Total Quality Management (Tqm) As a Prerequisite For Improving The Competitiveness In Waste Management And Waste Reprocessing Micro, Small And Medium Enterprises To Achieve Business Excellence

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Abstract Total Quality Management (TQM) can be defined as a quality management approach centered on quality, based on the participation of all its members and aiming at long term success through customer satisfaction and benefits to all members of the organization and society. Strategic environmental assessment (SEA) process can be broadly defined as a study of the impacts of a proposed project, plan, project, policy or legislative action on the environment and sustainability. In this research, SEA process has been aimed in order to incorporate environmental and sustainability factors in to waste and waste reprocessing project planning and decision making (WPDM) and Climate impact assessment (CIA) process such as project formulation and appraisal of Indo-Matsushita midget electrode (battery carbon rod) plant in 1979 at Tada, sustainable bridge, road and sanitation structure, green building, nuclear power plant, cotton roller ginning plant and concrete that included policies, programs, plans and legislative actions. Sustainable WM & WRM development is a kind of development that meets the needs of the present without compromising the ability and efficacy of future generations to meet their own needs. Environmental Impact Assessment (EIA) process can be defined as the systematic study of the potential impacts (effects) of proposed projects, plans, programs, policies or legislative actions relative to the physical-chemical, biological, cultural, and socioeconomic components of the total environmental product life cycle. The primary purpose of the EIA process is to encourage the consideration of the environment in Organization's WPDM process and to arrive at actions that are environmentally compatible. WPDM process should include the integrated consideration of technical or engineering, economic, environmental, safety, and health, social and sustainability factors in order to achieve business excellence. Prior to the National Environmental Policy Act (NEPA) process in 1970 in the USA, technical and economic factors dominance the World's Waste Management and Waste Reprocessing Management (WM & WRM) projects. The objective of the study is to conceptualize SEA process for the WM & WRM sector on the basis of fifteen number of sustainable detailed project reports (DPRs) submitted by the extension learners of Diploma in Entrepreneurship and Business Management (DEBM) course conducted by the Entrepreneurship Development Institute of India (The EDI of India) during the research year (RY) 1999 to 2023 under the author's chancellorship. The design of the study is cross sectional. Environmental Health Impact Assessment (EHIA) process has been conducted for nuclear power

plant to consider the safety and health impacts in order to mitigate psychological health loading on workers and nearby residents. Social Impact Assessment (SIA) process can be defined as the systematic identification and evaluation of the potential social impacts (effects) of proposed projects, plans, programs, or legislative actions such that social consideration is encouraged in WPDM process and to arrive at actions that are socially compatible with reference to a sustainable sanitation project. SEA process concerns to environment and sustainability effects in WPDM process and arrive at proposed projects, plans, programs, and legislative actions that are compatible with respect to environment and sustainability issues. International EIA process required multi-disciplinary approach that has been conducted very early stage of Japanese Matsushita carbon rod project in 1982 for strategic environmental assessment. The paper highlights SEA process conducted for certain projects that based on operation and process approach and associated studies for sustainable development. WM & WRM engineering product and process environmental life cycle analysis (LCA) has been conducted for identifying and measuring the impact of civil engineering industrial products on the environment and sustain efficacy by means of mass and energy balance methods. LCA considers the activities related to raw materials, transformation, ancillary materials, equipment, method, market, man power, production, use, disposal and ancillary equipment.As far as waste management and reprocessing management safety is concerned personal protective equipment and materials (PPEMs) that include garments, clothing, gloves, safety shoes, hard hats, safety glasses, shields, respirators, full aprons, safety belts, and other safety items which have to be used by an individual. Such equipment is important for personal protection and for safety. It is the manager's and supervisor's responsibility to ensure that they are used. The enactment of worker's compensation law and occupational disease law shall increase materially the cost of insurance to industry. The increased cost and the certainty with which it is applied will put a premium on accident-prevention work. This cost can be materially reduced by the installation of safety devices. WM & WRM experience has shown that approximately 80% of all the WM & WRM industrial accidents are preventable. EIA and EHIA processes have been conducted for a nuclear power plant to consider the safety and health impacts in order to mitigate psychological health loading on workers and nearby residents. SEA system is a potentially useful element of good environmental management and sustainable development; however, as currently practiced in WM & WRM industries, it is far from perfection. Emphasis should be given in WM & WRM industries on maintaining economic viability of the operation, while in turn taking care to preserve the ecological and social sustainability of the country. International EIA process required multi-disciplinary approach that has been conducted very early stage of Indo-Matsushita Midget electrode projecting 1982 at Tada for economic, ecological and social sustainability.

Keywords Education; Embed; Environment; Industry; Management; Waste; Sustainability

Introduction

The legislation of EIA process was established in 1970 by the enactment of the National Environmental Policy Act (NEPA) in the USA (Larry W.Canter, 1996). This was first time that EIA process became an official tool in WM & WRM sector to protect the environment. Three of the significant terms while complying with the requirements of NEPA process are "environmental inventory", "environmental impact assessment process", and "environment impact statement". EIAs of design and WM & WRM of civil engineering structures were undertaken in order to protect environment during the year 1950 in Japan, Europe and North America(Glynn Hendry J and Gary Weinke, 2003). The purpose of the EIA process is to encourage the consideration of the environment in organizational planning and decision-making process. Historically, the choice of proposed projects, policies, plans, programs, permits, procedures or legislations was primarily based on only one criterion called economic viability. Today, it is necessary to consider three criteria of economic, environmental and social viabilities. Environment coupled with quality management (EQM) is an intricate WM & WRM approach that was the targeted research area in order to achieve socio-economic improvement and sustainability based on the triple bottom-line approach (economical, environmental and social) feasibility studies (Vijayan Gurumurthy Iyer, 2016).

Materials and methods

The present study is conducted for climate change and control for the sustainable national development in context to plant science and agricultural technology (PSAT). The process of applying climate impact assessment (CIA) and sustainable development in PSAT plans, programs, polices, and legislative actions for human factor technology that are integrated with climate change and control. It is necessary to incorporate sustainability and environment into organizational planning and decision-making process. Sustainable national development which is a kind of national development that satisfies current

demands without jeopardizing the effectiveness and efficiency of future generations to satiate their own requirements. As sustainable development is integrated with CIA, investigations are provided entitled "climate change and control for PSAT towards sustainable national development".

"Climate" can be defined as the prevailing or average weather of a place as determined by temperature, precipitation, wind rose, glaciation, frequency of inversion, extreme weather events such as cyclones, tornadoes, cloud burst, typhoons, and hurricanes and environmental quality such as air, water and land quality to sustain PSAT. Long term variations in average temperature are the most important variables and attributes of climate change.

Change in weather conditions occur in an area over a long period of time such as temperature, humidity, dew point, pressure, volume, wind rose, air movement, photo chemical smog and sunlight energy (photo energy) due to biogenic and anthropogenic activities. Climate change is an evolution in the degree of certainty by biogenic and anthropogenic activities in causing the past half century's rapid rise of 1.1℃ in global average surface temperature of 14.9 ℃ from 13.8 ℃, and climate sensitivity factor of 0.5 ℃ / W/m^2 and net radiating force of 0.9-1.7 W/m^2, since mid-twentieth century is due to the observed increase in biogenic and anthropogenic greenhouse gas concentrations, the Antarctic and Greenland ice cores, sea floor sediments, glacial movements, changes in ice volume and sea volume and fossil pollen microorganisms. Global warming is the most important environmental challenge for the twenty first century. The climate change and control can be defined as the power to limit and regulate climate change as per sustainable environmental pollution and control standards. The 'greenhouse effect' is one of the environmental problems that have resulted either directly or indirectly from the biogenic and anthropogenic activities. The role of the human population on social and environmental change is given by the equation. I = P X A X T where the impact 'I' of the population on the social and environmental results from the size of the population (P), the per capita affluence or consumption (A) and the environmental damage by the technologies (T) employed to supply each unit of consumption. As 'P' increases so too does 'T' because supplied to additional people that must be mined from deeper ores, pumped from deeper deposits, transportation further. The per Capita consumption of energy in a nation can be used as a surrogate for the A X T part of from clearing forests for agriculture to mining, industrial, manufacturing, sanitation, road building and extraction of fossil fuels. The magnitude of greenhouse effect of earth is Ts minus Te, where Ts is actual surface temperature of earth (288 K) and the Te is the earth's "effective and efficient" blackbody radiation temperature of minus 19 ℃ (254 K). The greenhouse effect is a natural phenomenon due to biogenic and anthropogenic sources of a number of gases and aerosols that is responsible for earth having an average surface temperature 34℃ warmer that is 288 K Versus 254 K that it would have if it did not have radiatively active gases and aerosols in the atmosphere. As every doubling of logarithmic emission function and process of CO_2 in to the atmosphere, the global warming surface temperature goes up of 3 ℃, climate sensitivity factor 1 ℃ / W/m^2 and net radiating force 2-4 W/m^2. It is important to necessary to conduct climate impact assessment (CIA) process to systematically identify and evaluate potential impacts (effects), risks and options for adaptation resilience and mitigation of biogenic and anthropogenic climate change and document as climate research and development (R &D) papers. Three of the most significant terms of CIA process are "climate inventory," "climate impact assessment", and "climate impact statement".

The past three decades have been characterized by passage of the Environmental (Protection) Act (EPA) including Acts on control of water and air pollution, solid- and -hazardous waste management, resource protection and soil and groundwater remediation. In addition to EPA, the community strategies were adopted for sustainable development to address climate change, acidification, and air quality, protection of nature and biodiversity, management of water resources, the urban and rural environment, coastal zones and waste management. It is to be ensured that the balanced planning and decision-making process needed regarding the sustainable environmental and climate development in the public interest.

PSAT project planning and decision-making process should include the integrated consideration of technical, economic, environmental, social and climate and other factors. The most of important of these considerations can be referred to as "three *E* s " (Engineering or technical, Economics, and Environment " in project planning and decision making process. Prior to environmental impact

assessment (EIA) process or “Magna Carta for the Environment”, Engineering or technical and economic factors can be referred to as "two *E* s ” dominated the project planning and decision-making process. Traditional organizations typically management according to the functions in vertical organizational charts. However, when interactions and interrelations occur among parts of a systems that is among functions and departments it is required to manage as per process in horizontal organization charts. A system of profound knowledge provides efficient PSAT organizational planning and decision-making process for the management of parts in isolation and process of cross functional boundaries including optimization of climate change process that is fulfil our common goal or vision of integration of development and environment. “Climate Impact Assessment” (CIA) process. CIA process can be defined the systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programs, or legislation actions relative to the physical-chemical, biological, cultural and socioeconomic components of the total environment and climate. The primary purpose of the CIA process, is to encourage the consideration of the environment and climate factors in planning and decision-making process and to arrive at actions which are environmentally and climate wise compatible. The climate health impacts of projects, programs, plans, polices, or legislative actions should be considered in the decision-making process because of the importance of these concerns, particularly post COVID world, a climate health impact assessment (CHIA) process is proposed. For certain types of projects such as PSAT, biogenic plants and nuclear power plants, it may be necessary to address psychological impacts and damages of mental health on human, animals and plants. The emphasis is to given in conduction of primary, secondary and tertiary climate impact studies on the physical-chemical and biological climate (natural or biophysical climate environment) and cultural and socioeconomic environment (man-made climate environment) for sustainable PSAT. The global agreements that were adopted on various key issues such as climate change, biodiversity, tropical forests, and sustainable development, Viz., Law of the Seas (1954), Stockholm Declaration (1972), Montreal Protocol (1987), Kyoto Protocol (1987), Rio declaration (1992) and The Paris Agreement (2015).

Therefore, SEA process is a predictable process that is devised in to two phases (Vijayan Gurumurthy Iyer, 2015). The first phase is called initial environmental and sustainability evaluation (IESE) and the second phase is environmental and sustainability impact studies (ESIS). IESE has been carried out for Japanese Matsushita carbon company’s proposed project, plan, program, policy, permit, procedure, and legislative action in India to determine whether potentially adverse effects on environment and sustain efficacy with respect to physical, chemical, biological, economical, microeconomics environment and on human health and well-being are significant or whether mitigation measures can be adopted to reduce or eliminate adverse environmental and sustainability impacts. Detailed SEA procedure can be called as ESIS that was applied to identify and evaluate the environmental and sustainability consequences both beneficial and adverse impacts in order to ensure that the environmental and sustainability impacts were taken in to consideration in organization’s planning and decision making process. SEA process is designed to identify and predict the potential impacts of the physical, biological, ecological, socio-economic, cultural environment and on human health and well-being are adequately protected (Vijayan Gurumurthy Iyer, 2011). Given below some of the methods and techniques applied for the sustainable project formulation and appraisal of fifteen DEBM extension learners of The EDI of India attached with the professional counsellor and co-ordinator for the various projects such as midget electrode (Battery carbon rod) project, nuclear power plant and WM & WRM project(Vijayan Gurumurthy Iyer, 2015).

1) Expert judgment and stakeholders’ sentiments
2) Check list and matrices
3) Multi criteria analysis
4) Case comparisons
5) Simulation models
6) Software and information system
7) Questionnaires
8) Group discussions

9) Delphi approach
10) Flow charts and decision trees
11) Contingency analysis
12) Overlays
13) Fuzzy logic

Environment and sustainability compliance requirements have been identified and evaluated systematically in these projects (http://debm-ediiindia.ac.in/counsellors/student record). Fifteen DPRs of DEBM Learners were formulated and appraised (http://www.ediindia.org/doc/list of institutions for website_latest.pdf.serial number68). (http://debm.ediindia.ac.in ; Agency code: 80410, Password: 80410)(Vijayan Gurumurthy Iyer, 2015)..

Step-wise Structure of SEA Process

SEA Process has been itemized by the following nine steps.

a. Preliminary activities and decision of Terms of References (TOR)
b. Scoping
c. Study of base line data
d. Strategic environmental assessment and evaluation,
e. Evaluation of alternative measures
f. Assessment of alternative measures
g. Preparation of final documents
h. Decision-making process.
i. Monitoring, measurement and control opportunities for resource transformation and project implementation and its strategic environmental assessment process.

Conceptual Framework for Screening and scoping of SEA Process

Screening and scoping processes are the items which are employed in the SEA processes (Figure-1).

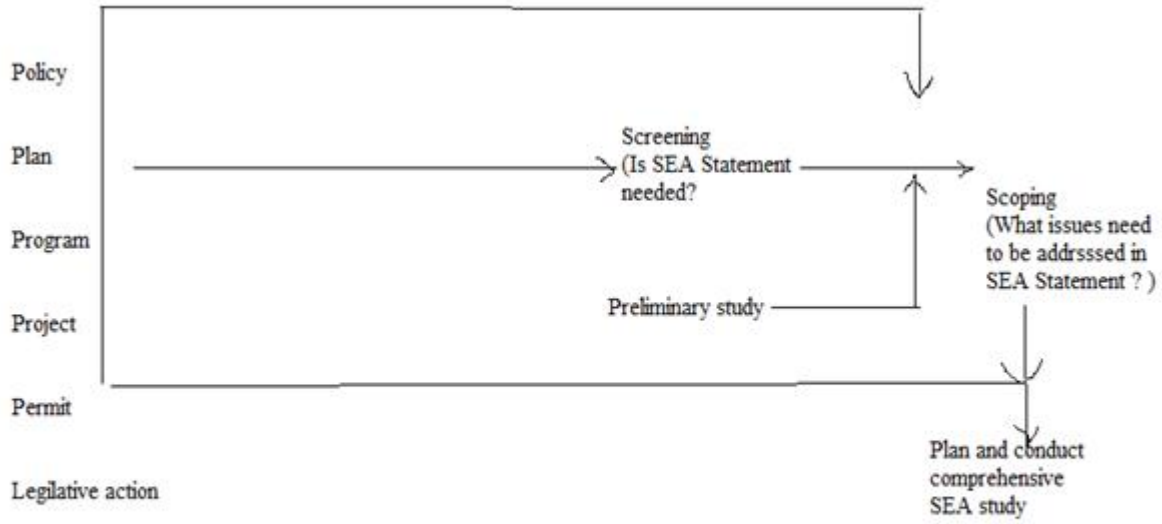

Figure-1: Conceptual Framework for Screening and Scoping Processes of SEA Process

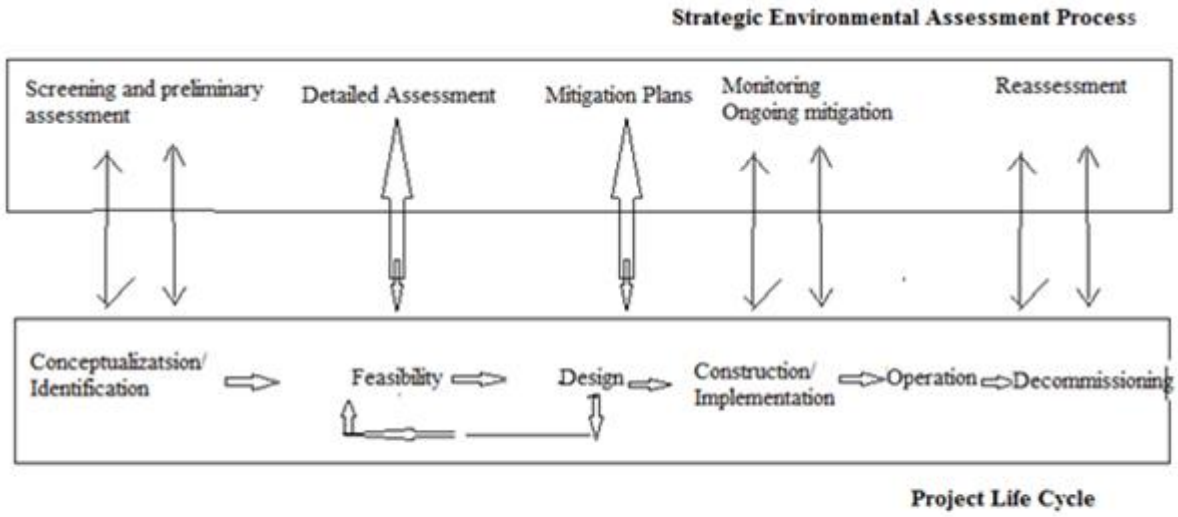

Figure-2: Strategic Environmental Assessment (SEA) Process at Different Phases of Project Life Cycle Assessment

Three most significant items are," Strategic environmental assessment inventory, environmental impact assessment, strategic environmental impact assessment statement. WM & WRM planning and decision making process should include the integrated consideration of technical, economic, environmental,, social, safety, health and sustainability factors (Figure-2).

Strategic Environmental Assessment Management Plan (SEMP)

A strategic environmental assessment management plan is a detailed plan and schedule for measures to minimize and mitigate any potential environmental and sustain efficacy impacts. SEMP should consists of a set of measurement, monitoring, control (mitigative) and institutional measures to be taken during the implementation and operation of the proposed projects to eliminate adverse environmental and sustainability impacts, offset them or reduce them to acceptable levels. Strategic environmental assessment process aims to incorporate environmental and sustainability considerations in to strategic planning and decision-making processes of the project formulation and appraisal. International EIAs are important considerations in project planning and decision making process(Vijayan Gurumurthy Iyer, 2010). It has been imperative to consider international EIAs in concrete project in order to mitigate CO_2 -and 424 ppm $CO_2$of induced climate warming problem and stratospheric ozone depletion problem. International EIA process is a potentially good environmental management (Glynn Hendry J and Gary Weinke, 2003).

Results and discussions

During the last two centuries due to the fast urbanization and industrialization along with advancement of WM & WRM Science, Engineering and Technology, there have been considerable developments in WM & WRM sector with the resultant wastage of copious amount of resources and tremendous environmental stress. Subsequently, it was realized that there were many adverse impacts on environment and society. These unsustainable WM & WRM developments have sustained the environmental growth (Vijayan Gurumurthy Iyer, 2010).. Sustainability of design and development, quality of life, safety on earth and continuous process improvement of our environment is of utmost important. Sustainable WM & WRM development means a kind of WM & WRM development that should

be occurred without damages to the environment. Hence, hectic WM & WRM developmental activities during the last two centuries have caused considerable environmental and social impacts. These impacts have been measured, monitored and mitigated by international environmental impact assessment process (Figure-3).

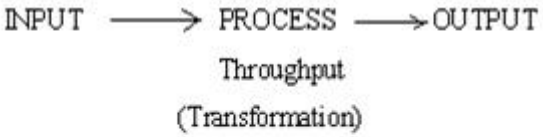

Figure-3 : Construction Management by Process Approach

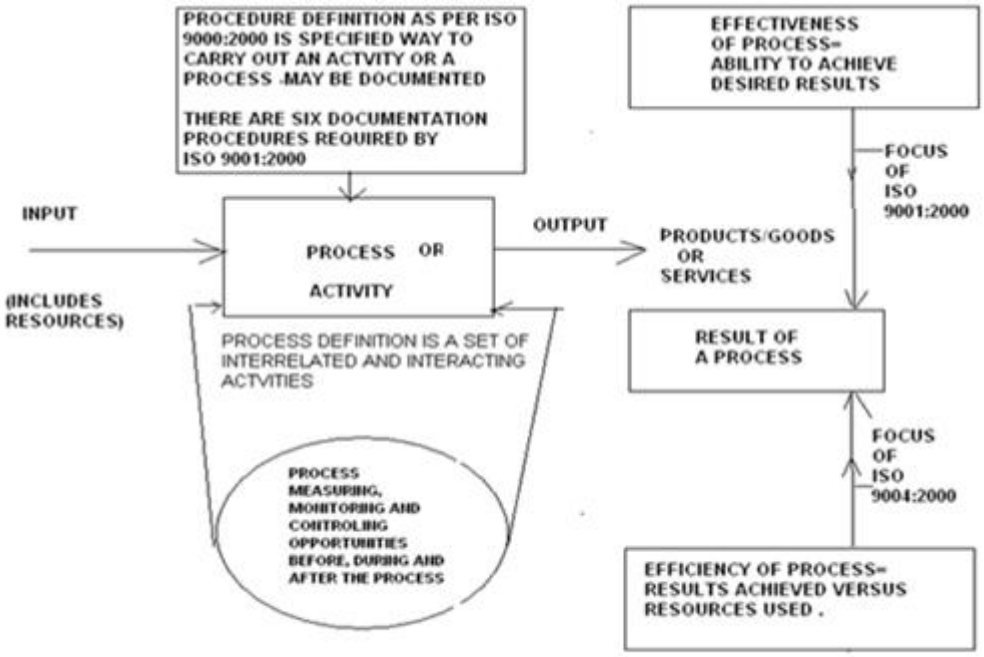

Figure-4: Schematic Diagram of a Construction Process

International EIAs are important in international project planning and decision-making process that mitigates potential environmental impacts in more than one country (Vijayan Gurumurthy Iyer, 2010). The use of sustainable WM & WRM technology and management in environmental and sustainability matters in two areas that is sustainable development with global problems and prevention technologies that are designed to reduce the environment effects of products and processes (Figure-4).

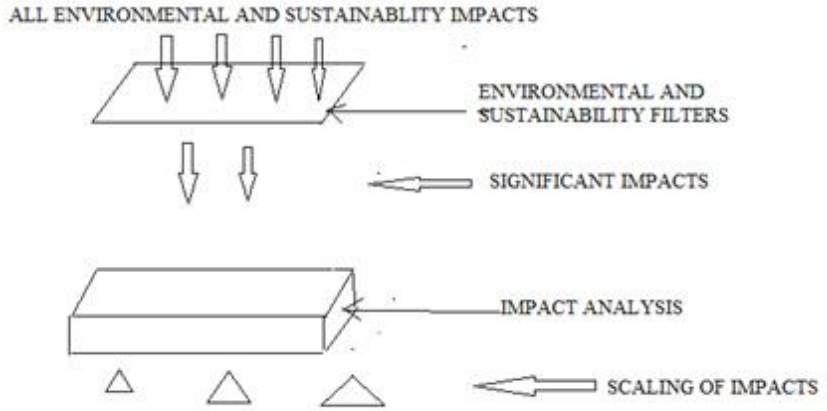

Figure - 5: Procedure for finding out the Significance of Environmental and Sustainabilty Effects

The integration of environmental protection and economic development is the most important strategic environmental assessment tool in achieving sustainable development (Figure-5)

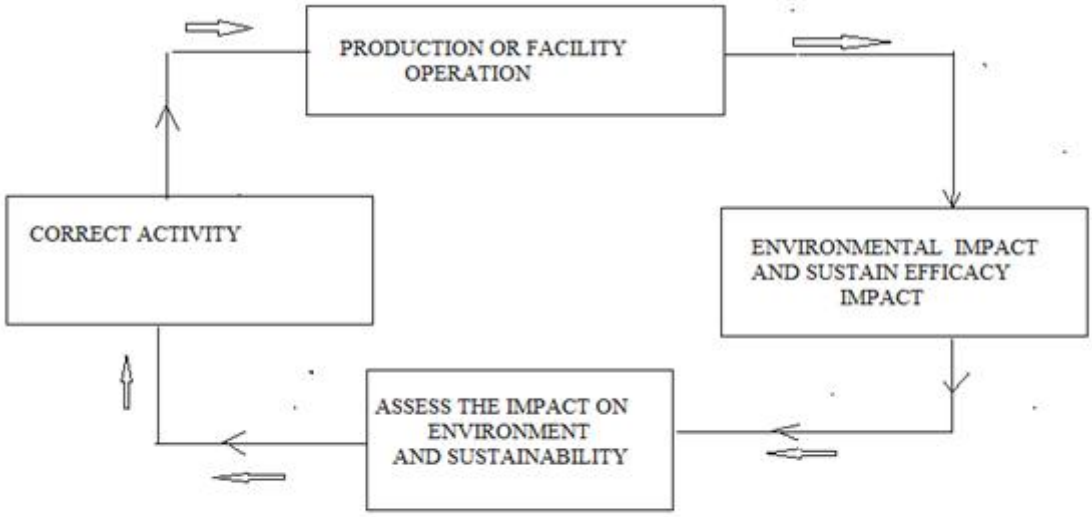

Figure-6: Environmental and Sustainability entitled" After-the -fact" evaluation

Project planning and decision-making should include the integrative consideration of engineering or technical, economic, environmental, ethical and social factors. A midget electrode project was taken as a case study for the strategic environmental assessment process (Figures-5 and 6). International EIA process has been designed for the sustainable midget electrode project design and WM & WRM to identify and predict the potential effects of the physical, biological, ecological, socio-economic, cultural environment and on human health and well-being are adequately protected. Environmental Impact Statements (EIS) have been prepared for the project which considering environmental and socioeconomic factors with respect to development and other proposed actions. Therefore, the EIA system is a potentially useful component of good environmental management (Glynn Hendry J and Gary W.Heinke, 2002).

In chromium tanning industry, chromium environmental contamination and pollution has discharged beyond safe limits which seriously affects the life on the earth (Vijayan Gurumurthy Iyer, 2007). Toxic emissions from industries, thermal power plants, smelting pollution, auto exhaust pollution in large metropolitan areas, photo chemical smog have been poisoning the atmosphere beyond the permissible levels which causes serious health hazards. Air pollution causes adverse

environmental health and social impacts. Mindless disposal of untreated industrial wastes in odissa chromite minesand other radio-active wastes in nuclear power plants, WM & WRM process debris, hazardous wastes, municipal solid wastes, agricultural wastes, domestic wastes have contaminated and polluted the water, soil and land beyond the tolerable limits, which adversely affects land fertility, water quality, vegetation, aquatic and marine life(Vijayan Gurumurthy Iyer, 2011). This is proving more and more hazardous as this development continuously damaging the environment viz., melting of glaciers, climate change, carbon tetra chloride emission, greenhouse gas emission, ozone layer depletion. For example, due to continuous increase in CO_2 concentration in the atmosphere due to industrial emission of about 382 ppm which lead to climate change. This decrease in glaciers contributes to about 29.5 % of mean sea level rise since 1991. Water supplies stored in the glaciers were projected to decline. Besides contaminating and polluting air, water, soil and land, intensive technological activities lead to depletion of natural resources (Vijayan Gurumurthy Iyer, 2011).

This must have been required to bring our energy and intellectual capacity in tandem whereby that can meet the challenge efficiently without major disruption as well as without compromising on the livelihood of future generation of their needs. Development would have occurred without damages to the environment and major disruption, and the process of urbanization and industrialization would have occurred in sustainable manner by utilizing the resources efficiently. Now, these environmental problems are the present environmental challenges and opportunities for improvement. In order to overcome these environmental problems that shall require new and more efficient solutions, technologies, processes and products alongside behavioral change.

Low carbon and energy efficient technology of WM & WRM industries can make contributions to mitigating impacts of economical growth on global warming (Figure-7) (Vijayan Gurumurthy Iyer, 2014). The resultant output of green products and services which are environmental advantages with good performance and cheaper prices. The dual goals of green design are the waste prevention and better material management as depicted in Figure 7. Design and WM & WRM of green buildings that has considerably reduced the environmental impacts associated with manufacturing, use and disposal (Vijayan Gurumurthy Iyer, 2015).

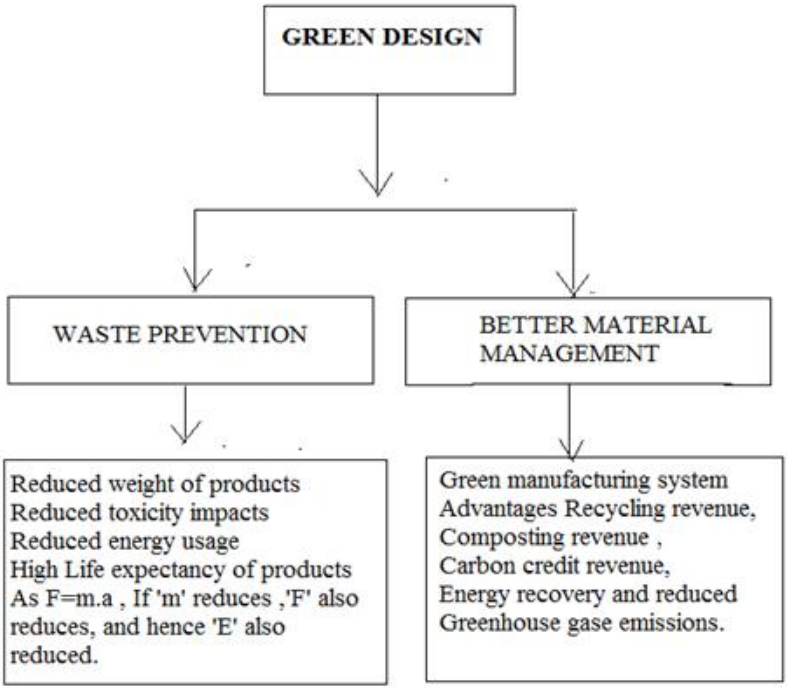

Figure 7 : Dual Goals of Green Design and Manufacturing Process

Prior to the enactment of National Environmental Policy Act on Environment in1970 in the USA, only technical or engineering and economic factors dominant in planning and decision making process in most of the world projects, plans, programs, permits, policies and legislative actions. As per the research results that project planning and decision-making process must include the integrated consideration of engineering or technical, economic, environmental, safety, ethical, social and sustainability factors. This important consideration can be referred to as "Concept of the Four Es and 1 S" in organizational planning and decision making process. There are ecological and biogeochemical principles and tools such as energy flows and material cycling, element ratios, mass and energy balance, element cycling, product environmental lifecyle assessment (LCA)(Figure-8) are available in order to solve major environmental problems that we face in our world today such as global warming, acid rain, environmental pollution and increasing greenhouse gases.

Product environmental lifecycle analysis (LCA)

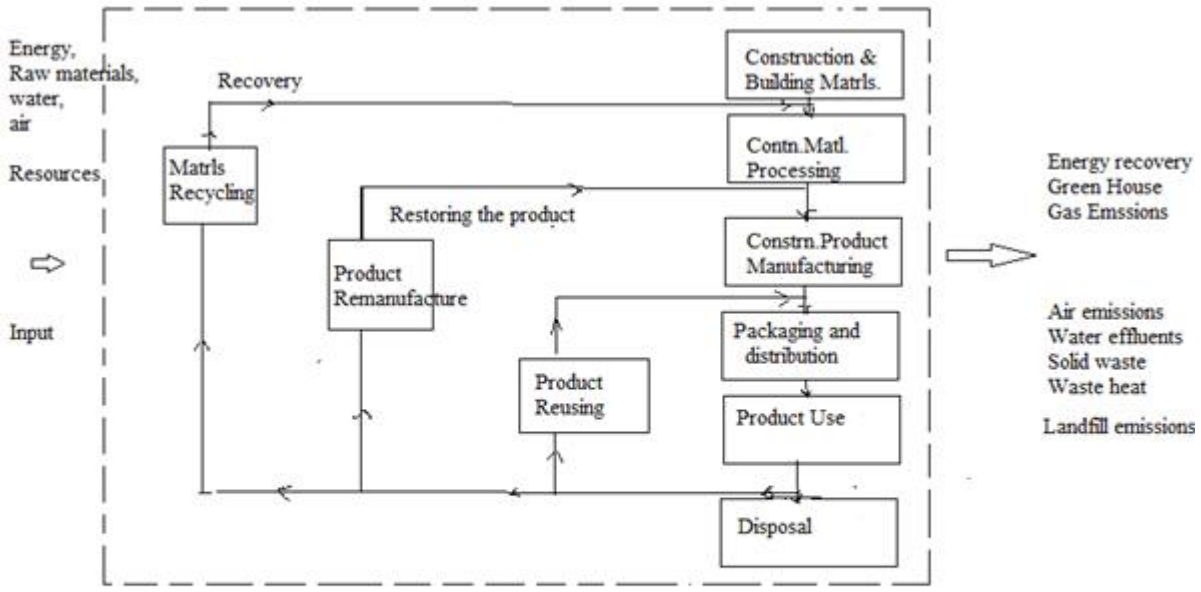

Figure - 8: Construction Product environmental lifecycle analysis (LCA)

Civil Engineering product environmental lifecycle analysis (LCA) is used for identifying and measuring the impact of industrial products on the environment and sustain efficacy by means of mass and energy balance methods(Figure-8) (Vijayan Gurumurthy Iyer, 2016). LCA consider the activities related to extraction of raw materials, ancillary materials, equipment production, use, disposal and ancillary equipment (Glynn Hendry J and Gary W.Heinke, 2002).

Environmental Health Impact Assessment (EHIA) Process for Nuclear Power Plant Project Towards Sustainable WM & WRM al Development

An environmental health impact assessment (EHIA) process is proposed in this research for nuclear power plant project during the WM & WRM phase in order to address psychological health impacts on workers and nearby residents (Vijayan Gurumurthy Iyer, 2016).. Environmental health impact assessment can be defined as the systematic identification and evaluation of the potential

environmental health impacts or effects of proposed nuclear power projects, plans, programs, policies or legislative actions relative to the physical-chemical, biological, cultural and socioeconomic components of the total environment. At present there are more than four hundred thirtyseven nuclear power plants situated in the World. It may be worth mentioned that none of the nuclear power projects, plans, programs, policies, or legislative actions in the World have got sustainable practice in conduction of EHIA process (Vijayan Gurumurthy Iyer, 2016). Nuclear power plants generate electricity using heat generated in pressurized water reactors where nuclear reaction takes place. During the WM & WRM phase of nuclear power plants which use Uranium-235, Thorium-232 and Plutonium-239 as fuels in nuclear reactors causing nuclear fission. That time copious amount of radiation dose due to radioactive pollution escaping out in the order of about 120 billion Becquerel (120 GBq) to 240 billion Becquerel (240 GBq) that is 50 grams to 100 grams, radiation activities viz., Alpha (α), Beta (β) and Gamma (γ) as against the safe limits of 0.1 Bq /l or Bq/kg (ppm) in land, air and water when operation, repair and maintenance of replacing old nuclear fuels with new fuels taken place. High exposures to radioactive pollution damage mental health and psychological burden on workers and nearby residents. As per a psychological health impact survey conducted by the author in a nucelar power plant at Quinson, China, severe psychological disorders including radioactive poisoning, depression and post-traumatic stress have been investigated to an extent among 49% of the nearby residents in and around 82% of the nuclear power plants in the World (Vijayan Gurumurthy Iyer, 2004) (World Engineers' Convention,Shanghai,China-2004). Psychological health impact loadings due to radioactive environment on workers and nearby residents have been studied in this research during the test run phase using computer simulation models. Psychological health impact assessment (PHIA) on workers and nearby residents have been addressed in order to mitigate psychological health impact loadings on workers and nearby residents.

Environmental Health Impact Assessment (EHIA) Process for Sustainable Industrial Development

In this research, EHIA process has been investigated on cotton double roller (DR) ginning industries using chrome composite leather clad (CCLC) washers and design and development of an eco-friendly alternative(Vijayan Gurumurthy Iyer, 2007). The objective is to assess the environmental health impacts of Indian cotton ginning industries. Most of the cotton ginning operations are performed by using DR ginning machines which serve an important role in the Indian cotton ginning industries. The rollers used are made of CCLC covering fixed to a shaft. The CCLC contains about 18,000 to 36,000 mg/kg (ppm) of chromium particles (Vijayan Gurumurthy Iyer, 2007). When the seed-cotton is processed in DR ginning machine, the lint cotton is contaminated with hexavalent chromium dust of about 140 to 1990 mg/kg (ppm) which is carcinogenic substance against the safe limits of 0.1 ppm. During the cotton ginning process due to persistent rubbing of CCLC over stationary knife the chromium particles are adsorbed into lint cotton such that the spun yarns and woven fabrics get contaminated about 100 to 200 ppm which according to World Health Organization (WHO) eco-standards should not be more than 0.1 ppm. The CCLC rollers used in cotton roller ginning machines get powdered during the ginning process. As chromium is a specific dust, gin and mill workers and residents are directly exposed to this carcinogenic substance and are vulnerable to environmental health hazards. To offset this problem, pollution-free eco-friendly washers/rollers both for laboratory and commercial studies have been fabricated and experimented. Environmental health inventory (EHI) serves as the basis for evaluating the potential environmental health impacts both beneficial and adverse of a proposed action. Environmental health impact statement (EHIS) describes the affected environmental health or environmental health setting without the project. Design and development of the EHI is an initial step in the EHIA process. It is concluded that EHIA process should be conducedfor certain projects, plans, programs, legislative actions, policies in the project planning and decision-making process.

International EIA Process

International EIA process is a potentially good environmental management system (EMS). International organization for Standardization (ISO)'s 14000 and 9000 standards focus on Environmental Management System (EMS) and Quality Management System (QMS) of all sorts of organizations apart from more than 19500 published standards. Environmental Management System (EMS) and Quality Management System (QMS) have been separately featured in ISO. Environmental Management System (EMS) standards apply to the management system concepts of an organization's environmental issues and opportunities (Giri.,C.C. et.al.,2003). It defines the features of an EMS that need to be in place to ensure that the organization identifies and focuses on improving areas where they have significant environmental impacts. This system can be integrated with ISO 9000 Quality Management System (QMS) standards in order to achieve excellence in quality as well as environmental obligations. The overall aim of the EMS is to provide protection to the environment and to prevent pollution so as to manufacture eco-friendly products and services. EMS focuses on key drives of performance excellence in products and processes as well as organizations that are focused on delivering values to the customers, internal operational processes, and to staff's learning. Hence, this system approach to the environmental management shall achieve excellence in the overall performance of the organization. In the present study about two third of WM & WRM waste was recoverable due to the conduction intensive on-site training programmes on recycling and composting processes as against the conventional WM & WRM management practices which could able to recover the waste of only 10 to 15% (Vijayan Gurumurthy Iyer, 2014).

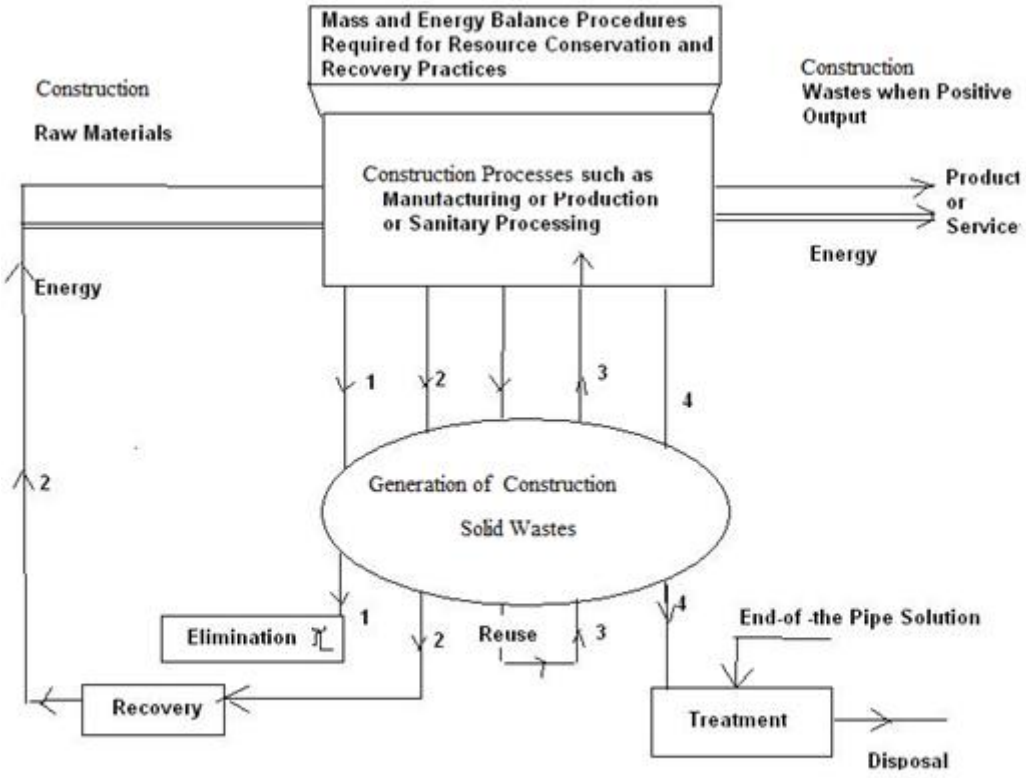

Figure- 9 : Schematic Representation of Constructional Process or Activity Showing Sustainable Construction Waste Management

WM & WRM wastes are produced by WM & WRM sector. The study has been attempted to identify and evaluate special waste minimization hierarchy of waste management for properly managing WM & WRM waste including minimizing generation and treatment that have been generated, and disposing of waste residuals. A case study has been included on generation of WM & WRM wastes and potential waste management strategies for a group or generic WM & WRM processes. All WM & WRM processes

generate wastes in the form of liquids, solids or gases. Some wastes are considered as hazardous. The waste minimization hierarchy of waste management is duly ranked from most desirable to least desirable (Figure-9). 1. Eliminating waste generation –Most desirable, 2. Reducing waste generation- Most desirable, 3. Reuse, recover or recycle waste materials- Most desirable, 4. Treating waste to diminish quantity and to detoxify the hazardous and non-hazardous solid wastes --Least desirable, 5. Disposing of waste residuals- Least desirable. Waste minimization include only elimination, recovery, reduce, reuse and recycle hierarchies. Waste minimization does not include treatment of wastes as well disposal that is point number 4 and point number 5 because, these are traditional waste control strategies involves treatment and disposal which are called end-of-the pipe solutions and are costly affairs as well as involve control of high discharge standards. Modern waste control strategies involve point number 1, point number 2 and point number 3 which are not requiring end-of- the pipe solution for the waste management problems. Solid and hazardous waste generation is the sum of material recovery and discards. Report on waste audit conducted for a WM & WRM industry is presented for recovering two-third of municipal solid wastes (MSW) by recycling and composting processes (Figures-10 and 11) (Vijayan Gurumurthy Iyer, 2014).

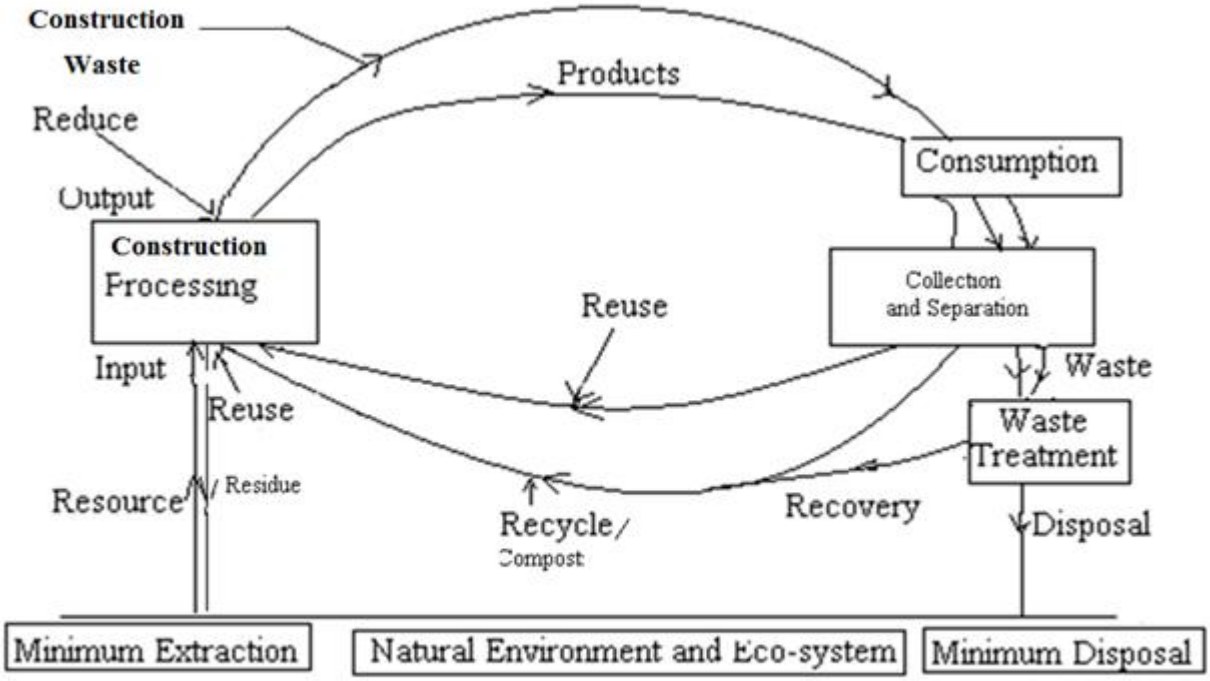

Figure -10 : Closed Loop-Shaped Green Economy for Sustainable Construction Waste Mgt.

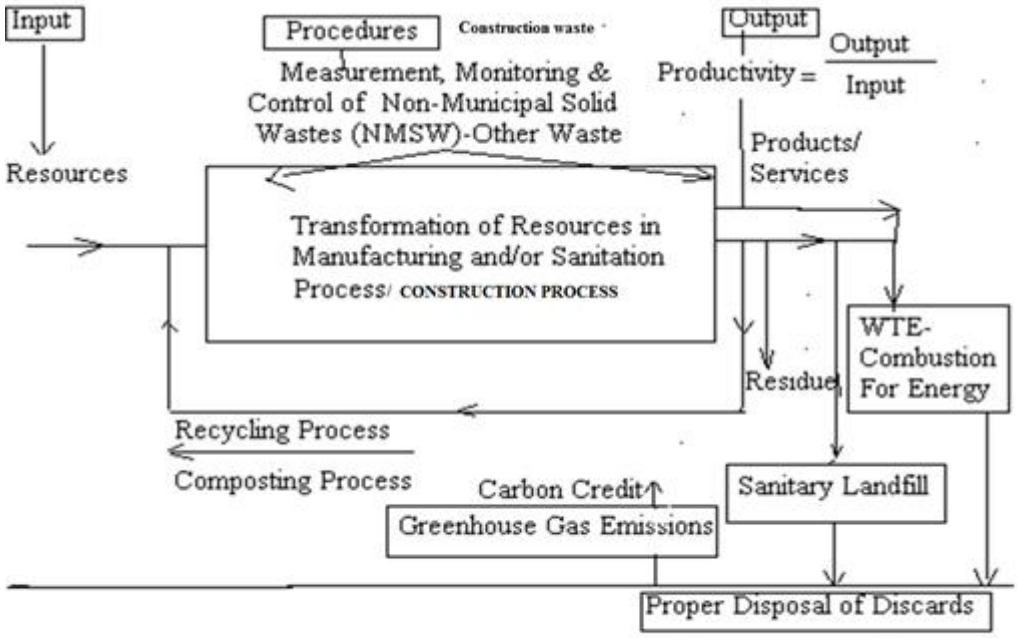

Figure - 11: Sustainable Construction Waste Management System

To achieve the sustainable economical improvement, natural resources to be utilized at optimum level so as to maximize efficiency as per the result analysis of optimum competitive and social markets. The efficiency of a kind of sustainable economical system is referred in "*A.K"* sustainable economic model that is the product of engineering or technical factor level (A) and the capital (K). The sustainable economic improvement is explained by three factors which are given below:-

① The natural increase in the accumulation of labour potential,
② Capital accumulation or money with which a business is started and run,
③ and
④ Sustainable technological momentum can be referred as total factor productivity (TFP) or efficiency in WM & WRM process.

Such momentum keeps the capital development dynamic which emerges from the sustainable enterprise creation process, green products or services, new methods of production and processes, new WM & WRM management and transportation, new markets and new forms of WM & WRM organization. Standard Production Function (SPF) is expressed based on operation approach as Y = f (C, L)

Where Y=Output, C=Capital, and L=Labour

As knowledge is an important factor for the economic growth, Standard Production Function (SPF) is modified based on process approach as $Y= A. f (X_1, X_2, X_3, X_4, X_5, X_6)$

'A' represents Knowledge on sustainable WM & WRM engineering or technical factor, Y= Output,

Input elements are namely, man power, machinery, materials, method, money and market denoted as $X_1, X_2, X_3, X_4, X_5, X_6$ f = Standard production function and process (Combined function and process management).

As per the given standard production function, knowledge is a decisive production variation, sustainable innovation level is required in engineering or technical system. The solution is the development of reformed SEA implemented WM & WRM industries (Vijayan Gurumurthy Iyer, 2015).

Importance for the Conduct of Environmental Impact Assessment (EIA) and Management Study and Chck for the WM & WRM Projects

Historically, the choice of new WM & WRM projects was primarily on one criterion, that is economic viability. Presently, second and third choice criteria that is environmental and social impact have become a strong yardstick, therefore a triple bottom-line approach that is economic, environmental and social factors to WM & WRM al project viability. Environmental Impact Assessment (EIA) process is a systematic identification and evaluation of potential effects of proposed projects, plans, programs, plans or legislative actions relative to the physical-chemical, biological, cultural and socio-economic components of the total environment.

Steps to Conduct Environmental Impact Assessment and Management

Step-1: Identification of quantity and quality characteristics of concerned environment of proposed project.
Step-2: Preparation of description of existing environmental resource conditions.
Step-3: Procurement of relevant quantity and quality standards.
Step-4: Impact predictions,
Step-5: Assessment of impact significance,
Step-6: Identification and incorporation mitigation measures.

Conduct of Environmental Impact Assessment (EIA) Study for the Efficient WM & WRM Industrial Generic and Source Specific Projects

(1) Prediction and assessment of impacts on surface water environment,
(2) Prediction and assessment of impacts on soil and ground environment,
(3) Prediction and assessment of impacts on the air environment,
(4) Prediction and assessment of impacts on the noise environment,
(5) Prediction and assessment of impacts on the biological environment,
(6) Prediction and assessment of impacts on the visual environment,
(7) Prediction and assessment of impacts on socio economic environment.
(8) Prediction and assessment of impacts on cultural environment,
(9) Prediction and assessment of impacts on archaeological environment,
(10) Prediction and assessment of impacts on anthropological environment

Benefits of EIA in WM & WRM Industries

(1) Considerable reduction inwaste and the depletion of resources.
(2) Considerable reduction and / or elimination of the release of pollutants in to the environment.
(3) Green design and green building products to minimize their environmental impact in
(4) Production, use, and disposal.
(5) Control the environmental impacts of sources of raw material.
(6) Waste minimization and adverse environmental impact of new developments.
(7) Promote environmental awareness among employees and the community.

Environmental Management Programs

The organization shall establish and maintain a program(s) for achieving the environemntalobjectives and targets. It shall include designation of the responsible function, team, or individual and a time frame for achievement (Giri.,C.C. et.al.,2003)..

a. State the objective / target.

b. State the purpose (how the objective/target will support the policy).
c. Describe how the objective/target will be achieved.
d. State the program (team) leader.
e. Designate departments and individuals responsible for specific tasks.
f. Establish the schedule for completion of the tasks.
G. Establish the program review, which will include format, content, and review schedule.

Conduct of Social Impact Assessment (SIA) Study

Social Impact Assessment (EIA) process is a systematic identification and evaluation of potential social effects of proposed projects, plans, programs, plans or legislative actions relative to the society. The purpose of the SIA process is to bring about a sustainable and equitable biophysical and human environment (Vijayan Gurumurthy Iyer, 2014). SIA process includes the monitoring, measurement and control opportunities including analysis and management of the intended and unintended social consequences whether both positive and negative impacts of planned interventions and any changes takes place in social transformation process invoked by those interventions. The SIA process should include the analysis of the use of land, culture, industrial process, economic development, and their impact on service sectors such as water use, energy use, sanitation and traffic. SIA process is done to ensure that there is no mismatch between the WM & WRM al development and socio-cultural and economic development of the project areas.

Sustainable Water and Waste Water Quality Management

Water quality is to be maintained in WM & WRM sites such that water supply to consumers is safe and hygiene. Relevant water quality standards are to be followed (Ralph A.Wurb,2003). Sustainable sanitation facility is to be provided. Sewerage system, Waste water treatment system, industrial waste treatment system, storm water drainage system and sustainable septic tank are important onsite requirements. Relevant waste water discharge standards are to be followed. Process approach for measurement, monitoring and control opportunities for water, waste water and industrial water water iniquity and quality has been followed(Mtcalf Eddy, 2012).

Safety Engineering and Management in WM & WRM Industries (Safety First)

Safety management is the systematic identification and evaluation of potential safety requirements of proposed projects, plans, programs, plans or legislative actions. The purpose of the safety engineering and management is to bring about design and WM & WRM s of sustainable civil engineering structures. It has been observed that some WM & WRM methods and machinery used in India are to be obsolete and outdated because they were old which operated on poor performances in terms of productivity, quality, efficiency and safety. Some of the alternative machinery, which are indigenous manufactured, also do not guarantee for the good performance and necessary safety conditions because of their poor design and materials of WM & WRM. It is mandatory that checking for safety requirements with regard to machinery, bridges, roads and buildings. Safety personnel responsible for overseeing the safety of all operating personnel must be cognizant of the latest laws and regulations pertaining to worker safety and occupational health (Pascal M.Rapier and Andrew C.Klein,1998). These are changed and/or updated from time to time.Checking for Safety (CFS) such that to ensure that the question of safety will not be overlooked, it is well to have all plans, specifications and drawings checked for safety, making special provision for this in each set of specifications and in the title plate of each drawing duly checking periodically for cranes, hoists, ventilation, lifts, tackles, fire protection systems, alarms, buildings, mechanical guarding and electrical and electronic equipment and heavy engineering equipment.

Personal protective equipment (PPEs) and materials include garments, clothing, gloves, safety shoes, hard hats, safety glasses, shields, respirators, full aprons, safety belts, and other safety items have to used by an individual (Pascal M. Rapier and Andrew C.Klein,1998). Such equipment is important for personal protection and for safety. It is the manager's and supervisor's responsibility to insure that they are used. As far as occupational-disease prevention is concerned that those persons engaged in or working near operation are exposed to appreciable quantities of dusts, fumes or gas, it is important that adequate control measures must be adopted. Some major considerations involved in the application of effective control to industrial occupational disease are given. Some of the policies, practices, and procedures to prevent exposure of personnel to unsafe materials are also provided. As far as the worker's compensation law is concerned, it has to be enacted strictly in our country. The principle involved is that the worker injured or disabled in WM & WRM industries should be enabled, through proper medical treatment, to return to wage-earning capacity as promptly as possible and while incapacitated, should receive compensation in lieu of wages, and regardless of fault. The expense of medical treatment and compensation should properly be borne by industry and become a part of the cost of its products. The laws generally provide that workers injured in industry shall be furnished the necessary medical treatment, and, in addition, compensation based on a percentage of their weekly wages, payable periodically. Dependents of employees kill in industry are likewise compensated. Occupational diseases law provides provisions for compensation benefits in occupational – disease cases. The enactment of worker's compensation laws and occupational disease law shall increase materially the cost of insurance to industry. The increased cost and the certainty with which it is applied will put a premium on accident-prevention work. This cost can be materially reduced by the installation of safety devices (Pascal M. Rapier and Andrew C.Klein,1998).Research experience has shown that approximately 80% of all the WM & WRM industrial accidents are preventable. As far as the fire loss prevention is concerned, which is an indispensable element in WM & WRM industry. It exists only with top management direction and the support of labor. The designation fire protection usually encompasses the entire field of prevention of loss by fire, including both the causes for the occurrence of fires and methods for minimizing their consequence. Some of the fire standards of protection to prevent injury and loss of life are given in this paper. Fire protection engineering practices both in building design and in safe operating practices are also included (Pascal M.Rapier and Andrew C.Klein,1998).WM & WRM noise safety is concerned, noise is recognized as a pollutant, both as a nuisance and as the cause of hearing impairment. There is evidence in WM & WRM sites that noise cause ailment such as hearing impairment, physiological and psychological disorders including anxiety and heart disorders. Protection from noise is required when sound levels exceed those standards. When protective equipment is required, it must be provided by a trained person and periodic checks made of the effectiveness (Pascal M.Rapier and Andrew C.Klein,1998).

Total Quality Management (TQM)

Total Quality Management (TQM) can be broadly defined as a set of systematic activities carried by an institution to efficiently achieve institutional objectives that satisfies beneficiaries at the appropriate time and price. The definition of quality is "The totality of features and characteristics of products or services that bear on its ability, efficacy and values to satisfy a given or implied need". TQM is a comprehensive and structured approach to an educational integrated management that seeks to improve the quality of educational services through ongoing refinements in response to continuous feedback. Thus this standard definition of quality is applicable commonly to both products and services that is stated and unstated (Giri.,C.C. et.al.,2003).TQM has an important role to play in addressing quality issues surrounding the WM & WRM al development.TQM is a comprehensive and structured approach to WM & WRM sector that seeks to improve the quality of services through ongoing refinements in response to continuous feedback. TQM leads to sustainable WM & WRM al development. International Organizational for Standardization's ISO 9000 series define TQM as a management approach centered on quality, based on the participation of all its members and aiming at long term

success through customer satisfaction and benefits to all members of the organization and society. Hence, TQM is based on quality management from the customer's point of view. TQM processes are divided into four sequential categories: plan, do, check, and act (Figure-12). This is also called the *PDCA* cycle or *Deming's* cycle for continuous process improvement. In the *planning* phase, WM & WRM lists define the problem to be addressed, collect relevant data, and ascertain the problem's root cause; in the *doing* phase, WM & WRM lists develop and implement a solution, and decide upon a measurement to gauge its effectiveness and efficiency ; in the *checking* phase, WM & WRM lists confirm the result through before-and–after data comparison; in the *acting* phase, WM & WRM lists document their results, inform others about process changes, and make recommendations for the problem to be addresses in the next PDCA cycle. ISO 9000 series focus on quality management for all sorts of organizations. It defines the features of quality management system (QMS) that need to be in place to ensure that identify and focus on improving the areas where they have significant WM & WRM al deficiencies (Giri.,C.C. et.al.,2003).

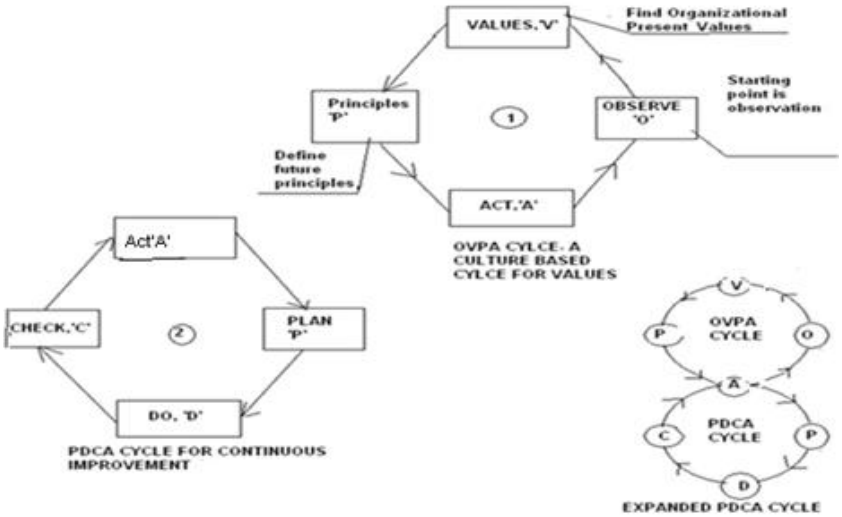

Figure- 12: Conceptualization of Culture Based Environmental and Quality Management entitled "OVPA" Cycle By Incorporating the Expanded PDCA Cycle for Indian Construction Industries towards Sustainable Construction Management

The ISO 14000 Environmental Management System (EMS) standards apply to the management system to manage an organization's environmental issues and opportunities (Giri.,C.C. et.al.,2003). It defines the features of an EMS that need to be in place to ensure that the organization identifies and focuses on improving areas where they have significant environmental impacts. This system has been integrated with ISO 9000 Quality Management System (QMS) standards in order to achieve excellence in quality as well as environmental obligations in midget electrode project. The overall aim of the EMS is to provide protection to the environment and to prevent pollution so as to manufacture eco-friendly products and services. The ISO 14000 series of standards assist the organizations to excel environmental and economic gains for continuously improving organizational performances. They are used for prevention of pollution, reduction in wastes, enhancement of internal management system efficiency, optimum utilization of resources and compliance for legal and regulatory requirements. EMS can be basically divided into five events which form the sequence of a cycle (Figure 13). These five events are (1) Environmental Policy, (2) Environmental Planning, (3) Environmental implementation and operations, (4) Checking and corrective actions, and (5) Management Review. The ISO 14000 series of standards have also been designed to cover the areas of environmental issues and opportunities for the organizations to compete the global customer centric markets so that the products and services can be manufactured at par with the international requirements (Giri.,C.C. et.al.,2003).

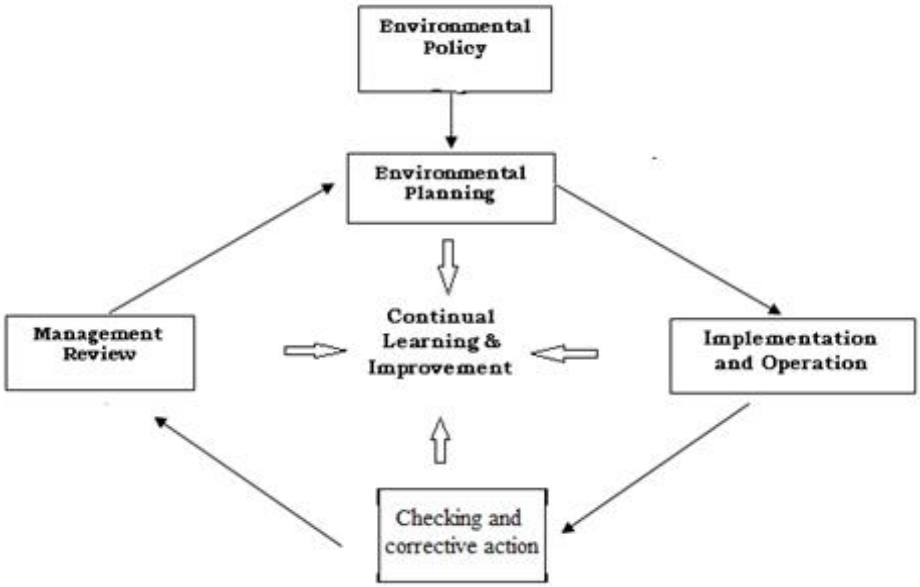

Figure - 13; Environmental Management System

EMS focuses on key drives of performance excellence in products and processes as well as organizations that are focused on delivering values to the customers, internal operational processes, and to staff's learning. It may be mentoned that Environment and Quality Management (EQM) and Occupational Health and Safety (OHS) is a managerial approach centered on environment and quality through beneficiary satisfaction in WM & WRM industries that lead to economical improvement and sustainability (Vijayan Gurumurthy Iyer, 2016). Hence, this system approach to the environmental management shall achieve excellence in the overall performances of the organization**.**

Conclusions and Recommendations

SEA process has been aimed in order to incorporate environmental and sustainability factors in to WM & WRM al project planning and decision-making process and climate impact assessment (CIA) process, such as projects' formulation and appraisal of Indo-Matsushita midget electrode (battery carbon rod) plant in 1979 at Tada, sustainable bridge, road and sanitation structures, green building, nuclear power plant, cotton roller ginning plant and concrete that included polices, programs, plans and legislative actions. The primary purpose of the SEA process is to encourage the consideration of the environment, safety, health, social and sustainability factors in organizational WPDM process and to arrive at actions that are compatible.EIA should be considered as an official tool to protect the environment. EIA process is a multidisciplinary approach that must be necessary in providing a prevention mechanism for environmental management and protection in any WM & WRM development. EIA process is designed to identify and predict the potential effects of the physical, biological, ecological, socio-economical, cultural environment and on human health and well-being are adequately protected.

As per research results, WPDM process should include the integrated consideration of technical or engineering, economic, environmental, safety, health, social and sustainability factors in order to achieve business excellence. The SEA process protocol has been proposed for checking the quality of environmental and social assessments and management plans. This treaty and official government procedures of SEA helpful for making much earlier in the decision-making process than EIA process. Therefore, it is key tool for sustainable development. SEA aims to incorporate environmental and sustainability considerations in to strategic decision-making process, in order to formulate policies, plans, and programs and legislative actions.

Prior to the National Environmental Policy Act (NEPA) process in 1970 in the USA, technical and economic factors dominance the World's WM & WRM al projects. The objective of the study is to conceptualize SEA process for the WM & WRM sector on the basis of fifteen number of sustainable detailed project reports submitted by the extension learners of Diploma in Entrepreneurship and Business Management course conducted by the Entrepreneurship Development Institute of India during the research year 1999 to 2016 under the author's counsellor-ship. The ISO 14000 Environmental Management System standards and Occupational health and Safety Management (OHSM) apply to the management system concepts of total quality management to the management of an organization's environmental and safety and health issues and opportunities. It defines the features of an EMS that need to be in place to ensure that organizations identify and focus on improving areas where they have significant environmental impacts. EMS focuses on key drives of performance excellence in products and processes as well as organizations that are focused on delivering values to the customers, internal operational processes, and to staff's learning. Hence, this system approach to the environmental management shall achieve excellence in the overall organizational performance. Engineering and Science product and process environmental lifecycle analysis has been conduced for identifying and measuring the impact of WM & WRM industrial products on the environment and sustain efficacy by means of mass and energy balance methods. LCA considers the activities related to raw materials, transformation, ancillary materials, equipments, methods, market, production, use, disposal and ancillary equipment. As far as the WM & WRM safety is concerned, personal protective equipment and materials that include garments, clothing, gloves, safety shoes, hard hats, safety glasses, shields, respirators, full aprons, safety belts, and other safety items have to used by an individual. Such equipment is important for personal protection and for safety. It is the manager's and supervisor's responsibility to ensure that they are used. The enactment of worker's compensation laws and occupational disease law shall increase materially the cost of insurance to industry. The increased cost and the certainty with which it is applied will put a premium on accident-prevention work. This cost can be materially reduced by the installation of safety devices. WM & WRM maangment research experience has shown that approximately 80% of all the WM & WRM industrial accidents are preventable. It is concluded that environment coupled with quality management is a managerial approach centered on environment and quality through beneficiary satisfaction that leads to economical improvement and sustainability based on the triple bottom-line approach. TQM has an important role to play in addressing quality issues surrounding the sustainable WM & WRM al development. Sustainable water and waste water management has been discussed.

EIA and EHIA processes have been conducted for a nuclear power plant to consider the safety and health impacts in order to mitigate psychological health loading on workers and nearby residents. SEA system is a potentially useful element of good environmental management and sustainable development; however, as currently practiced in WM & WRM industries, it is far from perfection. Emphasis should be given in WM & WRM industries on maintaining economic viability of the operation, while in turn taking care to preserve the ecological and social sustainabilities of the country. International EIA process required multi-disciplinary approach that has been conducted very early stage of Indo-Matsushita carbon rod project in 1982 at Tada for economic, environmental and social viabilities.

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