

Environmental Sustainability Assessment of an Academic Institution in Calamba City

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Abstract Management of environmental aspects and impacts, and integration of environmental concerns in instruction, research, and community extension programs of a private college in Calamba City, Laguna were evaluated to determine its environmental sustainability. Environmental audit and interview of students, faculty, and top level management about the college's sustainable initiatives were conducted. Energy consumption, hazardous and solid waste generation, and material consumption were the most significant aspects of the college. Its current environmental sustainability-related projects to address these aspects were short of sustainability. Furthermore, progress was not monitored and evaluated. Instituting an Environmental Management System could improve its environmental performance and communication of its sustainability initiatives to the stakeholders.

Keywords: Environmental sustainability, environmental management system, environmental aspect, environmental Audit

Introduction

Since the Earth Summit in 1992, sustainable development has been centered on the political agenda, and the education sector was not considered as an important institution contributing to Sustainable Development (SD) and not even defined as one of the stakeholder groups. However, the World

Summit on SD in 2002 recognized the role of education and educators as essential elements of the advancement towards SD (Peralta, 2004). As the incubators of tomorrow's leaders and decision-makers, higher education institutions (HEIs) provide opportunities to advance knowledge in the area of sustainable development (Velazquez et al., 2006) by promoting environmental protection and conservation as well as providing a healthy and environmentally sustainable campus (Stafford, 2011). SD requires a balance between human needs and preservation of resources (Ustad, 2010). A sustainable and productive environment is a prerequisite to a sustainable socioeconomic system (Morelli, 2011). Colleges and universities play a significant role to achieve such balance by displaying to the students and the public their commitment to environmental protection and conservation.

Similar to those of other firms and businesses, the operations and activities of HEIs have direct and indirect environmental impacts that need to be addressed through a systematic and sustainable approach. A systematic approach commonly used by many organizations is Environmental Management System (EMS). The establishment of an organized sustainability program like EMS could help colleges and universities to integrate environmental sustainability in their operations and activities. EMS provides a system for identifying the environmental footprint of the organization, environmental regulation issues, employing sustainable policies, and hands-on pollution prevention programs according to the United States Environmental Protection Agency (U.S. EPA, 2007). It is a continuous series of policy formulation, planning, employing, and evaluation of environmental strategies for further improvement of environmental performance of an organization (Clarke & Kouri, 2009). Therefore, implementing an EMS could help colleges and universities to improve their environmental performance on the road to sustainability.

A sustainable university also requires social responsibility and public participation in promoting sustainable community projects and awareness services. Universities should cooperate with the local community to highlight the environmental importance of the campus and should serve as the center of the community for such purpose (Alshuwaikhat & Abubakar, 2007). To encourage the academic institutions in the country to become more environmentally sustainable, the Department of Environment and Natural Resources (DENR) began seeking for sustainable and eco-friendly schools in collaboration with the Commission on Higher Education (CHED), Department of Education (DepEd), and Association of South East Asian Nation (ASEAN) (DENR-National Environmental Education Action Plan, 2011). However, this motivation was not enough to inspire all schools, colleges, and universities to integrate environmental sustainability in their management system. Considering that improving environmental performance and environmental sustainability of colleges and universities in our country are not mandatory, most HEIs' endeavors give more attention on the students' education instead of providing an institutional role model of how life can be organized in an environmentally sustainable way.

Despite the significance of the education sector to address sustainability, there have been no concrete data yet regarding the sustainability status of different academic institutions in the Philippines. In addition, most studies about the significance of the education sector to achieve sustainability and the integration of an organized system to address it were from foreign developed countries.

The aim of this study was to assess the environmental sustainability of an academic institution located in Calamba City, Philippines through the evaluation of its current sustainability projects and community programs, the status of

its compliance with environmental laws, and identification of its significant environmental aspects and their impacts.

Methodology

Study Site

The study was conducted in a non-sectarian private academic institution located in Calamba City, Laguna, Philippines which is considered as one of the most populated cities in the province (Figure 1). The campus was recognized as the first secondary school in Calamba City that was founded in June 1930. The three-hectare campus has fully air-conditioned classrooms catered to students of all levels, and each has a capacity of more than forty students per class.

Furthermore, the campus has complementary amenities for extracurricular activities such as sports and other school functions like multipurpose courtyard, audio-visual room, computer laboratory, amphitheater, library, and Chemistry, Physics, and Biology laboratories. In addition, the college also has a parking lot and a medium-sized canteen.

The study was mainly descriptive. Primary and secondary data were collected through direct interview, ocular inspection, and environmental auditing. Data gathered were measured and analyzed using weighted mean and sustainability indicators to rank the significant aspects of the college and to assess the status of its environmental sustainability.



Source: <http://www.mapstreetview.com/Philippines/Calamba/satelliteview.php>

Figure 1. Location Map of the Private College in Calamba City

Instruments

An environmental audit questionnaire was the main instrument used in the study. It is composed of two parts. The first part consists of sets of questions on the school's operations/ activities, aspects and impacts, environmental and sustainability projects, and disposition of the administration to introduce EMS or Sustainability Initiative in its management system. The second part consists of questions regarding the perceptions of students and employees about the environmental performance of the college. To validate the statements and answers of the interviewees, a thorough inspection of activities, facilities, and sustainability programs

was conducted. The identified aspects of the college based on its operations were evaluated using a prioritization matrix. The matrix consists of criteria that determined the significant aspects of the college.

Data Collection

Initial Environmental Review

As part of the initial environmental review, preliminary ocular inspection of the operations and activities of the college was performed by the researcher to evaluate its possible environmental issues. Likewise, the course descriptions and curricula of different academic programs were reviewed. Furthermore, sustainability-related projects were assessed through sustainability indicators such as energy consumption and greenhouse gas emission, water consumption, wastewater discharge, green spaces, solid waste and recyclable that were produced by different school activities and operations, material consumption, health and safety of employee and students, sustainability programs and training, programs and practices in relation to economic aspects, sustainability related projects and courses, and sustainability-focused research. These were the common sustainability indicators used by some popular sustainability assessment tools which were employed in the higher education sector, for instance Sustainability Tracking and Assessment Rating System (STARS), Campus Sustainability Assessment Framework (CSAF), and Global Reporting Initiative (GRI) (Mourdark & Clarke 2012, p.510).

Environmental Audit

To determine what school operations/activities interact with the environment and to fully assess the environmental performance of the college, an environmental audit was conducted by the researcher with the assistance of

the maintenance staff (Figure 2). Environmental auditing is a systematic assessment tool to evaluate the environmental impacts of certain activities. This audit focused on energy, water consumption, generation and disposal of solid, hazardous, and liquid waste as well as operation, facilities, environmental and academic programs and social aspects of the college. Thorough site inspection, weighing and classification of daily solid waste generated, inventory of materials and chemicals used in the laboratory and in other school's offices and activities, and inspection of medical records of students and employees were performed to validate the reports/documents about the environmental performance and compliance of school with environmental laws.

In addition, interviews of students, school staff, and officials were performed. The student respondents were from the different year levels of the college. On the other hand, the employee respondents comprised of faculty members, office staff, and top management officers, including executive vice president, maintenance supervisor, facility and building administrator, school librarian, and human resource supervisor who served as key informants. Three weeks were provided for the completion of the survey particularly for the school personnel.

Environmental audit was carried out in February, school year 2014-2015. The environmental audit questionnaire was adopted from the Pacific Sustainability Index (Morhardt, 2005). The questions were modified.

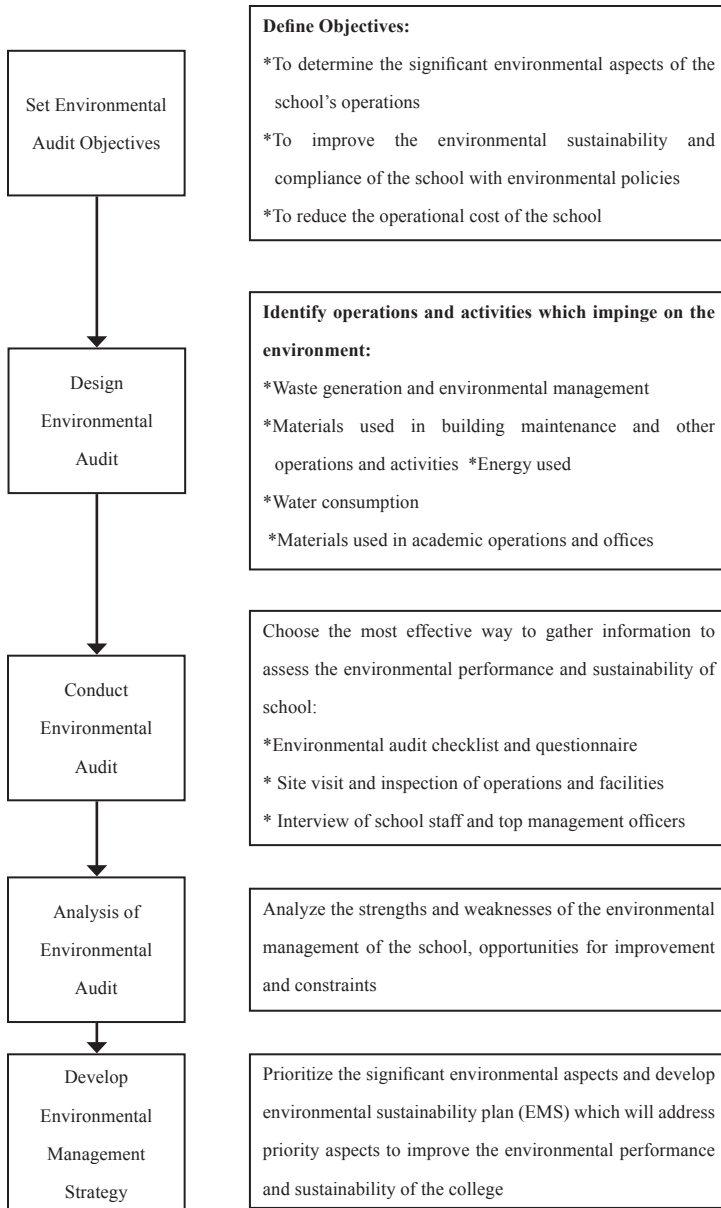


Figure 2. Environmental audit process of the academic institution.

Prioritization Matrix

To identify the most significant environmental aspects of the college, prioritization matrix was used. In this study, the term ‘significant aspect’ was defined as the component of a business’ undertakings or outcomes of its operations that impinge on the environment and can have a significant environmental impact based on the criteria used to evaluate its significance (U.S. EPA, 2007). The prioritization matrix included different criteria to identify the significant aspects of the college. These criteria were legal requirements, health risk, likelihood of occurrence, frequency of occurrence, severity of impact, opportunity to control, impact on public image, and potential to reduce or avoid costs. A score was assigned to each criterion using a scale of 0 to 5. A score of five (5) denotes that the criterion is very significant or related to the environmental aspect involved, whereas 3 indicates that the criterion is moderately important. Moreover, 1 indicates that the criterion is relatively low, and 0 indicates the criterion is not applicable. Direct observation during the environmental audit and interview of the key informants were the basis of scoring. The criteria utilized were adopted from EMS Guide for Colleges and Universities (U.S. EPA, 2007).

Data Analysis

The interpretation of the results of the study was purely descriptive. Mean was used to determine the central tendency of all the scores that served as the basis for the significance of each identified aspect of the college. The score given to each criterion in relation to the particular aspect included in the matrix was based on the inspection conducted and the expert judgment of the researcher and the environment related school officials such as the Pollution Control Officer (PCO) and maintenance and laboratory supervisor.

Results and Discussion

Significant Environmental Aspects of the College

The college had numerous environmental aspects as results of its operations and activities. Among all the aspects, the use of energy/electricity was the most significant based on the result of the prioritization matrix. The majority of the operations of the academic, administration, maintenance, and other departments used electricity which substantiated the result. Lighting, ventilation, use of electrical devices (e.g. computers, gadgets, projectors, shredders, printers, and other electrical devices), and facilities like audiovisual rooms, library, and laboratories were the common operations of the academic and administration department that widely used electricity. On the other hand, the maintenance department used electricity related to maintenance operations like cleaning, retrofitting, gardening, and printing of test papers. With respect to hazardous waste generation, the clinic office, and science laboratories such as Chemistry, Biology, and Physics Laboratories contributed to the generation of most hazardous wastes in which common operations were related to the use of chemicals and generation of medical wastes. Furthermore, the maintenance operation also generated hazardous waste from ink and toner used in the printing office.

In relation to solid waste generation and use of materials, almost all departments were accountable. For instance, the use of papers and production of solid waste were due to office work activities of the administration department and teaching-related activities and paperwork of the academic department. Furthermore, non-biodegradable solid wastes like plastic bottles and containers, candy wrappers, empty cans, chemical containers, residual waste, and scrap metals were some of the wastes generated by the canteen and maintenance department. On the other hand,

large amount of biodegradable waste including leftover food, vegetable trimmings, and animal entrails were coming from the canteen and HRM laboratories. These activities of the different departments mentioned justified the ranks of solid waste generation and use of materials in Table 1.

Only transportation related to school official business and cooking purposes done in the canteen and HRM laboratory consumed fuel; hence, the use of fuel was the least among all environmental aspects of the college (Table 1).

Based on the study conducted by Clarke and Kouri (2009), direct environmental aspects of the higher education institutions include solid and hazardous waste generation, water and air contamination through waste water effluent, and use of fossil fuels for energy. This claim supports the result of this study in which the use of energy/electricity, generation of hazardous waste from college laboratories and building maintenance, and generation of solid waste and wastewater were some of the topmost significant aspects of the academic institution (Table 1).

Table 1. Rank of significant aspects of college operations based on prioritization matrix

Environmental Aspect	Total Score
Use of electricity/energy ^(a)	684
Generation of hazardous waste and Medical Waste ^(b)	272
Generation of solid waste (recyclable and non-recyclable) ^(c)	269
Use of materials (solid materials) ^(d)	261
Use of chemicals ^(e)	168
Generation of Biodegradable waste ^(f)	137
Generation of wastewater ^(g)	124
Use of water ^(h)	115
Use of fuel ⁽ⁱ⁾	68

Footnotes:

(a) all aspects related to the use of energy/electricity

(b) hazardous waste and medical waste that have potential threat to the environment and health of the public including household hazardous chemicals based on Republic Act 9003

(c) all aspects that produce recyclable and non-recyclable solid waste to the environment during its operations

(d) all aspects related to the use of materials such as papers and other solid items

(e) aspects that require the use of chemicals, whether hazardous or non-hazardous

(f) all aspects that produce biodegradable waste such as leftover food, vegetable trimmings etc.

(g) all aspects that produce wastewater effluent that could impair the water quality of the surface water

(h) all aspects that use water for its operations

(i) all aspects that use fuel such as gasoline, diesel, and fuel for cooking.

In relation to the hazardous wastes that could possibly be generated by the college, inventory of the annual use of chemicals in the Chemistry laboratory was carried out. Sodium chloride (NaCl) was the commonly used chemical in the laboratory, followed by Congo red (590 grams). For liquid substances, Hydrochloric acid (HCl) was the most common liquid substance used (3.4 liters) for the entire school year (Table 2). These chemicals mentioned were frequently used in biology and chemistry laboratory activities.

Table 2. Chemicals used in school year 2014-2015.

Chemicals	Amount Used	Chemicals	Amount Used
Acid		Potassium permanganate (KMnO ₄)	166 g
Hydrochloric acid (HCl)	3.4 L	Lead nitrate (Pb(NO ₃) ₂)	70.3 g
Acetic Acid (CH ₃ COOH)	372 ml	Metal	
Base		Zinc Metal	197.6 g
Sodium carbonate (Na ₂ CO ₃)	454.2 g	Iron filings	282.6 g
Sodium bicarbonate (NaHCO ₃)	105.2 g	Magnesium ribbon	87.2 g
Ammonium hydroxide (NH ₄ OH)	625 ml	Nonmetal	
		Sulfur powder	129.8 g
Indicator			
Lugol's Iodine	1 liter	Iodine crystals	69.1 g
Methylene Blue (C ₁₆ H ₁₈ CIN ₃ S)	24.5 g	Organic compound	
Congo Red (C ₃₂ H ₂₂ N ₆ Na ₂ O ₆ S ₂)	589.97g	Phenol (C ₆ H ₅ OH)	29.8 ml
Salt		Urea (CO(NH ₂) ₂)	23 g
Copper sulfate (CuSO ₄)	345.5	Coconut Oil	250 ml
Common table salt (NaCl)	669.6 g	Other cleaning agent	
Calcium Chloride (CaCl ₂)	359.1 g	Ethyl Alcohol (C ₂ H ₅ OH)	1 liter
Potassium iodide (KI ₂)	152.8 g	Carbon tetrachloride (CCl ₄)	230ml

Source: Chemical Inventory Conducted in the 2nd Semester of School Year 2014-2015

Current Environmental Sustainability Practices of the College

The academic institution had a number of environmental initiatives/projects. However, some of these initiatives were voluntary based on the interview and audit conducted (Table 3). Most of the sustainability-related practices were not supported by documentation, and there were no records of progress particularly for those initiatives that address environmental issues. There were also no environmental initiatives in some of the operations that significantly interacted with the environment like laboratory activities, laboratory waste management, and the use of household chemicals and water for cleaning operations (Table 3). On the other hand, energy conservation such as turning off of lights and ventilation in classrooms and offices when not in use were encouraged by the college (Table 3). The college also promoted recycling and reusing of papers and segregation of biodegradable and non-biodegradable solid wastes in offices and in campus activities. Moreover, the concepts of recycling and reusing of materials were also integrated in the National Service Training Program (NSTP). However, students and employees were not required to do so.

Furthermore, to reduce contaminants of wastewater discharge, the college used filter to remove impurities from the sewage discharged by the laboratories. On the other hand, to improve the green space of the campus, the college implemented hydroponics system. Nevertheless, these initiatives were limited only to some particular situations and activities. Moreover, similar to other projects, there were no monitoring and documentation of progress of the latter initiatives. The efficiency of the environmental projects was evaluated based on the sustainability indicators related to the environment, economy, and society. The indicators used in this study were the core sustainability indicators used by some of the popular sustainability assessment tools employed in higher education institutions.

In relation to social aspects and economy, the college implemented policies related to occupational health and safety, employment of persons with disabilities (PWD), and productivity improvement of employees. Although the programs mentioned were part of the college responsibilities as stated in school policies, some of these were not yet put into action because they were still in the planning stage while some were partially implemented. With respect to the economy, the college generated employment and income for employees and residents of Calamba and nearby towns. Furthermore, the college also allowed employee and student loan. To reduce operational cost, energy conservation as mentioned in the previous section (energy conservation) and purchasing cheaper products were encouraged by the college administration. However, there were no assessments done yet to determine the efficiency of the said strategies.

Some of the aspects of the college were substantial elements to maintain a healthy and sustainable environment such as energy conservation through efficient use of electricity and hydroponics system to provide green areas in the campus. Energy conservation can reduce greenhouse gas emission, and green areas keep the environment healthy which is an important social feature of a sustainable campus (Koc, 2014). However, most of these environmental initiatives were short of sustainability since these projects were for short-term basis only, and progress was not usually documented and evaluated for the next action plan to take place. Being a sustainability leader, the college is accountable for developing strategies to manage and minimize its environmental issues and improving its environmental management practices (Klein, 2002).

Effective management and prevention of environmental issues require a system. System leads the institution towards sustainability through improvement of environmental compliance, performance, education, and financial aspect of the HEI (U.S. EPA, 2007). Since most of the environmental initiatives were non-systematic projects done in separation from one another and no assessment of progress,

hence, they were inadequate to address the issues mentioned. Addressing environmental issues by means of conventional methods and directives in a responsive and offhand mode have become extremely inefficient, hence, cannot assure sustainability (Brix, Brydon, Davidian, Dinse, & Vidyarthi, 2006). In this regard, recycling and reusing of papers and segregation of biodegradable and non-biodegradable solid wastes were integrated in the management system and selected academic programs yet most of these initiatives related to solid waste management were optional (Table 3).

Table 3. Current environmental sustainability practices of the college

Key Sustainability Indicator	Environmental Initiative	Mode of Implementation	Documentation/ Monitoring of Progress
Environment			
Energy Consumption/ Greenhouse gas emission	Turning off of lights, ventilation and other electrical devices when not in use	Optional	None
	Regular monitoring of classrooms to ensure that light and ventilations are off when there are no classes	Implemented regularly	None
	Dissemination of trends and updates regarding Climate Change	Optional	Community Extension Manual Report
Water Consumption	None	None	None
Wastewater discharge	Use of strainer to filter solid materials from the laboratory sewage	Use only in Chemistry laboratory sewage pipe	None
Green Spaces	Hydroponics (Science project)	Requirement in Biology subject	Research paper of students
Waste and Recyclables Produced	Providing garbage bins for solid waste segregation	Implemented but not properly observed	None

	National Service Training Program (NSTP) recycling projects	Requirement in NSTP	None
	Plastic bottles, aluminum cans, and dry papers are sold to the junk shop	Optional	None
Office Paper Consumption/ Others	Reusing and recycling of paper (3Rs)	Optional	None
Society (Student/Faculty/Administration)			
Employee, Injury, and Severity Rates/ Health and Safety	Occupational Safety and Health Practices	Partially implemented	Safety and Health Document files
	Productivity Improvement and Gain- sharing Practices	Partially implemented	None
Gender, Age, Persons with Disabilities, and Indigenous Groups	Hire capable PWD or senior citizen	Implemented	Administrative Handbook
Student, Staff, and Faculty Sustainability training	Productivity Improvement and Gain- sharing Practices	Optional	None
Community Outreach Program	Livelihood Enhancement Program	Implemented	Community Extension Office Manual reports
	Institutional Development of Barangay	Implemented	Community Extension Office Manual reports

Although the college had plans and policies to deal with social and economic issues, administering and full implementation were still not put into practice yet. This suggests that the college needs proper coordination with the stakeholders and strive more to pursue its social and economic plans and policies.

Table 3 continued...

Key Sustainability Indicator	Initiative	Implementation	Documentation/ Monitoring Of Progress
Economy			
Economic Value Generated	Employment, Income	Implemented	Administrative Handbook
Socially Responsible Investment	Allow Student/ Employee loan	Implemented	Administrative Handbook
Purchasing Consideration	Prefer to purchase cheaper items	Optional	None
Courses			
Sustainability-Related Courses/ Subjects	Environmental Science, Environmental Engineering NSTP	Implemented	Course Outline, Curriculum Development/ Students' NSTP projects
Sustainability-Focused Research	None	None	None

Integration of Environmental Concerns in the Academic and Community Programs of the College

“The university can play a role in the future directions of the society through teaching environmental education, modeling environmental operations, and conducting environmental research. The student education and the role demonstrated by the university can both influence the personal and professional decisions of the society and future environmental impacts” (Clarke & Kouri, 2009, p. 978). Since universities have a special societal responsibility in particular to youth training and public awareness about sustainability, therefore, it can make a substantial contribution to the development of our society on the road to sustainability (Alshuwaikhat & Abubakar, 2007). To perform the said responsibility, the college supports the implementation of the “National Environmental Awareness

and Education Act of 2008.” Environmental concerns were integrated in the National Service Training Programs (Table 3). Moreover, the importance of environmental protection and conservation were also tackled in other courses/subjects in which the environmental concepts were substantial and discussed comprehensively in the course outline of the subjects. These subjects were Ecotourism, Environmental Engineering, Environmental Science, and Biological Science. The college also implemented projects/programs related to the environment as part of academic programs and course requirements such as environmental seminars, hydroponic system, and community outreach programs. Although some of the environmental projects were related to the management of the topmost significant aspects of the college like 3 Rs, solid waste segregation, and energy conservation, most of these initiatives though were just short term projects only and no monitoring of progress was evident. There were also no initiatives in some of the operations that belong to the second most significant aspect of the college (generation of hazardous and medical waste) that could significantly impact the environment such as laboratory activities and even laboratory waste management.

Although environmental concerns were integrated in the academic curricula, yet the integration was limited only to those subjects mentioned in which the environmental concepts were substantial for the course or included in the course description. In addition, there was also no functioning environmental student organization. As an effective medium to convey the value of environmental sustainability to a wide variety of audience, colleges and universities should promote sustainability through infusing sustainability into seminars, workshops, training, graduate and undergraduate courses and curriculum, and research and development (Alshuwaikhat & Abubakar, 2007). Thus, there is a need to enhance the integration of sustainability in academic programs

and curricula of the college considering that achieving sustainability is a function of everyone.

To establish a close and harmonious relationship with all the 54 barangays in Calamba City, the college conducts livelihood enhancement program and institutional development for the local community (Table 3). This task was assigned to the Community Extension Office (CEO). The college collaborates with the local government unit to implement its community projects. Students and faculty assigned coordinated with the local officials of municipal government and selected barangay. Documentation and progress were recorded in the extension manual report as part of the responsibility of the CEO. Most of the community projects were related to socioeconomic aspects of the communities such as livelihood training, health seminars, and literacy program. In connection with the environment, common community projects implemented were tree-planting activities and barangay cleanup. However, the concept of environmental sustainability was not emphasized in most of these projects. Basic comprehension of the linkage and interdependency of ecological, economic, and social systems is a prerequisite in an efficient way of conveying sustainability to the community (USLF, 2009). Hence, the integration of environmental concerns in the academic and community programs of the institution was inadequate to mold the students to become environmentally sustainable individuals.

Compliance of the College to Some Environmental Laws and Regulations

The environmental audit and interview of the school personnel revealed the status of college compliance with some of the environmental laws and legal requirements. Although the college conforms to most applicable environmental laws, further improvements in the proper observance of these laws were necessary. The need to improve proper observance was

manifested in some significant aspects of the college in terms of generation of hazardous and solid wastes, use of materials, and generation of wastewater.

The academic institution needs to address issues such as proper compliance with Republic Act 9003, assessment of wastewater to comply with Republic Act 9275, proper procedure for disposal of chemicals and hazardous waste to comply with Republic Act 6969, and Laguna Lake Development Authority (LLDA) discharge permit (as provided in the LLDA Board Resolution NO. 96-33) to improve its compliance with environmental laws. Furthermore, incorporating sustainability is necessary aside from improving compliance. Laws only react to situations and cannot prevent environmental problems (Chan & Ho, 2004). Environmental Management System adoption and implementation can be suited to further improve compliance and address sustainability issues. According to Alshuwaikhat and Abubakar (2007), “EMS is a technique that deals with environmental problems which provides accountability to a university to implement environmental sustainability practices and regulations to ensure consistent and systematic management of environmental issues throughout the university to enable it to reduce its environmental impacts, increase its operating efficiency, and ensure consistent compliance with environmental laws” (p.1781). Table 4 summarizes the college status of compliance with common environmental laws and its related significant aspects.

Table 4. Compliance of the college to some environmental laws.

Environmental Law	Deficiencies in Proper Observance	Significant Aspect
“Republic Act 9003 Philippine Ecological Solid Waste Management Act of 2000” Article 2, section 21, and 22 Mandatory segregation of solid waste	*Insufficient number of garbage bins for recyclable, residual, and biodegradable wastes	*Generation of solid waste
	*No container for medical waste (waste from the clinic)	*Generation of hazardous waste
	* No permanent label or color code for each particular type of bin	*Generation of hazardous Waste
	*Lack of observance of proper implementation of solid waste segregation (biodegradable wastes are mixed with non-biodegradable)	*Use of materials
“Republic Act 6969 Philippine Toxic Substances and Hazardous and Nuclear Waste Act”	*No documented procedure for proper disposal of hazardous waste and expired chemicals from the laboratory	*Generation of hazardous waste and medical waste
	*No documentation and training for hazardous waste management	
“Republic Act 9275 (Chapter 5, Section 27) Philippine Clean Water Act of 2004”	*No record of periodic sampling of wastewater effluent to assure that the wastewater discharged to the environment meets the class C- freshwater standard	*Generation of wastewater
“Laguna Lake Development Authority (LLDA) BOARD RESOLUTION NO. 96 -33”	* No LLDA discharge permit for wastewater	*Generation of hazardous waste
	* No qualified Pollution Control Officer certified by DENR or LLDA to manage environmental issues of the college	* Generation of waste water
“RA 9512 National Environmental Awareness and Education Act of 2008”	*Complete integration of Environmental Education in all subjects aside from NSTP and courses with Environmental Science and related subjects	*Use of materials *Generation of solid waste

Daily Solid Waste Generation of the College

The school generates approximately 22 kilograms of biodegradable waste per day, 16 kilograms of papers per day, and 19 kilograms of plastic per day. About 62 kilograms of total solid wastes are also generated by the school each day (Table 5). Solid wastes that can be sold like plastic, aluminum cans, and papers are regularly collected by janitors. On the other hand, biodegradable waste materials are regularly collected by the municipal garbage truck. Although the amount of solid waste generated by the college is fairly small, improvement of measures to continuously reduce the volume of waste generated is still necessary.

Table 5. Daily solid waste generation of the college

Date of Sampling	Type			Total (Kg.)
	Paper (Kg.)	Plastic (Kg.)	Biodegradable (Kg.)	
2/23/15	11.25	15	31.5	57.75
2/25/2015	20	25.5	24.75	70.25
3/2/2015	13.6	20.25	27	60.85
3/5/2015	16	15	20.3	51.3
3/9/2015	12	29.3	20	61.3
3/11/2015	22	24	18.66	64.66
3/13/2015	24	24.5	16.5	65
3/16/2015	18.3	19.5	29.25	67.05
3/18/2015	17.25	19.75	21.5	58.5
3/23/2015	14.5	20.3	27	61.8
3/25/2015	18.5	18.25	24.3	61.05
3/26/2015	16	20.25	25.25	61.5
Total	191.4	222.3	266.01	741.01
Mean	15.95	18.5	22.2	61.75

School Building Facilities

Based on the environmental audit and ocular inspection conducted by the researcher, the Chemistry and Biology Laboratories had some common facilities provided such as sinks, shower room, fume hood, laminated working tables, storage room for chemicals, and display cabinet. Inadequate water supply is always encountered during the laboratory period particularly when there is weak water pressure being experienced during class session. The classrooms were all air-conditioned, well-ventilated, and provided with sufficient number of light bulbs, but some were no longer functioning.

For safety and emergency purposes, there were also fire extinguishers placed at selected area of the building and fire exit plan posted on the walls of every stairway. Fire hosepipe was also provided at every corner of the building. However, comfort rooms were limited only on the 3rd floor of the building and ground floor. Urinals were not water-free system. Hence, janitors were required to check the condition of the comfort rooms regularly. With regards to climate change adaptation and mitigation, no further improvement of the facilities had been done yet. Although there were minor renovations, these were not connected yet to enhance the capacity of the building structure to address the impact of climate change.

Although the academic institution conformed to the requirements of the building code and environmental laws, enhancement were still needed particularly for the facilities provided in the laboratory. Some of the facilities were not in the standard size or design, like the fume hood, sink, and shower room, based on the standards set by DepED Educational Facilities Manual (2007).

Conclusion

The topmost significant aspects of the college were the use of electricity, generation of hazardous and solid wastes from college laboratories and building maintenance, and use of materials. The majority of these aspects were not fully addressed by the current environmental programs and projects of the college since there were no documentation and regular monitoring of progress. Most of the environmental efforts were for regulatory compliance and short-term basis only; therefore, short of sustainability. Relevant environmental laws were implemented by the college; however, proper observance was not evident considering that some of these environmental laws could enhance its sustainability practices such as Republic act 9003 (Philippine Ecological Solid Waste Management Act of 2000) and Republic act 9275 (Philippine Clean Water Act of 2004). The college also integrated environmental concerns in their academic and extension programs, and research. However, similar to other programs, most endeavors were for compliance purposes only with the present ordinances of concerned government agencies and authorities, and there were no efforts to further enhance such compliance to develop the students to become advocates of environmental protection and sustainability.

Although the college had several initiatives to address its environmental aspects and impacts, there were missing substantial elements such as systematic approach, documentation, and continuous progress. Instituting a system like a functional Environmental Management System could remedy said deficiencies to improve the college's environmental sustainability. As EMS is an organized process of incessant improvement, it could integrate all the efforts of the college into a system which is continuous and progressive.

Recommendations

To further improve compliance with environmental laws and commit itself to achieve environmental sustainability, the college must support the establishment of a systematic approach like EMS to organize all its projects and programs. Extension projects and programs of the college should also center on environmental sustainability to communicate its significance to the public. The result of the study must be used as the basis for the establishment of such system. Furthermore, consultation with the stakeholders must be carried out to come up with a holistic environmental sustainability plan or EMS plan. To encourage colleges and universities to improve their environmental sustainability while complying with National Environmental Awareness and Education Act of 2008 (R.A. 9512), the Commission on Higher Education should provide incentives for HEIs that incorporate EMS in their management and operations.

This study tackled the status and ways of improving the environmental sustainability of a small academic institution. Future studies should look into the factors that restrain campus environmental sustainability of different colleges and universities. It would be preferable to include a larger sample size. Future researchers should conduct a comparative analysis of environmental sustainability initiatives implemented by different colleges and universities to provide knowledge about the relationship between drivers and frameworks of different campus sustainability initiatives or EMS.

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