

TECHNICAL REPORT

ON

INPUT OF MECHANICAL ENGINEERING IN THE ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT GOALS

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**DEDICATION**

This thesis is dedicated to my parents, who has always supported me and taught me that anything can be accomplished with the right mind set and by one step at a time. It is also dedicated to my lecturers who took their time to impacted this knowledge unto me.

**ABSTRACT**

The study focused on the role of mechanical engineers towards achieving sustainable development. Critical reviews of the 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 and improved upon to further benefit students, lecturers, engineers, and other practitioners of the field. 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.

**CHAPTER 1**

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

* 1. **DEFINITION OF MECHANICAL ENGINEERING**

One of the most diverse and versatile engineering fields, mechanical engineering is the study of objects and systems in motion. As such, the field of mechanical engineering touches virtually every aspect of modern life, including the human body, a highly complex machine.

The role of a mechanical engineer is to take a product from an idea to the marketplace. To accomplish this, the mechanical engineer must be able to determine the forces and thermal environment that a product, its parts, or its subsystems will encounter; design them for functionality, aesthetics, and durability; and determine the best manufacturing approach that will ensure operation without failure.

The modern world comes with a lot of moving parts. From the way that the clock on your wall ticks away the hours to the spinning of your car’s wheels on their axle, it takes many precise pieces and movements to keep things running smoothly. While it takes many hands and machines to put together something so complex as a car, those hands know what to do because of a mechanical engineer.

Mechanical engineers work across a huge variety of industries conceptualizing, designing, and creating machines as well as their components. Though it is one of the oldest engineering disciplines, it is also one that continues to change and grow with advancements in technology making it a vibrant and exciting career path even to this day.

Though it may not be a discipline that most people spend time thinking about, mechanical engineering is critical to so many aspects of everyday life, from modern conveniences to basic understandings of science. Indeed, mechanical engineering is one of the oldest scientific disciplines and can be traced back centuries to the great thinkers of Ancient Greece like Archimedes. Contributions from these ancient engineers include chariots with differential gears, water clocks, and even a primitive steam engine.

In 1206, one of the foundational books of mechanical engineering was written by Muslim inventor and engineer Al-Jazari, called Book of Knowledge of Ingenious Mechanical Devices which included the beginnings of such important modern designs as the crankshaft.

As scientific thinking continued to progress, mechanical engineering expanded to include more analytical thought, particularly with Sir Isaac Newton’s laws of motion, which were integral to continued engineering progress. In the U.S., the first three schools of mechanical engineering included the U.S. Military Academy, Norwich University, and Rensselaer Polytechnic Institute, which were all in full operation by 1825.

Ultimately, most things that we use today that involve any type of moving parts comes, at least in part, from the minds of mechanical engineers and that is unlikely to change any time soon. Even the development of more sophisticated electronics and other technologies will depend at least in part on mechanical engineers. That is why mechanical engineering is an interesting and essential area of concentration.

**2 What is mechanical engineering and Who is a Mechanical Engineer?**

Webster dictionary define mechanical engineering as discipline which make use of applied engineering, engineering mathematics, physics and materials science principles to design, analyse, manufacture, and maintain mechanical systems. Mechanical engineering has been ones broadest and oldest within engineering disciplines. Requirements of mechanical engineering field need knowledge of core areas including thermodynamic, mechanics, material science, dynamics, structural analysis, modelling and electricity. Furthermore, to these core principles, mechanical engineers use tools such as computer-aided design (CAD), computer-aided manufacturing (CAM), and product life cycle management to design and analyse, industrial machinery, weapons, manufacturing plants, aircraft, industrial equipment, medical devices, robotics, heating and cooling systems, transport systems, watercraft, and others. This branch of engineering involves design, production, and running of machinery.

American Society of Mechanical Engineers (ASME) described mechanical engineers as the one who create and develop mechanical systems for all of humankind. The principles of force, energy and motion are being concern, mechanical engineers use their knowledge of design, manufacture, and operational processes to advance the world around us, improve safety, ability to manage economic with strength and enjoyment throughout the world. Mechanical also developed machine and tool that produce product that range from sport equipment to pharmaceutical devices, medical devices, personal computers, humidifiers, dehumidifiers, automobile engines, robotic arms, electrical power plants and solar driers. Mechanical engineer usually touches all section of life, spanning industries with limited barriers, opportunities for mechanical engineers to build up their career are enormous as opportunity are available worldwide throughout many companies ranging from large multinational to small local companies.

**3. 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.

**3.1. 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.

**3.2. 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].

**3.3. 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.

4. 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.

❖ 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)



**4.1. Requirement framing**

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

**4.2. 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.

**4.3. 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 favourable 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.

**4.4. 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.

**5. 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 sociophysical, 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.