Ancient Engineering Philosophy For Sustainable Development

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Abstract - Ours is an era that places great emphasis on sustainable development and lifestyle as an all-encompassing philosophy. Therefore, it is imperative that we demand philosophical values based on sustainable development that can direct the attention of the public in general and engineers in particular to adopt and use the kind of technology that helps in the development of social and moral issues related to decision-making This means that the role of engineering not only provides planning, design and construction, but also has a responsibility to help protect the environment by restoring natural resources for future generations for which we also need to look back in time to understand the ages old idea of sustainable practices. Sustainable engineering is part of the creative process of using science and technology and using energy and resources at a rate that does not disrupt the integrity of the natural environment. Sustainability, understood in a holistic framework, is a complex and multifaceted vision of development that limits economic growth and other human activities to nature's capacity for self-regeneration and places progress in the human condition and respect for the perfection of the environment. This paper is an attempt to articulate an ancient solution to this modern problem of ethical concern.

KEYWORDS: Engineering, Sustainable development, Technology, Philosophy, Ethics, Environment, Awareness.

I. INTRODUCTION

The 21st century is a revival of the natural philosophical style of thinking. However, current trends offer meaningful new thinking about cultural understandings of technological development. Technology is always adapting to changing conditions and therefore alternative technologies are possible. Natural sciences and technology are embedded in the web of tradition. Innovation is subsequently linked to the transformation of tradition. Technological development can be understood as a cultural-historical process. The philosophy of engineering is an quite a new discipline that considers what is engineering, what engineers do, and how their work affects the society, and thus includes aspects of ethics and aesthetics.(1) In order for an organization to function smoothly, efficiently, a large number of decisions must be made. Engineers organizing technology typically receive no formal training in morality and ethics in modern education system. In addition, progress in technological action has an ethical dimension. It presents a challenge to individuals or engineers who are responsible for the advancement of technological development and believe that the technological working condition and fulfilment are sufficient. Communication, mobility, and information-related knowledge must be merged in accordance with ecological and civilizational paradigms to clarify questions of the acceptability of technological practice. It is therefore considered necessary to change and integrate the technicality of engineering into the concept of sustainable development through philosophical approach.

Sustainable development is a model of resource use that aims to satisfy human needs while preserving the environment so that these needs can be met not only in the present but also for future generations. The term was used by the Brundtland Commission, which created what has become the most frequently cited definition of sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (2) Sustainable development combines the concern for the carrying capacity of natural systems with the social challenges facing humanity. In the 1970s, sustainability was used to describe an economy in balance with basic ecological support systems. (3) The environmental crisis threatens the sustainability of economic activity. Many activities such as agriculture, forestry, fishing, tourism and recreation depend on a healthy environment. David Pearce argues that if intergenerational equity is to be achieved, future generations must be compensated for any environmental damage caused by current generations, and that is done by increasing the wealth and assets created by humans. (4) Sustainable development policies generally embody economic determinism with regard to technological change. It avoids the issue of ethics and assumes that environmental and economic goals are compatible. In the ancient times, the conflict between self-interest and the public interest was rarely an issue for engineers, as engineering work was almost synonymous with human progress.

Today's environmental issues have created a divergence between self-interest, professional interest and public interest.

II. ANCIENT ENGINEERING AND THEIR PHILOSOPHY

Engineering is a material branch of human activity, and studying it gives insight into the metaphysical and spiritual concepts of the ancient Indians. Many inconsistencies, apparently absurd, in the manners and customs of Indian communities are rationally explained by a study of the physical sciences and their secular development by the ancient Indians. The extensive ancient Indian literature includes texts on technical sciences. The information in these texts has a scientific basis and can be very useful for modern scientists and engineers. Engineering sciences were very advanced in ancient India. More than a thousand texts i.e. Shilpa samhitas can be mentioned on various technical sciences. Of these, about five hundred texts are preserved in the form of manuscripts on palm leaves, tree barks, etc. in some libraries of oriental research institutes and museums. A vast technical literature still exists because it is hidden in religious and mythological scriptures. The Matsyapooran describes eighteen divine engineers. This can be interpreted as eighteen different schools of learning, prevalent in ancient India. Bhrugu, Atree, Vashishtha, Vishvakarma, Maya, Narada, Nagnajeet, Vishalaksha, Purandara, Bramha, Kumar, Nandeesh, Shounaka, Garg, Vasudewa, Aniruddha, Shuka and Bruhaspati are the eighteen divine engineers. (5) Buildings (mainly houses, temples, palaces) in different parts of the country were built according to these schools of thought. For example, in the northern part, central part and southern part, the structures were built according to the Samhitas (engineering practices) of Kashyapa, Bhruga and Maya. Bhrugu, Vishvakarma and Maya are better known among the masses. Matsyapooran describes Vishvakarma (old learned man), his tools (Tape Jar and level, Binoculars and books), his vehicle (Swan) and his works (Creator of palaces of all worlds). (6) Sage Bhrugu divided all knowledge related to Shilpashashtra into three volumes. He further included three Shilpashashtras in each of these volumes. Engineering is divided into three parts according to the difficulty of the work. These are the *Dhatukhand* the part concerned with the extraction of materials. *Saadhankhand* – the part dealing with the transportation of materials and *Vastukhand* - the part dealing with the construction of structures. (7) All knowledge is further divided into ten shastras, thirty-two Vidyas and sixty-four Kalas. (8) In his professional work, the engineer has to deal with organic and inorganic substances, and among organic substances not only the plant and animal kingdoms, but also humans in all their stages. Engineers must make use of all labourers, artisans, and even specialists in various sciences in the construction of their works, and therefore must know the qualities and defects of these human beings, as well as of inorganic substances. (9) This study is entirely neglected in modern engineering, and the engineers and owners of the industries are left to do the best they can in this matter, without a proper scientific study of the materials (human nature) they have to use. An engineer must know the qualities of a philosopher, an electrician or a carpenter, as well as the qualities of wood and other things he uses for his work which makes the work of an engineer multidisciplinary which was well understood by the ancient engineers but neglected by the modern ones. The concept of Panchmahabhota" was explained in "Aitariya Upanishad (10) which says the five basic elements Earth (Prithwi), Water (Aap), Air (Vayu), Sky (Aakash) and Light (Tej) must be protected without creating any imbalance between these elements. A slight imbalance causes catastrophic effects which can be seen as side effects of modern era's technology.

III. SUSTAINABLE DEVELOPMENT AND TECHNOLOGY

Sustainable development is a complex, sometimes contradictory, and always multifaceted phenomenon. An important aspect of sustainable development is the inclusion of future generations in present-day calculations of the cost of economic development. This seems to bring in philosophical even transcendental considerations. "Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. Yet many of us live beyond the world's ecological means, for instance in our patterns of energy use". (11) Sustainable development and philosophy of technology is intended to cut across all engineering disciplines, within a multidisciplinary environment, incorporating the latest advances in cognitive science and computer-supported learning. It is a direct response to the need to educate a new generation of engineering professionals who can effectively face the challenges of economic development within a global marketplace. It is intended an integrative skills in analysis, synthesis, and contextual understanding of problems and also exposes to the latest technologies in different engineering fields and the implications for sustainability of their use. This framework is based on four dimensions of sustainability, technology, economics, ecology and ethics. (12) Sustainable development and technology is a phrase that is used to summarize a new approach to the world in which we live. It addresses several areas of concern. These include economics, environment, ethics and technology. The goals of sustainable development and technology include the development of technology that can remain sustainable, and continue evaluation of existing areas of technology. Sustainability is determined by examining the

impact of a process that can be evaluated in terms of waste generation, toxicity, environmental impact, safety issues, actual product use (i.e. need, demand) economically. In general, this movement can be characterized as an attempt to make engineering more green. It says “the cutting down of forests in order to increase export earnings is consistent with sustainable development”. But they add immediately: “Only if the whole or parts of the proceeds are invested in other export earning or import reducing activities in order to maintain the welfare of future generations”. (13) Making explicit the methodology used in discovering the underlying assumptions of sustainability debate can move us toward link-ups with the philosophy of technology. (14) Though many environmentalists think economists have little to contribute to sustainability, practitioners of a “exact philosophy” approach is not only valuable but it has sufficient evidence to get anything done worthwhile to solve the problems of the environment. (15)

IV. AWARENESS OF POLLUTION PREVENTION

The following quotations from ancient texts are equally relevant in the present age. *Drainage of water or wastewater*: If a land is waterlogged then the water should be drained out by digging drains parallel to north east and refilling the trenches by brickbats and stones so that excess water drains out. (16). Water drains should be deep (1 meter) below ground and the bottom surface should be smooth and sloping. If such drain is not provided then the owner should be fined (54 coins). *Treatment of saline soils*: An ancient text Krishishasanam, (17) states about saline soils and also describes the procedure to treat such soils. Saline soil destroys seeds sown in it. This soil should be excavated again and again and replaced by fertile soil. Add fertilizers and water or plant trees such as Tobacco etc., which remove salinity of soils. *Waste and Garbage disposal*: As per Kautilya (18) waste disposal sites should be on north east side and far away from residential areas. *Sanitation*: Kautilya has described following fines to be imposed for violation of civic rules on sanitation that are Throwing garbage on the streets - 2 coins, Throwing garbage in drains - 4 coins, Throwing garbage at religious places - 16 coins. Throwing dead animals - 48 to 96 coins depending upon size of animal. Cremation at unauthorized places -192 coins. As per Vashishtasamhita Rivers, roads, agricultural fields, green lands sunshades and public places should not be polluted (by urination or excreta).

V. ETHICAL ENGINEERING

The necessity of ethics in engineering has an important role and responsibility in communicating with society. There is a difference between morality and ethics because morality is something learned unconsciously and ethics is something learned by reflecting moral attitudes in the real world. Decision makers and communities play a significant role in the development and maintenance of engineering infrastructure. In many places around the world, even developed countries are suffering greatly due to a lack of understanding of the role and importance of infrastructure as a way to approach and manage it. The reality of applying the principles of sustainability in everyday life is the responsibility of all human beings. The emphasis on sustainable development and sustainable lifestyles as an overarching philosophy is increasing. Engineering professionals need to take a broader view of what constitutes sustainability and provide solutions that meet the assumptions of sustainability. Ethical values based on sustainable development are of fundamental importance today. An engineer today is not only concerned with technical problems, but must also help and facilitate the understanding and decision-making of communities. An important emphasis is placed on the process of providing infrastructure and other equipment for people. It should be in the pre-production or pre-production phase, including feasibility studies, concepts and case studies to consider results, alternative planning and design and material options. In any project, the past, present and future must be carefully considered in terms of the overall environment. This means that investment in this phase of development would have to increase substantially.

Engineering professionals are facing the challenge of their own renaissance. They must create innovative and sustainable approaches and technologies for development. The requirements of the philosophy of sustainability can only be met if the principles of sustainable engineering are followed. It also requires the development and maintenance of indigenous science and technology skills provided by key stakeholders, including government, private enterprise, academic and professional structures. An effective and supportive framework in which an individual could develop knowledge about sustainability in general is provided by various voluntary and statutory organisations. Modern engineering codes of ethics require engineers to prioritize the public interest over professional and commercial interests. According to Edwin Layton, codes of ethics serve several purposes. First, they are engineers identified as an agent of technological change and human progress. Second, the engineer is considered a "logical thinker without bias" and is therefore able to guide and decide between classes. Third, engineers are assumed to be socially responsible for ensuring the progress and benevolence of technological change. (19)

Despite the prevailing ethics of self-interest and the emphasis on individualism that modern capitalist societies express, they depend on shared values and collective activity. Engineering is one example of a collective activity that builds on the work of past engineers and consensus within the profession on appropriate technological solutions. The terms technological systems, (20) technological traditions, technological paradigms, technological regimes (21) and technological trajectories used by technologists – refer to technological development as a social enterprise shaped by the context in which it occurs. The design, selection and implementation of technology are rarely an individual effort. Most engineers rely on teamwork, and no individual engineer feels personally responsible for the outcome or dependent on the willingness and cooperation of any one engineer. As Cohen and Grace Point out – "groupthink" is usually responsible for perceiving and articulating whatever is justified. (22**)** Most engineering codes of ethics worldwide encourage engineers to consciously place the public interest above all others. This seems contrary to the market philosophy that the public interest will be achieved by individuals pursuing their own self-interest. Therefore, a revolution in ethics is needed to dislodge the powerful ethical egoism that rationalizes the market as the predominant decision-making tool in our society.

VI. TOWARD A HOLISTIC APPROACH

Sustainability understood in a holistic form is a multidimensional model of development that limits economic growth and other human activities to nature's capacity for self-regeneration, puts as its primary goal the improvement of the human condition (social and human development) and respecting the quality of the environment and the limits of nature is the basis of every economic, political, educational and cultural strategies. This holistic idea of development as a process could be sustainable not only according to the traditional concept of development, but also as a holistic vision that implies fundamental changes at all levels of social, economic, political and cultural structures, which helps in the restructuring of contemporary society. Understanding sustainable development means respecting the integrity of nature and the needs and rights of present and future generations. (23) This holistic idea of sustainable development does not imply a return to a pre-modern technological stage or the stagnation of society. However, a way of life based on a "diverse" set of the same old technological gadgets needs to be changed. In this sense, it is a challenge to our current irresponsible and dilapidated way of living and treating nature. Achieving such a transformation requires a high level of conscience, along with a clear and determined environmental and humanist commitment. Consequently, human beings should not only have the responsibility and moral obligation to preserve their present and future existence, but also the existence of all living species on the planet.(24) Responsibility has become the basic ethical imperative of modern civilization. It should be an inevitable criterion for judging and evaluating human activities and development activities. It is not just one human burden or human dimension that defines our dignity and humanity. For example, according to Carl Mitcham (25), a responsible citizen is very different from a person who fulfils his duty more efficiently. Therefore, new ethical values for a holistic concept of sustainability must be respected for the integrity of the environment and respect for the cultural diversity of the planet and human dignity, integrity, equality and solidarity between people and continents.

VII. CONCLUSION

India has undoubtedly developed vast civilizational knowledge in the form of a long spiritual and scientific tradition through the deep insight of its visionary seers in the times of yore. This knowledge system was not only systematically and scientifically developed, but also remains extant to this date in some form or another. Our society and indeed all societies of the world in the 21st century attach considerable importance to the concept of sustainable development. It is our responsibility to develop the community to achieve zero landfill, create sustainable infrastructure to support everyday lifestyles and take the next step to restore our natural resources for future generations. Sustainable engineering is part of the creative process of using science and technology and using energy and resources at a rate that does not threaten the integrity of the natural environment or the ability of future generations to meet their own needs where comes the need of understanding the scriptures which had been proven by time. This is the time when people should embrace the ancient's view of living with nature and protecting the surrounding of all kind either organic or inorganic. The role of engineers thus provides the foundation for proper planning, design, permitting and construction of development that will help protect the environment. However philosophical attitudes, values and beliefs about technology evolve and change across time, place and culture. The study of modern technology as a set of techniques for control and as a means of disrupting ecological processes is well documented. We drive performance-based engineering at every opportunity, exploring cutting-edge and traditional materials, developing technologies, renewable energy, complex geometry, sustainability and all other areas of building design to meet people's needs. Resources to support environmental activities in a sustainable manner include construction materials and manufactured and finished products used in construction. The emphasis should be on renewable resources, local materials, and the possibility of recycling and reuse of materials, durable,

energy efficient and low maintenance. Other important factors are materials that would not be harmful to the environment either during the production of these materials or when used in development. Engineering interacts internally with philosophical disciplines such as values, wisdom and ethics. Ethics in technology advocates implicit understanding and sees technology as always good and bad. This paper is therefore an attempt to express a solution with a philosophical concern. Therefore, engineers must plan, design and construct ethically and should develop sustainable solutions that satisfy the needs of the human being and keep the device in harmony with the overall environment. This will ensure the quality of life for current generations and the demands of future generations.

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