

# Environmental Management System Framework for Sustainability Achievement in Higher Educational Institutions

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**Abstract** – *The purpose of this paper is to map an environmental management system (EMS) framework for higher education institution (HEI) of Pakistan. On the basis of extensive literature review, environmental management system ISO 14001 framework was proposed for HEIs of developing countries. Then Initial environmental review (IER) was conducted through interviews, questionnaire and observations; followed by strength, weaknesses, opportunities and threats (SWOT) analysis to identify key environmental concerns of the selected public sector university. Finally, environmental management system implementation plan was developed for university in the light of ISO 14001 guidelines. Both direct and indirect interactions were considered to scan the current environmental practices of university. The SWOT analysis indicated that university is working somehow satisfactorily in transportation, but there is a need of improvements in resource consumption, landscaping, air quality and purchasing. The environmental management plan for managing all the major and minor concerns have been proposed on the basis of gaps experimented through IER and SWOT analysis. The analyses of quantifiable targets including carbon and water footprints have not been carried out in the plan. Following of EMS guidelines at the university will help to reduce the direct and indirect impacts of different activities on the environment. It will also help to create environmental awareness in young minds that how to integrate sustainability in everyday life. Educational institutions of Pakistan are paying less attention towards the environmental protection. In addition, the awareness of environment protection is also limited. This research is unique in Pakistan in the sense that it will help to explain the procedure for identification of major environmental concerns and mapping environmental management system for a university. Copyright © 2016 Penerbit Akademia Baru - All rights reserved.*

**Keywords:** Sustainability, Environmental management system, initial environmental review, environmental awareness

## 1.0 INTRODUCTION

Global warming, solid waste, wastewater generation and terrestrial eco-toxicity are the biggest problems faced by the community now days. These impacts are likely to increase losses of property and costly disruptions to society including human health, plants, land, air, infrastructure as well as energy, food, and water supplies. Higher educational institutes HEIs are supposed to solve these problems by conducting research and development activities in this critical area. However, instead of problems solvers, HEIs are problems creators and work as small cities having large size of population with involvement in many complex activities. This problem is more threatening in developing countries which are unaware about the environmental degradation and resource depletion. This problem can be eliminated by implementing environmental management system EMS in HEIs. Therefore, reactive

approaches in the form of professional and technical measures are redundant for the reduction of environmental pollution and degradation caused by multidimensional activities in the universities.

Pakistan is a developing country having less environmental protective measures in educational institutes. The aim of this research is to map the environmental management system EMS framework for higher educational institute of Pakistan. It involves the development of environmental protection policy by including the structure, plans and resources of university. The EMS framework will help to optimize resource consumption at the selected HEI. At the same time, the idea of sustainability will be instilled in young minds and aware them the integration of sustainability in day to day life.

## **2.0 LITERATURE REVIEW**

Environmental management system (EMS) is “the organizational structure, responsibilities, practices, procedures, processes and resources for determining and implementing environmental policy” [1]. EMS does not work as law instead it acts as a voluntary instrument in controlling the operational environmental impacts of companies [2].

Regulations and traditional practices addressing the environmental issues in ad hoc manners have become inefficient and unable to provide sustainability assurance [3]. These environmental protection regulations only focus to control emissions of air and water, and disposal of waste [4]. But the potential risk elements in different projects may vary in several conditions which required proper management [5]. In the same way the environmental issues are more complex, interconnected and multidimensional, therefore, a systematic and integrated approach in the form of EMS is required for environmental sustainability in investments, decisions making and management [6]. All significant activities that have potential impact on the community or environment should also be properly disclosed and managed in order to become transparent towards stakeholders [7]. Society and the government also aim to manifest advancement in the industrial system by assessing the environmental impacts generated by industrialization activities [8]. EMS implementation makes organization able to achieve recognition in market by enhancing public image, minimizing financial and legal risks, satisfying regulatory and legal requirements, improving work environment and staff moral, reducing operating cost and minimizing the consumption of resources and material [9].

EMS is mainly divided into two standards namely 1) formal, and 2) informal [10]. Clark and Kouri pointed that Canadian and New Zealand universities implemented non-formal EMS without seeking certification [11]. European universities on the other hand, implemented both formal and informal EMS with the ratio of 81% and 19% respectively [10].

A number of EMS frameworks have been developed for universities including osnabruck environmental management model [12], EMS implementation model for U.S. colleges and universities [13], and sustainable university model [14], ISO 14001 models, EMS self-assessment checklist, higher education 21 program, the auditing instrument for sustainability in higher education (AISHE), and European EMAS model (Eco-Management and Audit Scheme) [11]. The ISO 14001 and EMAS (Eco-Management and Audit Scheme), developed by the European Union are the two best known formal environmental frameworks. The organizations and sites certified with these EMS have been continuously increasing since their launch in the 90s [10]. A survey conducted by ISO in 2009 [15] states that 8813 sites in

Africa/West Asia, 3923 sites in Central/South America, 7316 sites in North America, 1623 sites in Australia/ New Zealand, and 89237 sites present in Europe; in which Spain has 16527, Italy has 14542, the United Kingdom has 10912, and the most sites are present in Far East of 112237 which are certified with ISO 14001.

All EMS models usually follow the cycle of plan-do-check-act leading towards continual improvement under the layers of policy, planning, implementation, checking, and review with the comparison of some unique features [11]. Since the base of all EMS models is ISO 14001 therefore, the essential elements of an EMS according to the ISO 14001 standards are: to i) develop a policy for environment, ii) identify the environmental activities affecting environment, iii) develop the environmental programs for targets and objectives, iv) utilize the procedures for the identification of legal requirements which are relevant with the environmental issues, v) assign the responsibilities to particular people for environmental tasks, vi) report about the environmental performance to the senior management in routine, vii) train the individuals who affect the environment by their actions, viii) maintain the documents about environmental issues by external and internal communications, ix) create a system for the assurance that environmental procedures are up to date, x) be prepare for environmental emergency along with the response procedures, xi) monitor and measure the operations having environmental impacts, xii) make available the procedures for the correctness of any non-conformance in environmental activity, xiii) make available the procedures for management and environmental records storage, xiv) conduct the internal audits for environmental programs on routine basis, xv) conduct the external audits for environmental programs on routine basis, and xvi) held review of environmental program periodically by upper management of institution [16].

Universities deal five areas of activities including education, research, operations, outreach, assessment and reporting [17]. The impacts generated by the universities are like the hospitals and mega hostels in terms of material and water usage, waste generation, consumption of electricity and hydrocarbon fuels in lightening and heating, operating machineries and transportation are all significant for the quality of environment [3]. The base for environmental management system (EMS) as an instrument was, the increase in natural resources exhaustion and environmental degradation and this instrument is emerged as a strong trend for the enhancement of environmental performance [18].

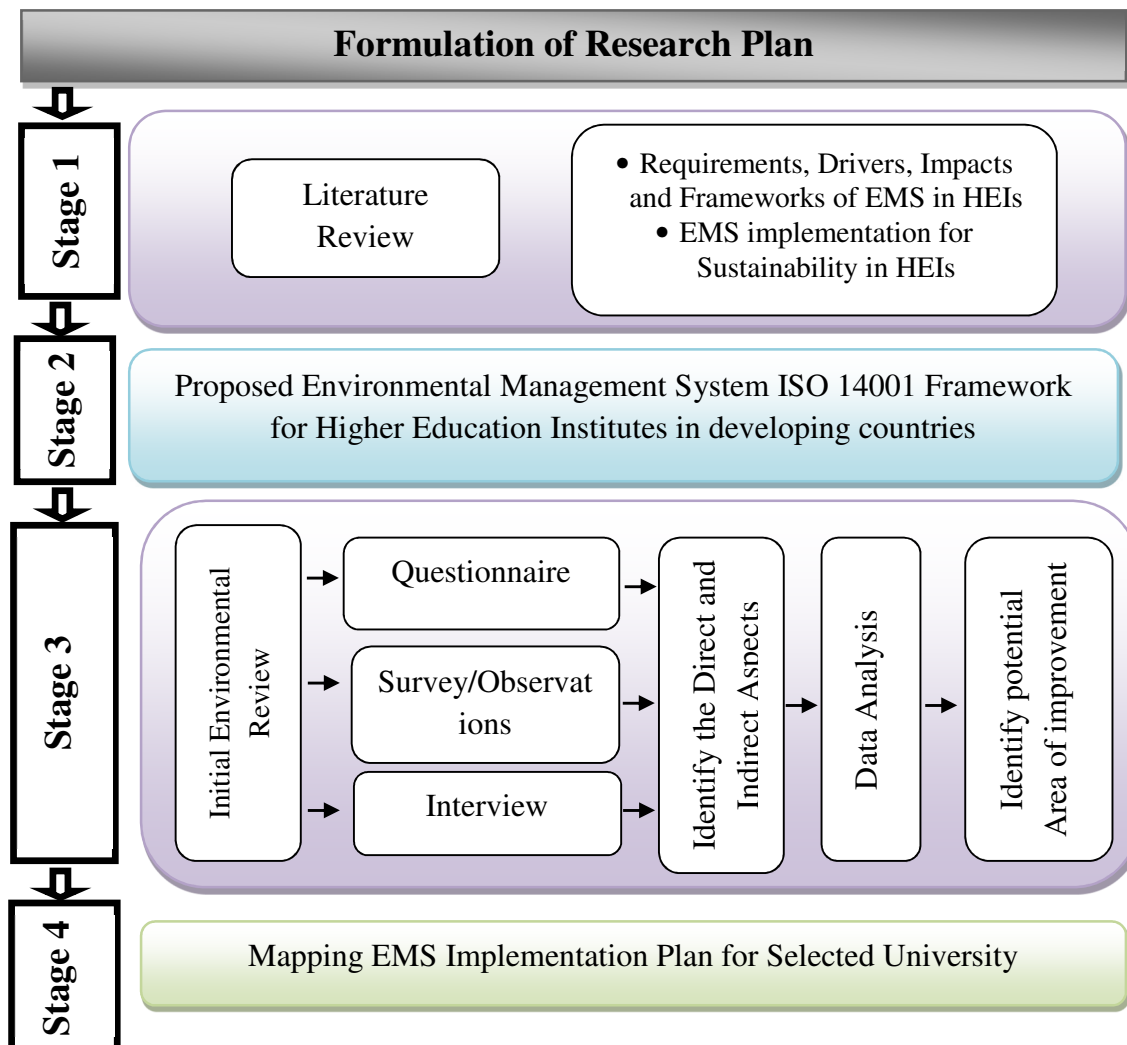
In 2006 there were 14 higher education institutes throughout the world having an EMS [14] in which the 10 institutions had ISO 14001 [19]. Another study shows the dominance of ISO 14001 in Northern Europe [20, 21]. A research conducted in India depicts the implementation of Environmental management system according to the guidelines of ISO 14001 [22].

In literature it is shown that many authors discussed thoroughly the progress of campus sustainability [23, 24, 25] and compared different EMS models [3]. Some authors also compared different EMS models for higher education institutions [11]. Different studies at the national level are also present about EMS in universities. Examples including Australia [26], Canada and United Kingdom [10], Sweden [27], and USA [16]. A number of universities also reported their experience with EMS in case study articles [28, 29, 12, 30, 31, 32, 33]. From the whole literature it can be concluded that environmental management system have gathered momentum in developed countries but the educational institutes of developing countries are lacking with the functional EMS. Since the resources in the public sector universities of developing countries are very low which only meet the basic requirements of education; therefore, this research aims to contribute towards reducing this gap by making an effort to

identify the requirements of environmental management system in the higher education institutions of Pakistan and propose an environmental management plan for it.

### 3.0 RESEARCH METHODOLOGY

The methodology was comprised on four stages, as shown in Figure 1. At first stage detailed literature review was done on environmental sustainability by implementing environmental management system (EMS) in higher education institutes (HEIs). By literature review the significance of EMS in HEIs was identified which helped in proposing EMS ISO 14001 for HEIs in developing countries at stage 2 [34, 35]. This was supplemented with case study of public sector university of Pakistan at stage 3 to identify the potential areas of improvement. For this purpose, 15 interviews via semi structured questionnaire were conducted from the relevant people involved in different activities in university. The results of interviews and observations were used to map the EMS implementing plan for public sector university of Pakistan as presented in stage 4.



**Figure 1:** Research methodology

## **4.0 ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001 FRAMEWORK**

The framework constitutes plan-do-check-act improvement cycle and five layers namely: 1) environmental policy, 2) planning, 3) implementation, 4) checking, and 5) review. Environmental management system framework basically provides a tool which leads higher education institutes towards sustainability. The proposed EMS framework presented in Figure 2. The detailed description of plan-do-check-act improvement cycle and five layers have been explained below.

### **4.1 Plan-do-check-act improvement cycle**

Plan basically helps HEIs to make their vision and mission and convert it into practical work. Therefore, management of HEIs identifies the needs, set their expectations, defines the basic plan in order to meet their needs and opportunities and finally determines their personal and financial requirements and schedule under the phase of planning. The next phase of improvement cycle is 'do' which assists HEIs to do, what management of EMS has said and defined in plan. Following the plan they identify that who are responsible and affected, formulate the tools and procedures to accomplish the objectives and fulfill the plan by providing trainings and involving people. Then in the phase of checking the overall performance of the management plan is monitored to determine that defined targets and objectives are meeting or not, things works as expected and finally identify root causes if any and make corrective actions. At last in review phase it is determined that any change is required in management plan to move towards new directions or to stay with the current plan. Each layer with its further components described below:

### **4.2 Layer 1: Environmental policy**

In the first step, principles and aims for the protection of environment are set in formally documented form. Environmental policy is basically a guiding document and following it is essential for the reliability and the success of EMS [2].

Following are the commitments that should be included in policy: 1) pollution prevention, 2) related legislations of environment and other requirements, and 3) continual improvement.

### **4.3 Layer 2: Planning**

The second most important step is planning. According to the above given three commitments of policy, HEIs should set their targets and objectives and develop a plan for their fulfilment. Planning includes aspects, legal and other requirements, targets and objectives, and environmental management programs described below:

#### ***4.3.1 Aspects and their impacts***

An element of activities, products, services of a HEI having interaction with the environment is called environmental aspect. Any change occurs to the environment partially or wholly due to these activities, products, or services are known as impacts [36]. As HEIs are involved in different activities like resource consumption that results in waste generation, therefore there is a need to identify and prioritize the significant aspects that need to be managed by EMS.

### ***4.3.2 Legal and other requirements***

HEIs should establish the procedures to find and have access to those legal requirements which are applicable to environmental interactions of their activities, services or products. HEIs should subscribe those legal and other requirements to manage their activities accordingly. For this purpose initiatives are taken by EPA New England for the proactive assistance by providing aggressive enforcement. Similar initiatives launched by other EPA Regions. Colleges or universities enforcement initiatives are published by the EPA's office of enforcement and compliance assistance (OECA). By implementation and following these compliances the ultimate goal to improve the environmental footprint at educational institutes can be achieved.

### ***4.3.3 Environmental objectives and targets***

Objectives and targets should be developed when HEIs identified the highest priority or significant environmental aspects, impacts and their concerned regulatory compliance requirements. Objectives are basically the goals at big level that remain consistent with the HEIs environmental policy for environmental performance improvement, significant aspects and impacts on environment and, relevant environmental regulations. But the targets are the detailed measurement of performance of these goals that should be met according to the given objectives. There should be at least one target of all environmental objectives but usually there are more targets which directly related to the stated objectives. In HEIs objectives may be the reduction of hazardous waste generation from laboratories and their relevant targets may be to decrease the quantity of hazardous waste of laboratory packs quarterly at some percentage as the compared to the previous waste generation quantity etc.

### ***4.3.4 Environmental programs***

Once the objectives are set then the detailed action plan which is also called environmental management program should be developed for each objective. It defines the responsibilities and tasks for particular action that who, how and when the actions will be taken for different objectives. Environmental programs illustrate how to take the actions in future and setting the deadlines to complete those actions.

## **4.4 Layer 3: Implementation**

After the development of plan, HEIs should then establish the necessary elements for the implementation and operation of their plan successfully. Implementation layer further comprises on structure and responsibilities, operational control and emergency preparedness and response, training and awareness, competence, communication, documentation and documentation control.

### ***4.4.1 Structure and responsibilities***

HEIs have to set up the structure and responsibilities for the development and implementation of EMS, sustainability initiatives and team projects by persons. During planning, roles and responsibilities are assigned by ensuring that: a) the roles are understood by every person b) every person knows how they will influence and affect their workloads, and c) all tasks will not fall on single person or department.

The structure consists of manager, team and the steering groups for assigning the responsibilities.

#### ***4.4.2 Operational control***

Operational control is a documented procedure which is on the EMS objectives and targets of significant environmental aspects or operations. Its major purpose is to improve the environmental performance of day to day activities of educational institutes. The creation of operational control is the foundation in order to achieve the consistent compliance and minimization of environmental concerns. Therefore, care should be taken by educational institutes by numbering and focusing the operational controls to make sure that written procedures are authentically implemented and communicated properly. Different institutional activities that can require operational control in written form are hazardous material management, hazardous waste handling storage and disposal etc.

#### ***4.4.3 Emergency preparedness and responses***

As organizations are involved in multi tasks also having experiences of some events that require some type of emergency preparedness and response. Like heavy machinery, hazardous type of chemicals is present in laboratory practices that may be accidently injurious for students, faculty and staff. Therefore, organizations should be cautious in emergency planning and preparedness. It would reduce injuries, protect students, faculty and staff also with the reduction in losses of assets and damages to the image of HEIs. Emergency preparedness and response should involve the provisions for: a) assessing the potentials for emergency and accidents, b) preventing events and environmental impacts associated with them, c) responding to those events, and d) mitigating their environmental impacts. Emergency preparedness plans are developed by the EMS manager along with the collaboration of outside regulators and consultants if required after the identification of potential for emergencies and accidents.

#### ***4.4.4 Communication***

Internal and external communication should be planned and implemented about EMS in order to ensure that environmental targets are met. Internal communication explains the environmental Policy and delegated EMS roles and responsibilities to employees with progress for specific targets and objectives. Faculty and students are the two particular audiences for internal communication at colleges and universities. In external communication, interested parties like grant organizations, local community members, regulators, insurers, alumni, and emergency responders etc taking interest in environmental impacts of educational institutes are addressed and documented. By the mean of a proactive approach and maintaining meaningful dialogue with external parties, the environmental policy and EMS objectives can be fulfilled.

#### ***4.4.5 Training and awareness***

It is an important element to create awareness and competency about the EMS and particular responsibilities related to meet the objectives and targets of EMS. The purpose of EMS training in HEIs should be threefold: 1) awareness about EMS, 2) task-specific training, and 3) training required for rules and regulations. For this purpose, it is required to develop EMS information materials including Environmental policy, Prioritized environmental aspects and their impacts, roles and responsibilities of EMS etc and agenda to make understanding for EMS participants. Adding to this, the EMS Team should prepare awareness training modules of EMS such as costs and benefits of EMS” for HEIs administration, “administration review of EMS” for the administration review team of EMS and environmental policy for the orientation of new students and faculty.

#### ***4.4.6 Documentation and document control***

The focal point of documentation control is to implement a valuable EMS. HEIs should prepare most integral documents of EMS like environmental policy, written procedures, forms and records required for the implementation of EMS. Documentation control assures the following points of EMS documents like it is: a) located easily, b) reviewed periodically, c) updated when needed, and d) removed as obsolete. In educational institutes controlled documents is usually centrally located controlling by the EMS Manager. Following features like effective date, approval signature and date, and copy number (if there is a requirement of more than one controlled copy) are also included in the controlled documents.

#### **4.5 Layer 4: Checking**

By successful implementation of plan, it is required to monitor that the targets and objectives are meeting according to the plan or not. If any objective is not met according to the plan, then corrective actions need to be taken. The whole environmental management system should be audited periodically to monitor that the standard requirements are satisfied [5]. It includes monitoring and measurement, corrective and preventive action and EMS audit.

##### ***4.5.1 Monitoring and Measurement***

Operational improvement and decisions based on the quantified data of environmental performance that need to be measured periodically through the parameters or matrices. After the creation of objectives and targets, parameters should be set and measured to follow the progress towards objectives and targets. Therefore, monitoring programs need to establish the standard operating procedures that report on regular basis.

##### ***4.5.2 Corrective and Preventive actions***

Monitoring and measuring activities, self inspection and regulatory compliances occasionally reveal the noncompliance regulation cases and goals (objectives and targets) in a wayward situation. In such circumstances, HEIs need to take corrective actions in order to address and remediate the noncompliance causes and reset the actions to achieve their goals.

##### ***4.5.3 EMS Audits***

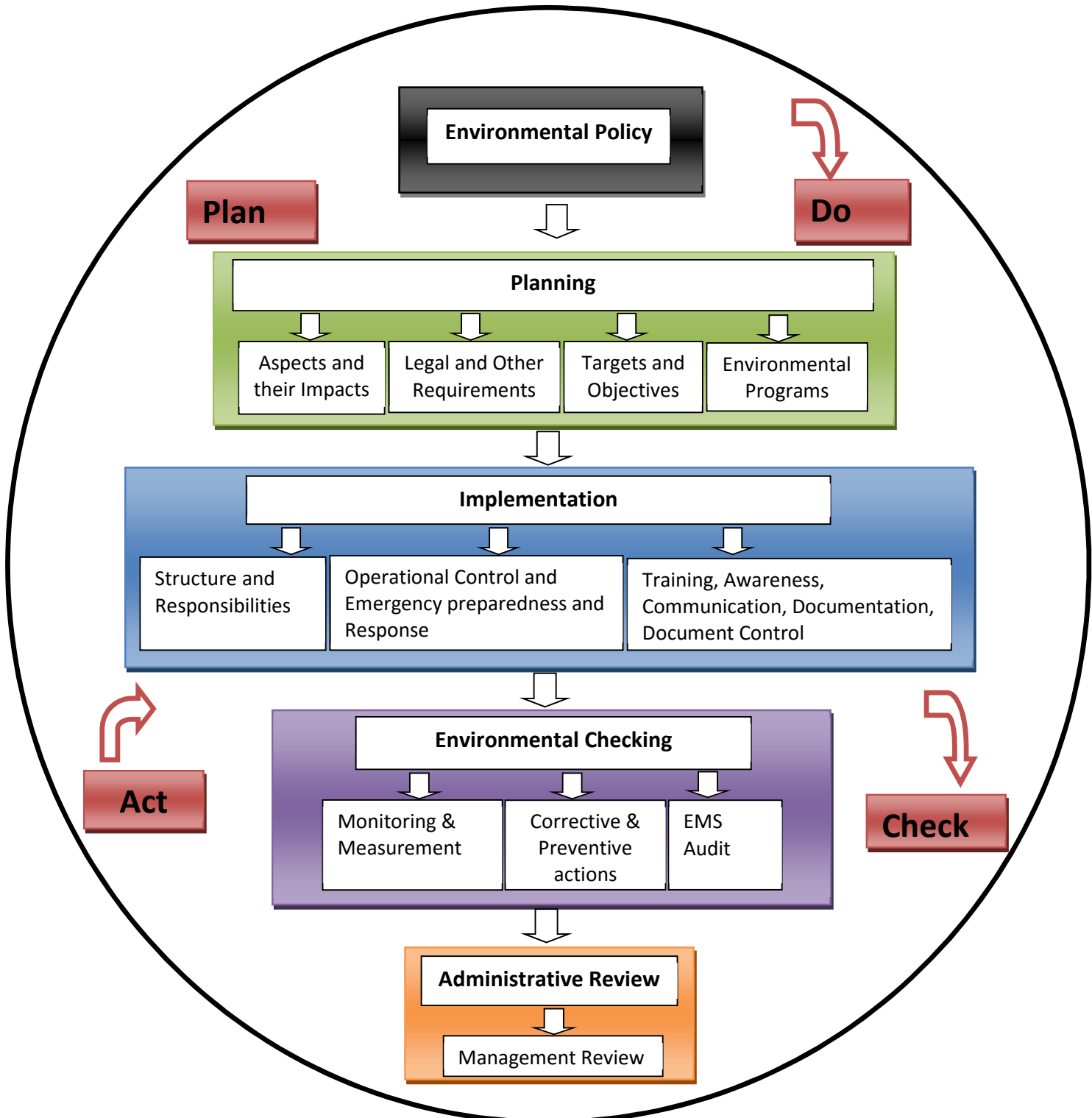
After the establishment of EMS, periodic EMS audits need to be establish to identify that all the EMS requirements are meeting properly and to resolve the deficiencies if present. For the effective EMS audit program, it is required to prepare the audit protocols and procedures, establish suitable audit frequency, provides trainings to auditors and maintenance of audit records. By the thumb rule, EMS parts need to be audited annually but for frequently audits; it can be break down into discrete elements or audit the whole EMS in one time. Periodic EMS audits will result in consistent performance of EMS, continuous improvement and minimizing or avoiding surprise anticipating problems.

#### **4.6 Layer 5: Administrative Review**

The key to continuous improvement is the management review which ensures that EMS will go on to meet the HEIs requirements over time. Indeed, management review should be viewed when there is a need of receiving constructive feedback as well as to promote the effectiveness



and value of EMS. It is also a better opportunity to maintain HEIs EMS cost effective and efficient.



**Figure 2:** EMS ISO 14001 framework for HEIs of developing countries

The environmental management system (EMS) has been formalized through the case study of University of Engineering and Technology, Taxila (**UET, Taxila**). It is located at Taxila, Punjab, Pakistan and covers the land area of 109 acres. Initially in 1975, it was established as

a campus of University of Engineering and Technology, Lahore, Pakistan. Later in 1993, it was chartered as an independent university, offering bachelor, master, and doctoral degrees in disciplines of engineering. The university offers degrees in various 12 disciplines. Currently the enrollment of undergraduate and postgraduate students is about 4000 and the administrative staff (officers and Staff) and teaching staff is about 1540. This educational institute is involved in different activities of education, research, operations, administration and community etc including research laboratories, classes, student housing, cafeterias, drinking water supply, construction and demolition also with the facilities of solid waste collection and transportation.

Therefore, the aim of this research is to identify the potential areas which require improvement. For this purpose initial environmental review has been conducted in university. Results have been analyzed by SWOT analysis for the preparation of environmental policy and EMP for UET Taxila on the lines of proposed EMS ISO 14001 framework shown in Figure 2 to minimize the ecological footprints. Roadmap followed for this study is shown in Figure 1.

### **5.1 Initial environmental review**

The detailed literature review was conducted, following with the initial environmental review in the form of interviews, observations [37] and questionnaire [22, 37] from the relevant staff in different tasks, and housekeeping in-charge was carried out.

In the environmental review both direct and indirect interactions/aspects in the university were considered for data collection and to identify the potential environmental aspects. The direct aspects/interactions were included waste (solid and hazardous), water and wastewater, transport, ambient/indoor air, landscaping, energy and the indirect aspects/interactions were purchasing investments, education and research and community services [11]. By initial environmental review it was identified that operational activities have the direct potential impact on the environment in the form of air emissions, solid waste and wastewater generation, natural resource depletion which need to be managed properly. The indirect aspects like research and education, finances and services indirectly interact with the environment. Therefore, both direct and indirect aspects are analyzed in this research.

### **5.2 SWOT Analysis**

Strengths, weaknesses, opportunities and threats (SWOT) analysis has been used for the analysis of collected data. SWOT is commonly used planning and decision-making tool for analysis and identification of strengths and weaknesses of certain area and ultimately examine the opportunities and threats for it [38, 39]. Internal elements determine the strengths and weaknesses of the system but opportunities and threats are dictated by the external forces. In this study, the existing gaps towards campus sustainability were analyzed by SWOT analysis and then comprehensive environmental management plan was prepared for the university. As the rational, management and decision making are allowed by the SWOT analysis [40]. Therefore, SWOT analysis helped in providing the logical framework for the detailed assessment of existing resources and to build the plan on the basis of opportunities by addressing the weaknesses. On the basis of this analysis existing strengths of the university were taken into account for the amalgamation of such beneficial activities into the university Environmental Management plan. Results of SWOT analysis is presented in Table 1.

**Table 1:** SWOT analysis of UET, Taxila

Aspects	Strengths	Weaknesses	Opportunities	Threats
Energy	<ul style="list-style-type: none"> <li>• Lighting arrangement and designs of some buildings supports the daylight. During summer, design and direction of buildings prevent from heating which contributes towards the conservation of energy.</li> <li>• All stakeholders are much aware about the control consumption of electricity on their own.</li> </ul>	<ul style="list-style-type: none"> <li>• Energy efficient heating and cooling system are not provided. Energy conservation measures and green house gas emissions are not taken into account by the management.</li> <li>• There is no provision of renewable energy source.</li> </ul>	<ul style="list-style-type: none"> <li>• Revenues can be saved by the conservation of energy which ultimately can be invested in better projects in the university.</li> </ul>	<ul style="list-style-type: none"> <li>• Generator is used for electricity generation purpose which can pollute the environment by green house gas emissions.</li> </ul>
Water and waste	<ul style="list-style-type: none"> <li>• Filtration plant on canal and 4 tube wells are provided to fulfill the water requirement of major water using groups.</li> <li>• Wastewater treatment plant is constructed for the future treatment of wastewater.</li> </ul>	<ul style="list-style-type: none"> <li>• No any flow fixtures are provided for the saving of water. From the establishment of the university to till now no any recycling system of wastewater is provided for the reuse of water for the irrigation of landscape.</li> <li>• There is no water control policy is present in university management.</li> </ul>	<ul style="list-style-type: none"> <li>• Rainwater harvesting techniques and greenbelts can be provided for the recharge of aquifers.</li> </ul>	<ul style="list-style-type: none"> <li>• The contents of BOD, COD and TSS are exceeding from the NEQ's by 28%, 41% and 60% which will pollute the environment and waterways.</li> <li>• Leakages and open wastewater emission from some laboratories create wastage of water and polluting the environment.</li> </ul>
Solid Waste	<ul style="list-style-type: none"> <li>• Bins are present in each department, library, Admin block, hostels, community, Cafeteria etc to collect the waste on daily basis.</li> </ul>	<ul style="list-style-type: none"> <li>• Approximately 691.2 tons/annum solid waste in the form of paper, stationary waste, packaging material, food waste etc. is generated in the campus but there is no any proper disposal system is present in the university.</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling of paper and segregation of waste can be carried out in the university and proper dumping system can be provided.</li> </ul>	<ul style="list-style-type: none"> <li>• Open disposal of waste, especially dispensary waste inside the university will pollute the environment as well as the underground water resource by deep percolation of leachates.</li> </ul>

Transport	<ul style="list-style-type: none"> <li>• University providing the bus service for the students and staff in the form of 22 buses and 22 vehicles. Faculty staff also provided with the carpooling facility by the university.</li> </ul>	<ul style="list-style-type: none"> <li>• As the university creates a link between two main roads due to which public transport use the university road to some extent.</li> <li>• The students live in the periphery of the university also using the public transport for coming and going out of the university.</li> </ul>	<ul style="list-style-type: none"> <li>• Shuttle system can be provided inside the university.</li> </ul>	<ul style="list-style-type: none"> <li>• Emissions may rise in future.</li> </ul>
Construction	<ul style="list-style-type: none"> <li>• 12 new construction and renovation projects started in the year of 2014-15, like academic block, extension of telecommunication department, Jamia Mosque, Mechanical department, Electrical Department etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction is not done on the concept of green building.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental friendly building materials can be provided in construction.</li> <li>• The concept of green buildings can also be promoted for energy efficiency and making the indoor air quality better.</li> </ul>	<ul style="list-style-type: none"> <li>• Green land area is covered by the buildings results in reducing the recharge area also with the reduction of trees.</li> </ul>
Landscaping	<ul style="list-style-type: none"> <li>• 32 types of plant species are present in university.</li> <li>• Manure is used for fertilization of plants.</li> </ul>	<ul style="list-style-type: none"> <li>• Only 23% of land area of university is covered with greenery and for approximately 6000 population round about 42,000 trees are required to meet oxygen requirement but university has only 1922 trees at this time.</li> <li>• Different pesticides are used for plants without any care and control measures.</li> </ul>	<ul style="list-style-type: none"> <li>• There is opportunity to plant new trees for recent population of university.</li> <li>• Creepers can also be planted. Roof gardens can be grown for the vegetable plants in the garden for cafeterias.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction activities are increasing by the increase of population and departments as well which leads towards deforestation in the university.</li> </ul>
Air Quality	<ul style="list-style-type: none"> <li>• University activities are not involved in the use of radioactive material and stacks etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Generator provided in university which consume 4860 liters diesel annually that emits GHG to the atmosphere directly.</li> <li>• No any air pollution control methods and legislations are followed in some laboratories.</li> </ul>	<ul style="list-style-type: none"> <li>• Air pollution minimization measures should be provided.</li> </ul>	<ul style="list-style-type: none"> <li>• Health of the workers and students can be affected by the increase of dust and air emissions in the laboratories during work hours.</li> <li>• With the increase of vehicles plying in the area during peak hours can increase pollutant level in the air in near future.</li> </ul>
Purchasing	<ul style="list-style-type: none"> <li>• University has 45 major suppliers for purchasing different items.</li> <li>• Punjab Procurement Regulatory Authority Act 2009 is following</li> </ul>	<ul style="list-style-type: none"> <li>• There is no environmental risk assessment policy of suppliers present for their goods and services.</li> </ul>	<ul style="list-style-type: none"> <li>• Selection criteria of suppliers can be included with the environmental risk assessment to prevent from future environmental hazards of</li> </ul>	<ul style="list-style-type: none"> <li>• With the increasing demand of purchasing items environmental risks will be faced in future</li> </ul>

	for procurement purpose.		excessive purchasing.	
Investments and Funding	<ul style="list-style-type: none"> <li>Total budget of the university is about 1196.066 million Rs for the year of 2014-15 with the expenditures of about 955.028million Rs.</li> <li>University is also generating its revenues from investments, strategic business, subsidiary affiliation and consultancy.</li> </ul>	<ul style="list-style-type: none"> <li>There is no any environmental or social filter present for decision making in endowments or investments.</li> <li>No ethical options are present for pension plans.</li> <li>No any environmental or social filters are present in accepting funds.</li> </ul>	<ul style="list-style-type: none"> <li>Social or environmental filters can be involved in the decision making of endowments, investments and accepting funds.</li> </ul>	<ul style="list-style-type: none"> <li>The total budget on investments is continuously increasing with the percentage of 76% and 86% for year 2013-14 and 2014-15 respectively showing the pressure on economy of the university and indirect impacts on the environment is also increasing.</li> </ul>
Research and Education	<ul style="list-style-type: none"> <li>University has a full fledged Environmental Engineering Department for environmental studies with the learning outcomes of engineer and society, environment and sustainability.</li> <li>Research area of department also covers the environmental issues like air and noise pollution control, solid waste management and many more.</li> </ul>	<ul style="list-style-type: none"> <li>Courses, contents and PLOs of other disciplines except civil engineering department do not integrate the environmental part of sustainable development in their programs as well as in research.</li> <li>No any efforts in the form of seminars or lectures etc are doing in order to make faculty, students or staff aware about the environmental sustainability</li> </ul>	<ul style="list-style-type: none"> <li>Compulsory course about environmental protection can be added in all disciplines to provide knowledge of environmental sustainability to the students.</li> <li>Lectures can also be provided to the teaching staff to become aware about the environmental part of the sustainable development.</li> </ul>	<ul style="list-style-type: none"> <li>Without the knowledge of environmental protection, graduated students can never be able to identify the environmental issues in their professional fields and solution for sustainable development.</li> </ul>
Community	<ul style="list-style-type: none"> <li>University cooperates with the society by taken active part in different external projects to establish links for the promotion of joint research.</li> <li>To help the society by providing pure drinking water university provides the services of water and soil sample testing to different organizations.</li> </ul>	<ul style="list-style-type: none"> <li>No any policy for environmental risk assessment of external projects is present which are cooperating with the society.</li> </ul>	<ul style="list-style-type: none"> <li>Working platform or projects can be made with other organizations to provide the facility of renewable energy and the procedures of safe and environmental friendly waste and water management to the community.</li> </ul>	<ul style="list-style-type: none"> <li>Signing of memorandum with other organizations without the environmental risk assessment of external projects can be indirectly effect the environment in future.</li> </ul>

The results of SWOT analysis provided a foundation to map an EMS implementation plan for the university according to the guidelines of ISO 14001. On the basis of which goals and objectives have been defined and management plan for various aspects was drawn.

### **5.3 Environmental management system for UET, Taxila**

The environmental management system has been mapped keeping in mind the IER data and SWOT analysis results given in table 2. Environmental management implementation plan was developed by following the EMS ISO 14001 framework for HEIs. EMS framework works under the umbrella of Plan-Do-Check-Act Cycle shown in Figure 2. The first step of the EMS was to make environmental policy for the UET, Taxila.

#### **5.3.1 Environmental Policy of the UET, Taxila**

First of all it would be the aim of the university to make policies, plans and management system by keeping environmental concerns into consideration and involve the people into different activities for the reduction of environmental impacts. This can be achieved by proposing the policy for university. The potential aspects and their impacts have been identified in IER. The targets and the objectives have also been set in the environmental policy.

In the environmental policy of the university certain commitments shall involve as;

- Utilization of the natural resources effectively to minimize the environmental impacts;
- Reduction of the waste to prevent from pollution;
- Ensure the compliance with the government environmental guidelines and legal requirements where applicable;
- Integration of environmental concerns in different decision making policies e.g. purchasing;
- Training and educating the students, faculty members and staff about the environmental sustainability to achieve continual environmental improvement; and
- Following the guidelines of EMS to make efforts for the reduction of ecological footprints of the campus.

#### **5.3.2 Environmental management plan**

The university environmental management plan has been developed on the basis of analyzed results. The plan depicts the particular measures that would be undertaken for the improvement of the university's environmental performance. The plan comprised on the defined priorities, setting objectives in environmental policy, and preparing environmental strategies to achieve objectives by following rules and regulations. Clean Air Act (CAA)[40 CFR Parts 50-99], Clean Water Act (CWA) [40 CFR Parts 100-145, 220-232, 410- 471], National Environmental Policy Act (NEPA) [40 CFR Part 6], Resource Conservation and Recovery Act (RCRA) [40 CFR Parts 240-299], and Safe Drinking Water Act (SWDA) [40 CFR Part 141] are the laws which would be followed for managing the signified aspects. The implementation plan for university has been proposed by keeping in mind the environmental management system framework of plan-do-check-act in the form of structure and responsibilities, training and awareness, documentation, monitoring and measurement, preventive and corrective actions and inspection,. It will facilitate by ensuring the maintenance of existing features according to the framework; and providing a roadmap to achieve the on-campus sustainability.

### **5.3.3 Description of EMP with implementation**

#### ***5.3.3.1 Management structure***

The management structure is inevitable to follow the environmental policy by defining the roles and responsibilities at different steps of management. According to ISO guidelines and literature three committees were proposed including: 1) review committee, 2) management committee, and 3) steering committee. The job description and responsibilities were also proposed. According to the proposed management structure the review committee was comprised on the university's senior management authorities (senior administration) and the management committee was represented by faculty members, students and staff. The roles and the responsibilities of the senior management included environmental declarations, approve policies, and budgets. The responsibility of management committee involved in environmental research and education initiatives, environmental projects under the guidelines of EMS were undertaken by staff and students performed the role in informal environmental education and small scale-projects. Management committee would also play a role in creating a link between senior management and the faculty staff and students. Next in the hierarchy there was the steering committee which comprised on fixed and volunteer students responsible to make assure that the targets should be met according to the EMS and if necessary would modify these targets and document the progress for the improvement of their overall environmental performance annually. The work record should be provided to the management committee for review. The main purpose of assigning the responsibilities to the steering committee was to create awareness and better communication amongst following with the occasional seminars and workshops.

#### ***5.3.3.2 Trainings and Awareness***

Training and communication are the important factor for creating awareness among people about sustainable environment in the university. It is necessary for the successful implementation of an EMS. Students, faculty members and other employees may conduct the environmental trainings and awareness programs e.g. seminars and workshops. The training and communication programs at UET, Taxila are required to be designed in such a way that it would help to make people aware about the environmental policy, aspects, and everyday procedures, processes and environmental issues of the university. Environmental experts may also be invited to educate the students and staff in the university. Orientation programs need to be conducted to inform the new employees and students about the EMS structure and aspects. The faculty members and students may also be trained about the auditing method.

#### ***5.3.3.3 Communication***

Communication is very important element in EMS which needs to be documented and implemented for EMS practices. The communication link among different departments and management committee may be created by the coordinators of relevant steering committees. All important information may be communicated to the review committee by management committee in the form of bi-annual reports. University website e-mails, brochures, notices and displays would be updated for staff and students about the current or forthcoming activity of environmental management system. The communication log of regulatory agencies or outside experts is required to be maintained for keeping the internal and external communication records. A dropbox and suggestion pool would be established, so that many university members can drop in suggestions and remarks.



### 5.3.3.4 Environmental management programs with operational control and response

On the basis of SWOT analysis, the operational control and response has been planned for the aspects of solid waste, water and waste, energy, air, landscaping, construction, purchasing, Transportation, research and education, investments, and funding and community.

#### 5.3.3.4.1 Solid waste management

After detailed observations it came to know that different type of waste generated in the university e.g. stationary waste, dispensary waste, organic waste (food and garden waste), packaging material, aluminium cans and tins as shown in Table 2.

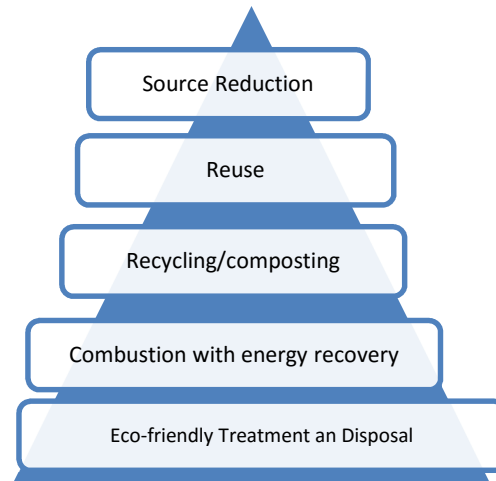
**Table 2:** Various types of solid waste in UET, Taxila

Type of Waste	Description
Concrete and chemical packing waste	Generated from the testing of material in civil engineering department and transportation department.
Hazardous waste	Generated from the university dispensary.
Municipal solid waste	Generated from departments, academic blocks, canteens, hostels and university residential colony.
Stationary Waste	Mostly comprises of paper generated from the offices and classrooms.

The concept of waste management is needed to be built-in the everyday operational activities, purchase policies.

Following are the steps which may be exercised for the solid waste management in UET, Taxila.

- As university already has the waste collection system in the university but there is a need of special approaches like waste management hierarchy incorporated with the 3'R concept as shown in Figure 3.
- Plastic bags and paper cups usage will be discouraged in the campus and eco-friendly and recyclable material may be preferred.
- The university would also take steps in the minimization of paper usage by providing the student information system SIS, so that records would be maintained online for the students.
- Students will be encouraged to use SIS for their assignments and term papers submission in order to reduce the wastage of paper.
- The concept of waste segregation may be carried out as to compost the organic waste in houses by proposing the biological treatment for biodegradable waste.
- Recycling units may be provided inside the University for the Reuse of paper waste.
- The waste is openly disposed at the gate 1 UET, Taxila. It is the need to build the proper composting pits inside the campus after taking the permission of municipal corporation development authority, so as to protect the ground water resource from the deep percolation of leachates.
- Hospital waste is required to be disposed of elsewhere or it may be sent to the certified agency for proper treatment/incineration.



**Figure 3:** Solid waste management hierarchy

#### ***5.3.3.4.2 Water use management***

*and waste*

The university has filtration plant on the nearby canal and 4 tube wells for meeting its water requirement. The annual consumption of water in the campus is about 80300000 gallons. There is opportunity to find out the water footprints by the share of water consumption at various activities in university. It would help to devise strategy in order to reduce the water footprints. The university constructed the wastewater treatment plant for the treatment of wastewater. The university is required to make efforts for the control consumption of water by providing low flow fixtures and conservation strategies e.g. rain harvesting methods.

#### ***5.3.3.4.3 Energy management***

Energy bills for year 2013-14 and 2014-15 was collected. From them it is identified that about 10% energy is conserved in the year of 2014-15 as compared to last years. The university building already supporting the daylight which help in conservation of electricity. There is the opportunity to provide the renewable energy sources and efficient heating and cooling system at the university. Steering committee may be responsible for the assurance of regular check for the maintenance of heating and cooling system. For this purpose trainings and awareness are required to be provided to the members of steering committee and housekeeping staff that how to take care and maintain the heating and cooling system. The university also needs to be carried out the carbon footprint analysis in order to estimate the total greenhouse gas emissions by the consumption of energy.

#### ***5.3.3.4.4 Sustainable landscape of building***

University land is covered with 23% green area with the presence of 23 types of 1922 trees. It would be required to investigate that these plants are suitable for the climatic conditions of the area and excess water is not needed for them. There is also the opportunity to plant new trees in order to meet the oxygen requirement of increasing population of the surrounding. A management plan is required to be prepared for the use of treated waste water for irrigation purpose and measureable use of fertilizers and pesticides in gardens. As the gardens and trees are reducing due to excessive construction activities so creepers and roof gardens are needed to be planted to increase greenery in buildings.

#### ***5.3.3.4.5 Air Quality management***

The university is situated between the margalla hills with a lot of greenery, so the air quality is somehow better. At the same time there would be the need of increasing trees and green land areas in the campus in order to reduce the impacts of particulate matter of excessive crushing in margalla hills. The usage of petrol and Diesel in the mechanical engineering department, different types of chemicals in environmental engineering department and testing of materials in civil engineering departments pollute the ambient air quality of the laboratories by different gases and dust particles; therefore, it would be needed to carry out the sampling exercises in order to get the baseline data on the air quality within the buildings. It would help in making the decision of providing the dust collectors, electrostatic precipitators etc for better air quality.

#### ***5.3.3.4.6 Sustainable transportation***

The university has 22 buses and 22 small vehicles for the pick and drop of students and faculty members. A lot of faculty members are using their private transport and the students living in the periphery e.g. two to three kilometers of the university using public transport; therefore, it would be the need of encouraging the staff and students to use car pool. Along with the encouragement for car pooling university would be provided with the measures in the form of financial incentives for travel, providing campus shuttle facility to faculty staff and students from the selected points in different day timings in order to discourage the personal transport to the campus, and proper maintenance of the university vehicles in order to reduce the fuel consumption and GHG emissions.

#### ***5.3.3.4.7 Green building initiatives***

With the increasing of the university's population different construction activities are also increasing. Currently 10 new buildings are under construction and renovation. There would be the management plan for creating the concept of green design of buildings in order to reduce the volumes of inputs like water, energy, maintenance material which may result in reducing volume of air emissions, solid waste and wastewater. It would also be included in the specification of the new construction projects for the contractors to follow up the environmental rules and regulation to make campus and environment sustainable.

#### ***5.3.3.4.8 Purchasing***

University has procurement cell for purchasing different items by following the guidelines of Punjab Procurement Regulatory Authority Act (PPRA) 2009. By employing the EMS in the university environmental risk assessment of the products is required to be carried out and selection criteria of the suppliers and specifications of the product are also needed to be comprised of environmentally safe and green products.

#### ***5.3.3.4.9 Investments and funding***

University makes a lot of investments and endowments in different fields which may indirectly affect the environment; therefore, investments and funding strategies are required to be made under proposed EMS to incorporate the environmental filters in decision making. Environmental or social filters would also be involved in accepting funds. Ethical options are also needed to be incorporated in the pension plans. There is also requirement to make environmental friendly investments for environmental and sustainable development of the campus.

#### ***5.3.3.4.10 Research and education***

Universities educate and prepare the entrepreneurs, future leaders and decision makers that work in, develop, manage, influence and lead the institutions of society. Therefore, university is responsible for making sustainability as a teaching tool in its all disciplines to communicate the environmental sustainability to their audience. The proposed EMS would infuse environmental sustainability into the curriculum and courses of the graduate and undergraduate in the fields of built environment, management, humanities, science and technology. The most important environmental sustainability issues like resource, conservation, environmental preservation, health and safety, global warming may also be incorporated into the courses.

Seminars, workshops and conferences are required to be arranged for environmental sustainability by the management committee of EMS. It would encourage the research, and also provide the avenues for academia, industry and international organizations to educate and discuss the environmental issues. The major environmental issues like global warming, climatic change would also be discuss in seminars and conferences by the environmental experts which will made students, faculty and administration staff in the university and outside knowledgeable and aware about all these issues to address them in a best way.

#### ***5.3.3.4.11 Community***

The strategies are required to be made under the supervision of proposed EMS implementation plan to make partnerships with agencies of government, other institutions, NGOs and other private sector organizations for their participation in attaining environmental sustainability. External projects may be signed with their collaboration in order to fulfill the social responsibility of university in promoting environmental equity and justice to all races and gender by providing the facilities of pure drinking water, renewable energy resources and environmental friendly water and waste management to the community also with the provision of care for handicaps.

#### ***5.3.3.5 Documentation system***

It was identified in literature that record keeping and documentation were not considered as priorities by many universities but it is the integral part of EMS. The EMS suggests that 1) there would be the proper documentation system in the university to keep the records of the EMP efficiency and effectiveness, 2) an environmental information system should be prepared to publish the information so that all members of the university would be informed internally and also to the public if required, 3) all the events conducted under EMS should be documented properly and annual reports need to be carried out following with the implementation of EMS, 4) by using the basic web programming and intranet facility, EMS should be maintained on intranet website. Document distribution and updates should be accurate, quick and auditable by doing so.

#### ***5.3.4 Checking and review***

The environmental performance of the university by following the environmental management plan would be regularly checked by the monitoring and measurement mechanism and preventive actions would be taken if required.

Following ideas would be undertaken in order to monitor the EMP's procedure and functioning.

- **EMS audits:** Internal audits of EMS are required to be carried on the six months of interval at the university. Moreover, different checks may also be done in order to assure that there is no any deficiency present in the implementation of EMS plan in concerned areas.
- **Performance evaluation:** Management and steering Committee should voluntarily evaluate the performance of each aspect on every month.
- **External audit:** External audit should be carried out once in a year.
- **Management review:** Management system review will be carried out by inviting the fellow environmental experts from the research institutions and the university.
- **Performance measurement:** The performance of the environmental aspects are required to be measured/gauged by setting the indicators, including daily energy consumption in the buildings etc.

## 6.0 CONCLUSION AND RECOMMENDATIONS

Universities are striving to minimize the impacts of their everyday activities across the world. The present research discourses the requirement and roadmap of EMS implementation plan in HEIs by the case study of UET, Taxila Pakistan. The university endeavors to attain environmental protection, and improvement and sustainable campus in a long term. This can be attained by proposing and implementing EMS as an instrumental tool. For these purpose major environmental aspects of the UET, Taxila were identified by carrying out the detailed initial environmental review. From the observations it came to know that waste management and resource consumption are the thrust areas for which proper management system is required. Other activities are also need to be addressed for proper maintenance in order to improve the environment. Although the collection of waste and awareness to use the minimal resources is present but proper disposal, recycling and reuse system is still needed. SWOT analysis has been conducted in order to find out the strengths and weaknesses of the UET, Taxila. EMS has been mapped on the basis of SWOT analysis outcomes. As a result of this analysis sustainable committee has been proposed to take care and monitor the environmental issues of the university, and environmental management plan for the landscaping, air quality, transportation, construction, purchasing, investments and funding, research and education and community activities has been prepared. By initiating the EMS, water footprints and carbon footprints can be calculated in the UET, Taxila and mitigation measures can be explored for its reduction. Quantifiable targets like impacts of carbon and waster footprints are not included in the research which can be studied further. The proposed EMP implementation in the university will be the major step in the sustainability path and hope for following this suit by other educational institution of the country to make campus sustainable.

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