world is numerous. This piece is just an introduction to the topic under discussion because splitting the topic in detail will occupy a large volume of text.

What is engineering? Engineering is a profession in which scientific knowledge and mathematics, gained through study, experiment and practice are applied with intuition or judgment to develop ways to use economically, the materials or forces of nature for the benefit of mankind. So many authors have given their personal definitions on their understanding of the word “engineering”. This word has turned the face of the earth to look more interesting and accommodating.

In the years back, there was nothing like electricity, which has made work easy and improves the standard of living. As of then, our forefathers were timid and live in the society that was not transformed through electricity. Because of the efforts of engineering, electricity has advanced and man utilizes it to achieve his goals in life.

In our homes, schools, offices, agriculture, automobiles, banks, security, and so many other areas, we observe the applications of engineering. In fact, you may not be able to read this article effectively without the underground works performed by engineers before the final manufacturing of the device. Engineering is a faculty that have been making machines with unique properties everyday. It is filled with experts that have great innovative ideas.

**The Major Importance of Engineering**

The importance of engineering to be elaborated on are related to six key areas. These six key areas are the importance of engineering in:

* Agricultural;
* Banking;
* Automobile;
* Educational;
* Marketing; and
* Health sectors.

## Agricultural Sector

* Agriculture simply put is the cultivation of crops and rearing of animals. This definition is as related to agricultural science. Due to the advancement in the agricultural practice, agriculture has developed a strong link with the field of engineering. It is because of the magnitude of this link that leads to the creation of agricultural engineering, which is among the branches of engineering. This engineering branch takes care of agricultural related affairs.
* In our today’s world, hardly will you see a commercial agricultural farmer that does not make used of machines to increase the rate of his or her agricultural output. This importance added by engineering has really promoted the practice of agriculture all over the world.
* There are specific kinds of fertilizers for specific kinds of crops. These fertilizers in most cases are products of chemical engineers. They look into the chemical constituents of the manure and used the result generated from the scientists to know which will have good effects on crops and go into their productions.
* In the dry season, there is no rainfall, yet agricultural products are being supplied to markets where they are being sold to the consumers. The question is: how are these products made available irrespective of the fact that is usually no rainfall in the dry section of the year? Drilling engineers are among the people that make those products available as through the work they do generate water from beneath the ground. It is the water that is used to keep the crops growing through the irrigation system.

## Banking Sector

* Sometimes people argue on why engineers should be found in any bank. They do say that none of them suppose to be there because there is a big difference between the two disciplines. The fact remains that engineering is a course of men who can withstand pressure and a great test. Because of this, bank sometimes chooses graduates from this discipline to work with. That is why some engineers are found in the marketing department of various banks today. Banks are interested in who will give them what they want and not just who studied their related course in the tertiary institution.
* Engineering plays fundamental roles in banking institutions of various societies. In a bank, there are many engineers that engineer the affairs of the banking activities. Without these engineers, the banks will not function effectively. Banks are advancing on a yearly basis and they have been demanding the services of the engineers (especially Software and Networking Engineers) to make the advancement unique. Engineering in banks has added a lot to the quality of services that banks render to their customers.
* Let us start with the one every bank customer is aware of before going deep in the other area of the banking activities. Gone are days when bank cashiers count money with the manual process using their fingers. Today, the money is being counted within few seconds by money counting machines. Who manufactured those counting machines used in the banks for counting of money? The answer is nobody else than the engineers. That is to say that the money counting machine would not have been in existence if not because of the engineers.
* What of the computers used by bank staff during their banking activities? Are these computers thrown from heaven for the banks to start marking use of them? No, at all because they are physically made through computer engineering and then supplied to the banks that make use of them.
* Modern day banks cannot function without the use of durable bulletproof doors, to be protected from the hands of the armed robbers. The features of these kinds of doors are usually made of glass and some others steel. Metallurgical and materials engineers that deal on glass and steel are the people that test and confirm the strength of the materials used in the production of such doors so that they can resist the effects of bullets (bullet proof doors).

## Automobile

* People like to have mobile houses of their own if they have the money to make a purchase. Automobiles have helped in a great way to ease the stress being faced by the man from moving from place to place. These automobiles are into existence because the engineers came up with the idea and they succeeded in making it accessible to people all over the world.
* What is automobile? According to Oxford Advanced Learner’s Dictionary, an automobile is a car. It is engineering that is being studied that gave birth to many designs of cars that are all over the world. Starting from the making of the cars from the scratch, mechanical engineering makes it possible. This is the category of the engineering field that first designs the shape of the car in question before the final production.
* When it comes to the making of the engines of the automobiles, metallurgical engineers play their own roles as well. This is evidence on the importance of engineering in the beautiful world of the automobile. Metallurgical engineers make proper effort to find out the proper quality of alloys to be used in the production of the engine blocks before finally casting the engine of the vehicle. The casting of the engines of vehicles can be carried out using any convenient casting processes, especially [investment casting process](https://hubpages.com/education/investment-casting-process).
* The author of this article who is a graduate of Metallurgical and Materials Engineering is currently developing a book which discusses the applications and importance of Materials Engineering in the society. This is a sound book that will serve as an eye-opener to people who want to know more about the engineering field.
* The piston and the gears of cars are products of casting carried out by metallurgical engineers during car production. When investment casting is used to make these parts, high accuracy is obtained. But other casting processes can be used for the production.
* The importance of engineering in our society made it possible for car owners to drive so many designs of cars each year. Someone may be driving Honda 2008 model and all of a sudden hear that the latest Honda of 2015 which has more advanced level has been produced by the company. What he does on hearing this is to sell his old modeled Honda and go for the new design, all centering on the importance of engineering in the society.

## Educational Sector

* Education is very important in the life of every intelligent individual, and it has been spiced up with the contributions of engineering. It will be boring without the presence of engineering in it. The works of the engineers are seen in all levels of education; primary, secondary and in the tertiary level. People on many occasions have got involved in debates based on the positive contributions of engineering in the education department.
* Starting from the clothes that teachers and the lecturers wear to classes where they teach the students on the knowledge they need to acquire, the clothes would not have been made if engineering is ignored. That you as are a reader of this piece of write-up wear cloth on your body right now is a product of textile engineering field.
* In various institutions of learning, it has been made compulsory that every school will have computers integrated as part of their academic study or curriculum. These computers being talked about are made possible because of the efforts being put by the computer engineers. Some higher institutions have air-conditioners installed in their lecture halls to make the students feel comfortable learning in a good environment. This machine that maintains a certain level of temperature in lecture halls and offices in educational institutions are all products of engineering.

## Marketing

* What business does engineering have with marketing? Has engineering in any way contributed to the level of marketing activities in our society? The answer to the questions is yes. Engineering in totality has greatly impacted much in the marketing sector. Marketing is the action or the business of promoting and selling products or services. The promotions of services and products have been made possible as engineering continues to advance on the daily basis.
* The internet has helped many businessmen in the marketing of products and selling some useful services to their customers. People sit with their computers and advanced mobile phones and promote their businesses through this channel. Presently, there are many websites created where people go and render services to get paid in turn for the work well done. An example of such website is the one called Fiverr. This is a website that has been a source of daily bread to people from different parts of the world. There are dozens of services being offered by sellers in that website including web and graphics designs, promotion of books and other tangible goods, application designs, sound cloud works, writing businesses, and so many others.
* Because of the importance of engineering in the field of marketing, people can use their mobile phones, which are the products of engineering, to order for goods from other countries which get supplied to them within few days. Also, some business owners have hosted many websites on the web where they tell people all over the world of products and services they sell without the buyers visiting the location of the business company.

## Health Sector

* Health and engineering; any similarity? Do you think the two have something in common or does engineering have an influence on it? Beyond any reasonable doubt, the health department of every country firmly depends on engineering to achieve any of their goals in the health status of the patients being admitted to the hospitals. It is true that engineering does not have any business with the drugs being used in hospitals as that is the business of pharmacists, but, what about the other equipment used in the hospitals?
* Let us start with the instruments which the doctors used whenever they are carrying out surgery. Do you think the materials of that nature are being produced by the doctors? No, because starting from the pattern making to the final finishing stages of such equipment are being carried out by the engineers. Examples of such instruments are the scalpel, surgical lamps, stethoscope, and so many others. All these instruments are made available to the surgeons with the help of engineering.
* There are situations where the patients are not manually diagnosed by the doctors to find out the cause of a particular illness. In such complicated cases, the doctors use computers to find out the cause of such illness. These computers are being produced by the engineers who apply engineering principles to automatically detect problems in the human system

**WHAT IS SUSTAINABLE DEVELOPMENT**

**Sustainable development** is the [organizing principle](https://en.wikipedia.org/wiki/Organizing_principle) for meeting [human development](https://en.wikipedia.org/wiki/Human_development_%28humanity%29) goals while simultaneously [sustaining](https://en.wikipedia.org/wiki/Sustainability) the ability of natural systems to provide the natural resources and [ecosystem services](https://en.wikipedia.org/wiki/Ecosystem_services) based upon which the [economy](https://en.wikipedia.org/wiki/Economy) and [society](https://en.wikipedia.org/wiki/Society) depend. The desired result is a state of society where living conditions and resources are used to continue to meet human needs without undermining the integrity and stability of the natural system. Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

**. Sustainable Development in Terms of Mechanical Engineering**

 In March 20, Brundtland [3] submitted a United Nations report titled 'Our Common Future' there the idea of sustainable development was first highlighted in the Word Commission on Environment and Development. Sustainable development is a creation that was done to meet the present generations need and as well not querying the capability of generation to come, in meeting their demand [4]. Sometime this can also be defined as: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability therefore, encompass the system of managing ecological balance by protecting the generation to come by not eroding the natural resources. Definition by Bruntland has attained universal acceptance and many see this as means of delivering sustainability as a result of current unmanageable style of society. In 2005, for instance, the Royal Academy of Engineering published principles guiding sustainable development on energy, which can resolve the challenge that, "we are surpassing the planet capacity to accommodate our emissions and many of the resources we used, whist most essential need of majority that occupy the planets cannot be meet. [5]. According to Ehrenfeld, [6] sustainability is the key possibility that will enhance human life to flourish on the planet forever".

 An acceptable universal definition for sustainability is difficult to achieve as it is expected to get many things done. The earth will be able to support itself if sustainability is achieved. Earth Charter speaks of on "a sustainable global society founded on respect of nature, universal human rights, economic justice and a culture of peace". But generally, the concept of sustainability is built on three pillars as shown in Fig. 1. Fig. 2 shows the interaction among the three elements of sustainability: Society, Economy, Environment and all this three element has their foundation built in mechanical engineering [7].



Fig. 1: The three pillars of sustainability [2]. Fig. 2: Sustainability diagram representation [7].

 **Impacts of Mechanical Engineer on Sustainability in Terms of Population, Aggression and Pollution**

 The impact of mechanical engineer on sustainability is major on the environment and hereby simply divided into three components: population, aggression and pollution.

 ***Population***

 United Nations population estimates and projections, United nation estimated that world population will be about 7.55 billion in 2017, and may surpass 11 billion people by 2100 as shown in Table 1. The world is metamorphosed radically, and the word population will continue to increase daily as there are more rural area to urban area migration which demands for adoption of sustainable acts. Requirements for green technology to sustainable energy, clean air, drinking water, green transportation, safe waste disposal and renewable energy should be considered.

Table 1. Population of the world and regions, 2017, 2030, 2050 and 2100, according to the medium-variant projection

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Region  | Unit  | 2017  | 2030  | 2050  | 2100  |
| World  | billion  | 7550  | 8551  | 9772  | 11184  |
| Africa  | billion  | 1256  | 1704  | 2528  | 4468  |
| Asia  | billion  | 4504  | 4947  | 5257  | 4780  |
| Europe  | billion  | 742  | 739  | 716  | 653  |
| Latin America and the Caribbean.  | billion  | 646  | 718  | 780  | 712  |
| Northern America  | billion  | 361  | 395  | 435  | 499  |
| Oceania  | billion  | 41  | 48  | 57  | 72  |

***. Aggression***

 The attitude towards the natural life and biological system shows that human belligerence toward both animals and plants, for example the issue of wildlife, forests and the extreme rate of over exploring the natural resources available such as wood, water, petroleum, coals, minerals has affected the possibility of achieving environmental sustainability [2].

***. Pollution***

 Engineering has driven and steer industrial innovation and improved the prosperity of human. In turn, this has led to the creation of new and important group of problems to the environment which range from exposure to air pollution, toxic exposure to water, food, soil, depletion of non-renewable resources (Solid minerals, petroleum, wood), destruction of ecosystem and global climate brunt. Human effects on the climate incorporate the air contamination in urban communities, the poisons including dangerous synthetic concoctions like nitrogen oxides, sulphur oxides, unstable natural mixes and particulate issue that deliver photochemical exhaust cloud and corrosive rain, and the chlorofluorocarbons that debase the ozone layer.

 Particulates, for example, sulphate pressurized canned products in the climate lessen the immediate irradiance and reflectance (albedo) of the Earth's surface, a marvel known as worldwide diminishing, the reduction is evaluated to have been around 4% in the vicinity of 1960 and 1990. Worldwide darkening may have disorganising the worldwide water cycle by decreasing, vanishing and precipitation in a few regions and cause cooling effect also [10] In other to actually achieved sustainability development goals, mechanical engineers need to develop mechanical systems that will help in harvesting all this natural resource stated in section 3.2, 3.3, 3.4 without having environmental pollution on the communities.

## . Roles of Mechanical Engineer in Terms of Design and Infrastructure

 System design, infrastructure provision and engineering enterprise management, are main concern of mechanical engineers, as making decision is an act that is performed throughout the life-cycle of the infrastructure, enterprise, process or product. Mechanical engineers play lots of role of such life circle decision making. The one been utilized in most continent is partitioned into five principle phases, which involve Life Cycle Engineering means to integrate state of the art technologies into subsequent sustainability and to enable information and statistics flow as shown in

Fig. 3

* Frame work requirement, Feasibility Study usually cover this.
* Decision scoping, Project Definition Study often capture this.
* Preparation and comprehensive design stage
* Execution, supply and run
* The end of useful life and Maintenance, Repair and Overhaul (MRO)



Fig. 3: the role of mechanical engineers in design and infrastructure

 The accompanying segments give direction on how sustainability contemplations and a feasible way to improvement and deal with designing with impact making decision at each stage [8]. Qualitative and participative style is suitable for framing and definition of scope decision [9]. While analytic and strategic method is suitable for planning and design. Furthermore, quantitative and managerial skill where best for execution, supply and running the product. User and stakeholder preference and desire must be capture at all time throughout the duration of this process. When the phases of decisions are implemented, supplies, up and running, it has impact on the future development. It of importance to note that earlier involvement of sustainable development in the process of execution, delivery and functioning stages benefit from rigorous examine of sustainable development issues. From there on unforeseen challenges with resource scarcity due to short sightedness might lead to overturning the at risk sustainable efforts. Engineering decision and execution need to use standard of sustainable development at all stage [5]

###  Requirement framing

 Framing the requirements draws in a description of the necessity or coveted results [11].

Advertisers describe this the 'necessities and needs' for new commodity or service, and the surrounding is finished by portraying the challenges, issue or problems to be handled in its general setting and vital concurring the limits to the decision making. Regularly, such work and results are attempted and decided through a Feasibility Study be that as it may, at the opposite end of the size of engineering projects; they may essentially be done in the beginning periods of a generally consistent outline process.

 Progressively, there is likewise a need to acknowledge deliberately what it is adequate to fabricate or make the customer or client for the engineering design unable to suit a significant jump in design idealization to acknowledge a full practical improvement approach. This approach from a sensible point of view should be incorporated into the plan [12].

###  Decision scoping

 In this phase, important effort will be vital to conclude on cautiously constructed characterization of the challenge(s) to rectified the problem(s) encountered, therefore to decide on the goals, purposes and aspiration for the project in order to developed the engineering decisions. These results are accomplished through an established project descriptive research or plainly outcome derived from the earlier phases of the smoothly continuous design proceeding previously hint at.

 It is pivotal to the effective conveyance of sustainable development to understand that this is the phase where thorough thought of sustainable development challenges, and specifically a support to severe approach will create the best advantage. The more outline choices are derived at this phase without thought of sustainable development, the less sustainability development can be achieved.

### . preparation and comprehensive Design

 Preparation can effectively be grouped as an analytical process that introduces the action that will be taken, which involves an assessment of the alternative accessible, developing the aims and goals that would display a favorable outcome and a method of attaining them. Comprehensive design at that stage involves the creating of results, component or process preparation, or groundwork preparation that attains the entire numerous yet associated prerequisites, wellness for reason, security, quality, esteem for cash, aesthetics, constructability, and usability and material proficiency. It is accomplished that alongside the reduction of the antagonistic socio-environmental impacts, the augmentation of the surroundings where attainable, and the improvement of quality of life for end users, workers and nearby resident alike. This is a substantial threat for engineering designers yet one that can with cautious idea, imagination, advancement and persistence be conveyed for societal advantage. Despite the fact that there is a different phase of 'End of usable life' to think of, is indispensable that, at this Preparation and Design phase, dynamic thought of these challenges is incorporated. A major instance of such attention is the significance of design for dismantling, to consider the utmost reuse and recycling of the resources installed in the infrastructure or end result or goods created.

### . Execution, Distribution and Service

 Execution, distribution and service involve the critical recognition of the designs, for instance, a genuine product, development of advanced foundation or application of a recent method or practice in chemical engineering. It bears rehashing that it is vital to perceive that prior practical methodologies are to a highly powerless at this phase to being toppled through foolhardy reactions used in unanticipated troubles and resource requirements, e.g., the cost lessening measures taking on the appearance as ‘value engineering’. The fundamentals of sustainable development as a result, have to be adapted in all levels in an engineering resolution reached and also in its applications.

###  The End of Useful Life

 All devised and concoct commodity or goods created, methods, framework and groundwork would always resolve to a designed and truly existing design life, after which sustainability and a sustainable advancement or feasible development approaches a request proceeded with use of the reasoning which is of now examined. The revolution of resources for additionally utilizes, or for re-retention into the earth, through recycled, reusing or disposition, is an essential component of sustainable development, for which the term 'rumination' has been proposed or recommended [13].

 The waste order must be practiced or adaptive: Firstly, anticipate events that may call for reuse or recycling; If that isn't attainable, at that point create a realistic or useful chance in recycling; If after maximizing useful recycling should disposition be deliberated upon; After that, a rehabilitation of the energy incorporated into the material to be discarded of should be desired, with discard to landfill being deliberated upon as the final option, not the initial option as is often the scenario at hand.

Conclusion

 The engineers need to be very conscious about the growing environment amid the consumers and overall law of a government or constitution, within reach is a huge burden and tension on inventors as well as engineers in working, in achieving sustainable developments. The development here is defined in terms of industrialization, is fundamental, essential, necessary and imperative for the social-economic advancement of any communities. Antithetical to environmentalist, sustainability is an approach or notion which takes into consideration the sociochemical, public and, the fiscal or monitory targets and as an alternative, the measurement of a community or association.

 In conclusion, to achieve a global transformation on our economy through sustainable development, we have to promote our current policies and channel our vision into the vision of the United Nation agenda for sustainable development. Aside that, young minds in mechanical engineering should be trained in anticipating the sustainability problems oppugn at contributing to a global sustainable development

Recommendation

 Higher institutes of learning should consequently develop new perspectives in teaching mechanical engineers the required knowledge in achieving sustainable development in whatever environment the students is position in future and must be contingent upon the ability to adapt to threats to sustainability and engaged oneself within the progression of the world. A debateable and project familiarize with teaching and a good learning foundation or core should be marked in outline, which present the prospective essentials and important proficiency for inexperienced and blooming engineers.

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Reference

 [1] E.W. Aslaksen. The Relationship Between Engineers and Society: is it currently fulfilling its potential ?. InJournal and Proceedings of the Royal Society of New South Wales 2015 (Vol. 148, No. 455/456, p. 28). Royal Society of New South Wales [2] M.E. Abu-Goukh, G.M. Ibraheem, H.M. Goukh. Engineering education for sustainability and economic growth in developing countries (the Sudanese Case). Procedia-Social and Behavioral Sciences.2013 Nov 22; 102:421-31

 [3] G. Bruntland. Our common future. The World Commission on Environment 1 and Development. 1987:45-65. [4] N. Ralic, & D. Milosevic'. Several experiments from the education for sastainable development. (CP1203), 7th International conference of the Balkan Physical Union, edited by A.Angelopoulos and T.Fildisis. American Institute of Physics, 2009. [5] A.M. Forster, N. Pilcher, S. Tennant, M. Murray, N. Craig, A. Copping. The fall and rise of experiential construction and engineering educat