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Mastery-Humility Model for the Teaching of Sustainability

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ABSTRACT: *Since 1987, sustainability has been the catchword for many efforts to rectify the many global crises caused by a combination of events, either natural or human-made. Meeting population growth demands caused nations' ecological footprints to exceed the biocapacity, making them vulnerable. The SDGs, though, meant well do not focus on the security of the resources. It results in making sustainability as elusive as ever. Economic efficiency by Pareto optimality and Kaldor-Hicks does not synchronise with sustainability, although theoretically possible. It was noted that high welfare levels could match with low levels of consumption and less wastage, parallel with high spiritual fulfilment. In this paper, the pursuit of sustainability can be more amenable by engaging engineers who are competent and ethical. The use of the teaching course Integrated Design Project (IDP) as presented will help them attain mastery and humility. The mastery-humility (M-H) model was developed from the theory that emerges from the semi-structured interviews of 30 academics. Looped Confirmatory Factor Analysis and SEM followed. Three hundred and thirty-four undergraduates of two universities undertook the questionnaires survey. The convenient sampling sizes of 167 per group with and without taking IDP indicated that the former satisfied the fit indices criteria. Therefore, IDP can prepare them for 'real-world' problems with sustainability in the driver's seat.*

KEYWORDS*: Sustainability; ecological footprint; sustainable development goals; Pareto Optimality; Kaldor-Hicks welfare; Integrated Design Projects ; ethics and justice*

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I. INTRODUCTION

More than 30 years ago, the terms sustainable development were introduced by a team of investigators who made up the United Nations World Commission on Environment and Development (WCED. Headed by Gro Harlem Brundtland, the report then was presented and debated at the UN Conference on Environment and Development in 1989. With the subsequent endorsement of the term, sustainable development, defined as "development that meets the present's needs without compromising future generations' ability to meet their own needs," has become an important concept ever since (WCED, 1987, Burton, 1987). It turns out to be significant generic sustainable models and made use of in a large amount of sustainability narration. Sustainability, however, is assigned with the three pillars of sustainability: environmental sustainability, economic sustainability and social order of ethics and justice for social sustainability.

Ecological Footprint

Ecological Footprint indicates how rapidly the Earth's resources are consumed and the space availability to absorb the waste generated. It is equal to the total sum of all productive land and seas areas divided by the number of population on this Earth. The amount of 'biocapacity' per person is 1.73 global hectares (Wackernagel et al., 2002; Global Footprint Network, 2017). A country will have an ecological deficit if its ecological Footprint greater than its biocapacity. It is a measure of sustainability for any countries. The overshot conditions may occur, causing climate change. Most countries, from 2000 to 2013, increased their GDPs and ecological footprints at the same time. In 2013, Man required 1.7 earths to meet all of his needs for natural resources that are renewable (Global Footprint Network, 2013). Humanity's Ecological Footprint in 2014 was 69.6 per cent greater than Earth's biocapacity (Global Footprint Network, 2018).A significant portion of the ecological Footprint is carbon footprint. It was 60 per cent in 2014, which is an increase from 44 per cent in 1961. Thus, there is a need for more significant efforts in utilising green technologies. Ecological Footprint accounting measures the supply and demand for renewable resources and ecosystem services. It can gauge unsustainability when the demand (Ecological Footprint) exerted does not stay within the available biocapacity (supply). It can be used to complement the Human Development Index in the Sustainable Development Goals (SDGs). It can also evaluate whether the expected outcomes of sustainable development's efforts are fruitful (Wackernagel, et. al, 2017).

Sustainable Development Goals (SDGs)

The 17 SDGs are: "(1) No impoverishment, (2) Zero Starvation, (3) Free from Sickness, (4) Good Education, (5) Egalitarianism, (6) Safe Water Use, (7) Renewable Power, (8) Steady Business Growth, (9) Industry, Innovation and Infrastructure, (10) Reducing Inequality, (11) Sustainable Societies, (12) Accountable Production and Consumption, (13) Climate Movement, (14) Life underneath Water, (15) Overland life, (16) Justice, Peace, and Firm Institutions, (17) Collaborations for the Goals" (United Nations, 2015). There were a hundred and sixty-nine targets from the above SDGs. It was noted by Wackernagel, et.al (2017) that 19 out of the top 20 ranking countries in the index have an Ecological Footprint of over five global hectares (gha) per person. In other words, high Footprints relates to a high SDG index. If all the other countries consumed as much as the top 20 countries, we need the Footprint of 3 planet earths instead of 1.7 presently. This kind of demand on the planet is not sustainable. The SDG index follows the conventional development pattern to the letter. It ties-up higher achievements in the development with higher Footprints. This particular scenario of the result is what sustainable development has set out to remedy in the first place. The economy's growth often comes together with an increase in per capita consumption of services and goods. If this were not balanced by a corresponding increase in energy and material production efficiency, a larger per capita Footprint would result. Hence, some countries may have to increase consumption to meet basic needs. It is harder to achieve sustainable development on a global scale with an increase in the average Footprint. The policies of all governments need to be realigned in the context of developments. To a greater extent, once policies are being made, there will be a wide-ranging responsibility for the professionals since 2/3 of the decisions concerning developments rests on the shoulders of the engineers and the architects. In fact, sustainability has entered the mainstream of engineering design.

II. SUSTAINABILITY: CONCEPTS AND APPLICATION

There are two distinct views on the philosophy of sustainability, namely the pessimism of neo-Malthusians against the optimism of Cornucopians (Chenoweth & Feitelson, 2005). There had been a debate between the two. The former viewed the sufficiency of the resources available for human needs. The latter on its ability to tackle the impacts. Malthus (1766-1834) predicted that natural resources would not meet the future population's demand. (Chenoweth & Feitelson, 2005). It relates through the following: (Hasna, 2004):

$$P(t) = P_0 e^{rt}$$

where P_0 = Initial Population, r = growth rate and t = time

The Cornucopian school of thought acknowledged insurmountable natural limits to growth, and only through the advancements of technology, the world can provide natural resources without limit (Chenoweth, & Feitelson, 2005). There ought to be a compromise between the two. Current engineering philosophy on sustainability must take the correct approach by ensuring the resources consumed are not to deprive the future generation of their needs. Since most current practices lean towards Malthusian theory, there is the need to advocate and put a balanced approach to achieve overall positive results. This approach must cover a defensive stand towards the environment and balancing the utilisation of natural resources. The approach is to design the resources sustainably. In other words: "(1) renewable resources must not be consumed faster than they are regenerated", and (2) "waste must not be created faster than it is assimilated by natural systems" (Daly, 1990). The following are the three pillars of sustainability: resources (environmental), economic and social.

Sustainability can be achieved by using the earth's resources in the following three simplified approaches. Adopting in whole or part of these steps ensures efficient use of the allocation of resources. The earth's resources remain 'intact' despite meeting the demands of this generation's developments and the next.

(a) Long term design through Nature-Inspired Algorithms

Through many years of evolution, Nature has been surviving. Biomimicry is emulating Nature's best biological ideas to solve human dilemmas. The biological systems' effectiveness in adapting to changing surroundings makes the Nature-Inspired Algorithms a popular choice. A group of ants and birds called colony and flock of birds are modelled in Particle Swarm Optimization (PSO). There are many algorithms on optimising which can mimic bird flocking or fish schooling. Karaboga (2005) formulated an optimisation technique based on the foraging of honey bees (Artificial Bee Colony algorithm).

(b) Closing the loop design through Ecological Engineering

Mitsch (2003) defined ecological engineering design as "Integrating the natural environment with the human society resulting in the benefit for both". It aims to restore any ecosystems damaged through human activities and bring back the values for human and ecological, which are sustainable. The design consists of Energy Augmentation, Self-organisation/self-design and Adaptation (Kangas, 2005).

(c). Efficient Design: Use more from less

Due to the strength and simple to construct, solid circular columns for the bridge piers are wide. Due to the smaller cross-section area (as high as 70%), the use of these columns is very economical. Furthermore, from a structural point of view, hollow columns are more efficient. Seismic mass reduction can be achieved when the vertical members' weight is particularly relevant in the entire structure's performance (Turmo, 2008). From the perspective of mass production, standard components are likely to be preferred over customised sections. This may make sheet metal in long constant width strips yield significant losses from the cut products. Constant depth I-beams used in structural design is less efficient when compared with beams with varying depths. The alternative is to use a modular design for material efficiency (Worrell, et. al, 2016).

Economic efficiency for Sustainability

As mentioned above, the two factors that form the definition of Sustainability are fairness between generation and 'optimality'. It is about equitable distribution of productive capacity and welfare between this generation and attaining viable social welfare. The welfare concept should include the non-physical aspects of well-being, such as social and psychological, which permit the interchange between all kinds of social happiness. The long-held view that long-drawn-out working hours will lead to high productivity has been reassessed because of the need to improve and enhance life balance, leading to a better quality of life. Some societies achieve high welfare levels with low levels in term of consumption as well. The relationship between an individual's behaviour affecting material goods is essential. So does the fulfilment of spiritual being and the relationship between personal welfare, social standing, and material consumption, leading to the latter being more efficient with less wastage (Fazrin, 2007).

There are several efficiency-related concepts: Productive efficiency, Pareto superiority and optimality, and Kaldor-Hicks efficiency. The most often notion used is the Pareto optimum, which is "consequently understood as a societal situation in which it is unattainable to increase the welfare of an individual by re-allocating resources without simultaneously reducing that of another individual" (Coleman, 1979). However, the Kaldor-Hicks criterion is a welfare criterion based on possible mutual compensation for reallocation of welfare. In contrast to the Pareto criterion (without interpersonal benefit comparison), which assess changes in society's welfare as a whole, there is a gain in some individuals' welfare while there is a loss to others. The Kaldor-Hicks criterion considers the principle of compensation (Coleman, 1979). Each Kaldor-Hicks optimum is also a Pareto optimum, not vice-versa. Both are ways to operationalising efficiency, with the latter being the most commonly referred to for understanding economic efficiency and policy.

Meanwhile, there is a shift to green Pareto efficiency and optimality (Munoz, 2020). This due to the internalisation of environmental costs in the pricing mechanism of the traditional market. Once in green markets, traditional Pareto efficiency thinking and the optimal choice fall outside 'green production frontier'. Thus, the traditional Pareto optimality is put aside. Another view is that the utilitarian optimal growth and green consideration may end up with the present generation unduly burdened and creates inequality between generations. Fazrin (2007) suggested a 'compromised development policy'. It put in place specific measures allowing the optimal growth pattern but mitigating the 'intergenerational and intragenerational' welfare inequalities. This may well serve humankind better, especially those in the developing countries. It is optimising economic development while taking into account the intragenerational and intergenerational fairness. As it stands now, economic efficiency is not necessarily guaranteeing sustainability, although theoretically, it is possible (Bishop, 1993)

Social Sustainability and Responsibility: Ethics and Justice

Society has every right to ensure that any activities utilise resources within its jurisdiction to stay within the law and justice. It is not hindering any good economic activity. Any polluting industries generating physical, biological and chemical wastes must cease operation if found violating the stipulated conditions. The rights of the members of society are paramount. Their safety and health are invaluable compared to any financial loss if relocations are being mandated to the wrong-doers. Justice must seem to exert itself. With proper governance and due diligence, the immediate communities' members will be free from any untoward incidences. A point of agreement can be reached between affected parties in the planning and operation of any industries. The people can decide for themselves on the acceptable limit. The optimum pollution level in economic terms is the level of pollution at which the marginal cost of abatement equals the marginal damage to the environment. In Figure 1, the marginal abatement and damage curves show logarithmic increases in both. This suggests that the higher the environmental quality targeted, the higher the target's incremental cost. The two curves cross, at E*, the optimum level of environmental pollution at an affordable cost (Pescod, 1999). Point E* can therefore be decided by the consensus of all in the society, which set the standard.

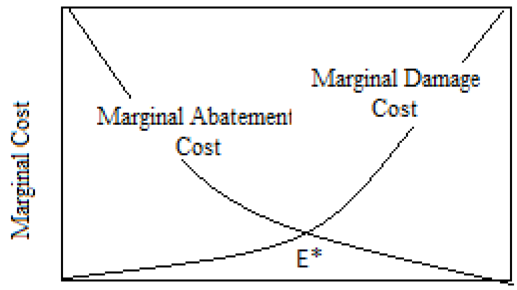

Figure 1. Optimum Pollution Control
From Pescod, (1999)

There are sufficient laws on environmental control and monitoring in most countries, but the weak area seems to enforce them. This could be due to a lack of economic incentives and other benefits. More often than not, it neglects a non-quantifiable factor, the inner exhortation, relying totally on external forms of coercion only. A more enduring approach for keeping in check the adherence to laws is not merely an increase in fines, sanctions and penalties. Instead, the internalisation of responsibilities and to being convinced of doing the right things. It is this realisation that aligns one's thoughts, meaning and actions. When a person is in this state of mind, there is no necessity for any external forces. His moral compass will primarily guide his actions, and all others are secondary.

Any system which encourages self-regulation should receive serious attention because this approach has the potential for resource conservation. This will depend, of course, on the ethical consideration of the individual. For environmental preservation, both the living and non-living elements must reach a certain equilibrium point and balance. There are ecosystems connecting plants, animals and human kingdoms. There is a need to properly place each and everything in its proper positions. To achieve this condition, knowledge-based practices and methodologies must be in place. For the very fact that the definition of engineering is the utilisation of resources of nature for humankind, it is apt that the pursuit of sustainability is entrusted upon them. They are supposed to be competent and ethical. This paper discusses the way these values are delivered. The outcomes should be mastery which goes beyond competency and with ethical virtues attaining humility.

III. CURRICULUM: INTEGRATED DESIGN PROJECT (IDP)

The engineering curriculum is typically completed after four years of undergraduate study after 12-13 years of Secondary School education. In the first year, the basic mathematics and sciences are taught dealing with the fundamentals and physics and chemistry principles, especially the former forms the significant components in the study. The forces of nature are expressed in mathematical forms. The derivation from first principles is carried out to arrive at expressions depicting the relationships or laws. The mathematical, physical, laboratory and computer models are tools for design purpose in the final year integrated design project. Integrated Design Project Course/Capstone Design Project, usually taught in the final two years, is an indicator of the disciplines' competency. In this study, the mastery indicator is accomplished in the Integrated Design Project (IDP) for several reasons: the training to deal with 'real world' problems, working as a team member, and using a sustainability design approach for an efficient design. The outcomes for this course are as follows (Table 1):

**Table 1. Course Outcomes (COs):
Integrated Design Project (IDP)**

Course Outcomes (COs)	Statements
CO1	Defining and formulating problem solving to complex design problem
CO2	Utilising defensible manual and code of practices with available resources maintaining close attention to the preservation of the environment and issues related to rules, legislation, safety and health and other societal obligations
CO3	Justify with informed reasoning and consideration on consequent responsibilities to the society
CO4	Accommodate the concept of sustainability in the project design
CO5	Practise effective engineering management in the project design
CO6	Demonstrating skills of leadership and as a co-worker in a team, capable of delivering collaborative results in the forms of design

	and product outcomes subject to the rigor of analysis and evaluation exercise.

Source: Engineering Accreditation Council (EAC), (2020)

Mastery Attainments

Generally, in Engineering, one is a novice when he is new to his job or knows little. As an engineer in training, supervising engineers assessed his ability to apply what he has learned as students and accept becoming a Professional Engineer. He becomes competent when he can perform to basic standards based on the Code of Practice and becomes 'experienced' when he can cope with any challenges demanding his skills. He achieves mastery when he can invent new and better ways to do a job. In other words, he can optimise by being efficient in his design. Mastery is typically equated with having Professional qualification, which is obtainable after spending many years working. The other type of mastery is at the undergraduate level, indicated by the student's outstanding scholarly achievement, and this number is minimal. Thus, a mastery that is adopted here is assessing any student's potential who shows the indication that he can shoulder the responsibility of a vicegerent. In other words, can he, as an engineer utilise the earth's resources sustainably in his design. The available setting is in the Capstone Design Class/Integrated Design Project (IDP).

There is a distinct difference between mastery and competency though most agree that one who has the mastery of the field by default he is supposed to be competent. Mastery is higher than competency. It seems that individuals can reach that level after many years of practice. Some equated mastery as Master-Craftsman. The individual has reached a certain level in a particular area. He also knows other things too apart from that area, but he has in-depth knowledge of that area. Being a master of something means that there is the realisation that there is still a lot more to learn because people who say they know everything are not a master of it actually because they think they know everything. In this paper, an indicator of mastery needed to be established as an instrument to gauge the potential of the students in reaching that level in the future as he/she practices. To see the potential of achieving mastery, it is necessary to observe an individual student's ability in the class.

Humility Traits

Humility is defined as having compassion for others and willingness to share credits for any accomplishment. It is usually accompanied by higher levels of humaneness, honour and value. Humility differs from low self-esteem and it is not the opposite of confidence. It is not also wallowing in self-pity. Humility is an indicator or sign of strength, virtue, and incredibly empowering. It is a reflection of spiritual, mental and emotional maturity. Humility is a positive outlook of oneself (Tangney, 2000), having integrity and dignity. It was also defined as the ability to respect the truth from wherever it comes from, knowing his/her proper place and position in the society. He/she has a high regard for the high contribution of others to the society and de-emphasises his/her equally significant roles. Emmons (1999) mentioned that being modest is really about one's authentic and genuine self-evaluation. The perception of humility as one who has been experiencing frequent failure and has low self-worth is incorrect (Roberts, 1983). They are the high achievers with praise-worthy accomplishments and have mastered their field/area but remain humble. In engineers' education, the instilling of confidence level for the graduates will possibly bring about 'arrogant' as the outcome. To counter this possibility, it is the humility traits than can achieve balance and level-headedness. Humility will be like a moral compass to lead them to achieve moral competence.

IV. METHODOLOGY OF STUDY

A pilot study with 30 undergraduate students was carried out to try out the questionnaires on the mastery-humility model developed based on the pilot semi-structured interviews. Cronbach's coefficient was 0.71 for the whole scale. The questions then were modified with the addition of 2 more survey items to make it 24 after the completion of the semi-structured interviews of 30 academics and upon achieving the theoretical saturation. Five hundred seven students responded to the main (MH) questionnaire study. For this mastery sub-scale study in this paper, 167 samples were taken from each group.

V. FINDINGS AND DISCUSSIONS

For calibration of the SEM, a pooled Confirmatory Factor analysis was obtained. The Cronbach's Coefficient for the six constructs ranged from 0.72 to 0.94. The composite reliability level (C.R.) ranged from 0.73 to 0.95. For validity analyses, the convergent validity's average variance extracted (AVE) for every construct was 0.5 to 0.8, and the discriminant validity's Heterotrait-Monotrait ratio (HTMT) was 0.85. The Confirmatory Factor Analysis (CFA) satisfied the criteria, and the construct validity has the following fit indices (Table 2). The causal/effect modelling gave the loadings for the mastery-humility model, as shown in Figure 2.

Table 2. Fit Indices

Test	X^2/df	RMSEA	CFI	IFI	TLI	PDF	Helter's Critical N
Value	<4	≤.08	≥.95	≥.90	≥.90	≤1	≥75
Pooled Model	3.924	.076	.952	.952	.944	.804	159(01)

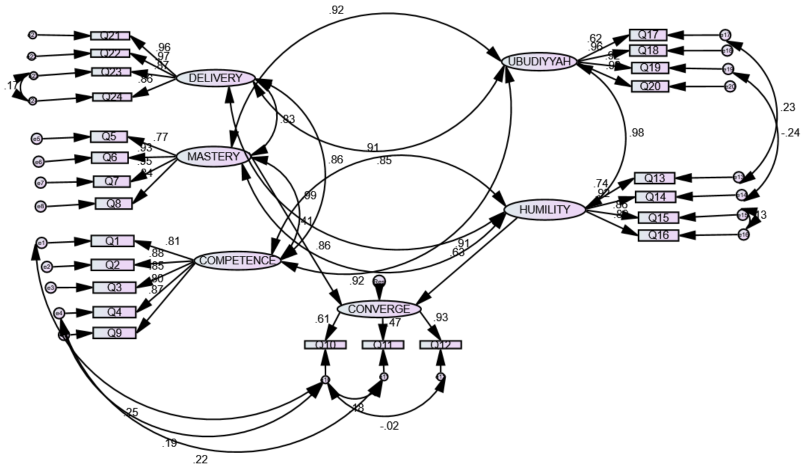

Figure 2. Mastery-Humility Model (Causal/Effect)

Hypothesis tested:

HM: Integrated Design Project Course (IDP) has a positive effect on Mastery

For this study, two groups of respondents from both universities under study were involved. The first group (Group NDP) comprises Semester 5 and 6 students. They are still taking enabling courses that precede Integrated Design Project (IDP) course. The other group is from Semester 7 and 8, where IDP is the culminating course taught (Group IDP). The course is used as an indicator of mastery ability and has six Course Outcomes (COs). It is usually conducted by addressing the 'real world' problems. In other words, design products have to meet the need for sustainability criteria. They have to achieve the best efficient design. The sample size is 334 students equally divided between both groups. According to Kline (2005), SEM's sample size should be in the ranger of 100 – 200. Thus, the sampling is acceptable. It can be observed by looking at Table 3, the loading of MASTERY → CONVERGE moderated by Group IDP is much higher than the NONIDP group (.413>.154) and the corresponding direct effect .549>.198.

Table 3. Effect of IDP on Mastery subscale (HM)

Test	Loading	Loading	Direct Effect	Direct Effect	Remark
Value	Mastery → Convergence	Humility → Convergence	Mastery → Convergence	Humility → Convergence	Respondents
HM (a)	.154	.871	.198	1.317	NON-IDP (N= 167)
HM (b)	.413	.629	.549	.978	IDP (N= 167)

Table 4. Fit Indices

Test	Chi-square	X^2/df	RMSEA	CFI	TLI	Remark
Value		<4	≤.08	≥.95	≥.90	Respondents
HM (a)	507.321	2.196.	.085	.944	.928	NON-IDP
HM (b)	470.106	2.035	.079	.953	.939	IDP

As for the fit indices, Group IDP shows a better set of fit indices (RMSEA = .079<.08, CFI = 0.953> 0.95 and lower Chi-Square = 470.196, p =.000). Group NONIDP, however, fails the fit indices criteria (RMSEA=.085, CFI=. 944 and higher Chi-Square = 507.321). Thus, HM, which indicates that the Integrated Design Project Course (IDP) positively affects Mastery, is significant.

VI. CONCLUSION

A measure of sustainable development is that the biocapacity must be greater than the ecological footprint. Reducing carbon footprints by using green technologies will achieve sustainability. The three pillars of sustainability (environment, economy, social) are insufficient without spiritual fulfilment. Pareto optimality and Kaldor-Hicks deal with economic efficiency. Economic efficiency does not guarantee sustainability. They believed that it is impossible to increase one's welfare by sources re-allocation without making someone else worse-off. The latter should be compensated. The utilitarian optimal growth and green consideration may ultimately lead to the present generation unduly burdened and creates intergenerational inequality, especially in developing countries. The SDGs is off-target, with sustainability being focused on developments, not the security of resources. This can be corrected with proper alignment. In the training of engineers, the public's welfare is paramount and is codified in the code of professional conduct. The very definition of engineering itself is to utilise nature's resources for the good of humankind governed by ethics and justice. So being competent and ethical, they can tackle a range of sustainability problems. Hence, by using integrated design project subject in an engineering course, graduates are moulded with mastery and humility outcomes, which go beyond competent and having the ethical virtue of humility, assessed by the mastery-humility model. Hence, engineers with social scientists and economists can work together presently and in the future to pursue realistic sustainability goals.

REFERENCES

[1]. World Commission on Environment and Development. (1987). Report of the World Commission on Environment and Development: Our Common Future. UN Documents: Gathering a Body of Global Agreements. Oxford, UK.

[2]. Burton, I. (1987). Our common future: The world commission on environment and development. Environment, 29(5), 25–29.

[3]. Global Footprint Network. (2018). National Footprint Accounts, Ed.; Global Footprint Network: Oakland, CA, USA.

[4]. United Nations (2015) Resolution adopted by the General Assembly on 25 September 2015, Transforming our world: the 2030 Agenda for Sustainable Development.

[5]. Wackernagel, M., L. Hanscom & D. Lin, (2017). Making the sustainable development goals consistent with sustainability. Front. Energy Res. 5.

[6]. Chenoweth, J & E. Feitelson, (2005). Neo-Malthusians and Cornucopians put to the test: Global 2000 and The Resourceful Earth revisited FUTURES, 37 (1). pp. 51-72.

[7]. Hasna, A.M. (2004) Sustainability philosophy in engineering context review and discussion, Faculty of Engineering and Surveying, Master of Engineering Toowoomba QLD: University of Southern Queensland.

[8]. Daly, H.E. (1990). Toward some operational principles of sustainable development, Ecol. Econ. 2, 1–6.

[9]. Karaboga, D. (2005). Technical Report-TR06, An idea Based on honey bee swarm for Numerical Optimization, Erciyes University.

[10]. Mitsch, W.J. & S.E. Jorgensen. (2003). Ecological engineering and ecosystem restoration, John Wiley & Sons, New York.

[11]. Kangas, P.C. (2005). Ecological engineering: principles and practice, Lewis Publishers.

[12]. Turmo J, et al. (2009). Shear truss analogy for concrete members of solid and hollow circular cross-section. Engineering Structures, Volume 31 (2) – February, 455-465.

[13]. Ernst Worrell, E., J. Allwood & T.imothy Gutowski. (2016).The role of material efficiency in environmental stewardship. Annual Review of Environment and Resources, Vol. 41:575-598, 2016 https://doi.org/10.1146/annurev-environ-110615-085737.

[14]. Farzin, H.Y. (2007). Sustainability and optimality in economic development: theoretical insights and policy prospects, The Fondazione Eni Enrico Mattei Note di Lavoro Series Index, http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm

[15]. Coleman, Jules L. (1980) "Efficiency, utility, and wealth maximization", Hofstra Law Review: Vol. 8 : Iss. 3 , Article 3, https://scholarlycommons.law.hofstra.edu/hlr/vol8/iss3/3

[16]. Muñoz, L. (2020). Sustainability thoughts 125, International Journal of Management studies and Social Science Research(IJMSSSR), Vol. 2, Issue 6, November-December, Pp 108-117, ISSN: 2582-0265, India.

[17]. Bishop, R.C. (1993). Biodiversity: ecology, economics, policy, Ambio Vol. 22, No. 2/3, Springer, pp. 69-73 https://www.jstor.org/stable/4314049

[18]. Pescod, M.B. (1999). Innovative technology management, International Conference on Innovative Technology Management Technologies, ENSEACH, Kuala Lumpur.

[19]. Engineering Accreditation Council. (2020). Engineering programme accreditation standard. http://www.eac.org.my/web/document/pdf

[20]. Tangney, J. P. (2000).Humility: Theoretical perspectives, empirical findings and directions for future research, Journal of Social and Clinical Psychology, 19, 70-82.

[21]. Emmons, R. A. (1999). The psychology of ultimate concerns. New York: Guilford.

[22]. Roberts, R. C. (1983). Spirituality and human emotion, Eerdmans Publishing.

[23]. Kline, R. B. (2005). Principles and practice of structural equation modelling. New York, NY: The Guilford Press.

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