

The Role of Environmental Auditing and Monitoring in Greening TVET: A Case Study of Ol'lessos Technical Training Institute

Titus M Musyimi

Rift Valley Technical Training Institute, Eldoret, Kenya

Abstract

The study focused on an evaluation of the trade projects which trainee candidates were undertaking in TVET Institution. So far, there is limited literature available on investigations on how these student trade projects impacted on environment in TVET institutions. Due to debate on global warming and its impact on society, there is compulsion to establish whether managers of TVET really understood what this might mean for their institutions. The purpose of the study was therefore to evaluate the impact of student project designs on greening the environment in TVET institutions of North Rift Region of Kenya, and was guided by two objectives; to determine whether such projects were in compliance with public procurement and disposal act, and to examine whether projects supervisors put emphasis on projects environmental impact as required by National Environmental Management Authority (NEMA). Descriptive research design was employed, while questionnaires & observation methods were used for data collection. A sample of 102 projects that were done over a period of 5 years was selected using cluster and purposive sampling from 6 institutions in the North Rift Region of Kenya. Data was analyzed at confidence level of 95% by descriptive statics and inferential statistics. The findings indicate that student trade projects were not environmentally sensitive. Secondly, that majority of such project designs did not consider possibility of recyclability, disassembly or disposal after they were finished with them. Conclusions drawn from the research showed that most trainees' trade projects did not consider the impact on the environmental in choosing their designs, and that the lecturers who supervised the projects did not put any emphasis on environmental sustainability – green designs & recyclability of the project materials. The recommendations were that every project done by trainees must seek to address its impact on the environment; that project supervisors should insist on the recyclability, waste disposal management and cost effectiveness of materials used; and that TVET Institutions should implement energy plan and install noise barriers and recycle most project materials to earn some income to enhance greening the institutions. It is also recommended for institutions to include student project in their audits as focal areas in their work plan activities

Key words: *Recyclability, disassembly, environmental impact, waste disposal*

Introduction

According to National Environmental Management Authority (NEMA) regulations (2017), a lot of building operations solid waste such as paper, cartons, plastics,

broken glass, and related office and industrial wastes. These wastes should be handled appropriately in order to avert effects such as injuries, odor and public health hazards. The best mitigation measures in workshops would be to provide litter bins which encourage the separation of wastes into glass, paper, and wood for recycling. The proponent should also provide bins for collection of e-waste. For every ton of paper that is recycled, we save three cubic yards of landfill space. In composting, schools can decrease the number of dumpsters being filled per month by as much as 50%. In addition, some schools have discovered that large-scale composting programs can make money through the sale of the finished compost. This money can be used to offset other recycling costs. In the hospitality and tourism industry, despite its contribution in the Kenyan economy, has created enormous industrial and commercial waste and toxic gases. This is a big concern due to its potential hazardous effect on environmental pollution (Gullen, 2008).

In response to the problem of solid waste management and need to the implementation of green practices, hotel practitioners are making effort to improve their environmental practices. The program allows hotels, camps and lodges that apply for eco-rating to be evaluated and recognized for best practices (Ecotourism Kenya, 2014).

In regard to the TVET institutions, there is a lot waste generated in various departments ranging from wood, plastics, food, rubber, metal filings, paper, and e-waste, thus the reason for the sector to be in the front line in the greening practices. According to UNESCO (2014), it involves the responsible use of raw materials, energy, water, etc., awareness of the impacts of production processes, and careful management to minimize any unintended results of production. A number of approaches have been developed to support sustainable production, including: “cleaner production”, environmental auditing, life-cycle analysis, eco-design, industrial ecology and so on. According to the Greening Colleges Approach proposal of Majumdar (2011), colleges should become role models for environmental friendliness as well as a source of inspiration, and an innovative and profound training provider as well as accepted strategic partner for a sustainable development of their regions. He further posits that preparation for work should equip students with the knowledge, competencies, skills, values and attitudes to become productive and responsible citizens who appreciate the dignity of work and contribute to sustainable societies.

Literature Review

In the Constitution of Kenya (2010), chapter 4 deals with articles 42 provides right to clean and healthy environment, chapter 5 deals with land and environment. The same constitution also specifies that noise from machinery should be mitigated by deploying acoustic screens to contain noises.

Greening TVET

According to UNESCO (2013) many countries of the globe are facing big challenges due to environmental degradation and climatic change caused by emission toxic waste from industries and other businesses. This phenomenon should cause institutions in TVET sector in Kenya to pay attention to the kind of

materials used to make the trainees trade project and to ensure such do not aggravate the situation being experienced in other parts of the world.

Majumdar (2007) argues that sustainable TVET institutions are managed with the higher objective of providing a holistic educational process where both the teachers and students are not only exposed to learning and pedagogy but also experience being part of an institutional green operations and experience having personal involvement in such ways where decreasing global carbon footprint, rationalizing consumption of energy and use of resources are communal responsibilities.

Green education reform policy formulation is parallel with meeting green skills occupation in the labor market. National Education for Sustainable Development (ESD) strategies provide policy support to wider implementation of green education and training. Having this in place, TVET sector can act as the conduit of sustainable development-oriented transformations to reverse global climate change issues that are recognized globally, and addressed locally (Majumdar, 2011).

Waste Reduction and Recycling

According to Alexander (2008), there is a variety of waste produced; it consists of metals, plastics, paper, aluminium, food and glass. This means that waste management is quite a critical environmental issue. . TVET institutions generate considerable amounts of waste in their respective areas of locations and proper management of solid waste in these institutions will go a long way in ensuring solid waste management principles are replicated throughout the country. Gakungu, Gitau, Njoroge & Kimani (2012) argue that as key providers of skills in Kenya, technical training institutions (TTIs) are responsible for training artisans, technicians and technologists for the various spheres of the economy. These young professionals are the ones who will guide the production processes and use of resources. The institutions are therefore in a position to introduce the concepts of clean environment by ensuring good practices. They can therefore strive to conduct their activities and use of resources in a manner that develops environmental awareness and fosters responsible solid waste management. A study on how these institutions manage the waste will guide good practices which can result in reduced waste and in effect reduced environmental pollution within the society at large.

Further in a studies done in other areas solid waste is equally becoming a threat to the environment. For example a research in Maasai Mara, found that increase in tourism had in turn caused an increase in solid waste and liquid waste generation (Otieno, 2010). Urban centres environment are major sources of carbon dioxide. methane, nitrous oxide, and fluorinated gases that contribute to global warming which is a major contributor to climate change, the majority of GHGs emanate from burning fossil fuels, mainly from motor vehicles and industries (International Energy Agency, 2012).

Statement of the Problem

It has been observed that recycling of materials used in student projects has numerous benefits toward boosting the college financial performance and environment sustainability as well overall economy of a county. However, in Kenya few studies have addressed the issues of recycling of material used in colleges and how that can sustain the environment. Most student projects use electric cables, glass containers, paper cardboard, used ink/toner cartridges, batteries and car oils for practical lessons by electrical and electronic students. Some of the said used materials have hazardous effects on human bodies and environments and if this is left unmitigated it could diverse problems. Most tertiary institutions do not have proper disposal system. In some instances there might be only one incinerator for chemical disposal in applied science laboratories. Thus, the afore mentioned problem has prompted the researcher to find out whether it has been addressed in TVET institutions in North Rift Region and what can do to towards practicing recycling student projects.

Justification/Rationale

Modern machines and projects in the recent past have to conform to design approaches which are environmentally sensitive. Such approaches require: Life cycle analysis of the project, design for disassemble (DFD), the use of environmentally preferred materials and even guidance by the International Standards Organization (ISO), such as BSEN 14001,14004,14011,14012,14040 and 14050. ISO guide before relates to the inclusion of environmental aspects in any production standard and ISO 9011-2002 provides quality guidelines on environmental systems auditing (Lyon's & Maxwell, 2008). It is against the international requirements that the researcher felt that the projects done by trainees in TVET institutions should not be treated in isolation as concerns environmental compliance and greening Kenya.

Theoretical Framework

Stakeholder theory. The theory states that an organization can enhance the interests of its shareholders without damaging the interests of its wider stakeholders (Business Dictionary, 2009). However, stakeholder theory, argues that there are other parties involved, including governmental bodies, political groups, trade associations, trade unions, communities, financiers, suppliers, employees, and customers. Sometimes even competitors are counted as stakeholders - their status being derived from their capacity to affect the firm and its other morally legitimate stakeholders. The stakeholder view of strategy is an instrumental theory of the corporation, integrating both the resource-based view as well as the market-based view, and adding a socio-political level.

Stakeholders theory underpins this study of recycling management, because the influence that the enterprise on stakeholders, although however, it will adversely affect the enterprise itself eventually. Thus the final management situation of business is dependent on their interaction with the stakeholders. Some of the stakeholders in colleges recycling programs are scavengers, semi-fixed recyclers, suppliers, government, industry, associations, scientific research, institutions, financial services and logistics center. Therefore, TVET trainee projects should be

done without affecting the wellbeing of the stakeholders and the neighboring communities.

Methodology

Research Design

The researcher adopted the descriptive research design and the target population of the study was 6 TVET institutions North Rift Region in Kenya. The researcher used cluster and purposive sampling. The cluster sampling was chosen because the research investigated an area covering four counties and needed to select a sample of few institutions in each category. The first stage was to cluster the institutions into, counties and picked 6 institutions using purposive sampling. Nassiuma, (2000) asserts that in most surveys or experiments, a coefficient of variation in the range of $21\% \leq C \leq 30\%$ and a standard error in the range $2\% \leq e \leq 5\%$ is usually acceptable. He also argues that in most descriptive and experimental research, coefficient of variation of at most 20% is accepted and standard error of 0.02 can be used. He gives the following formula in relation to determining sample size:-

$$n = \frac{Nc^2}{c^2 + (N - 1)E^2}$$

Where n = Sample size

N = Population

c = Covariance

E = Standard error

6 Institutions were selected from North Rift Region using simple random sampling and purposive sampling and were administered 20 questionnaires each.

Study Findings

Table 1 indicates the distribution of the respondents according their level of training and the year of study.

Table 1. *Demographics on Schooling Characteristics*

		Frequency	Percent
Level of training	Certificate	15	14.7
	Diploma	87	85.3
	Total	102	100
Year of study	2nd	21	20.6
	3rd	81	79.4
	Total	102	100

Study results in table 2 indicated students undertake course which require designing a project before the end of the course 83.3%. However, it was found that most of

these projects do not emit waste to the atmosphere which are likely to pollute the environment at 78.4%. More findings revealed that students did think of the recyclability of the project materials or the project after its life cycle 79.4%, with 88.2% of the student purposely attempting to design project which were environment friendly as required by the NEMA. Findings also established that majority of students were well aware of NEMA at 98% and its requirement of on new products at 73%. It further indicated that lectures did not insist on project having any greening approach 74.8%. A high frequency of students recommended for TVET to introduce environmental courses units to enhance environmental awareness at 98% while an average of 57% were aware of Public Procurement and Disposal Act. However, a significantly lower percentage of 42.2% said they had never heard of Public Procurement and Disposal Act.

Table 2 NEMA Awareness

		Yes	No	Total
Does your course require you to design a project before the end of the course?	Frequency	85	17	102
	Percentage	83.3	16.7	100
Does the project emit any waste to the atmosphere that are likely to pollute the environment	Frequency	22	80	102
	Percentage			
Year of study		21.6	78.4	100
During the design state, do you think of the recyclability of the project materials or the project after its life cycle	Frequency	81	21	102
	Percentage	79.4	20.6	100
Have you ever thought of the impact of your project to the environment as required by NEMA to make it environmentally friendly?	Frequency	12	90	102
	Percentage			
		88.2	11.8	100
Have you ever heard about NEMA?	Frequency	100	2	102
	Percentage	98	2	100
Do you know of any requirement of NEMA on new products?	Frequency	75	27	102
	Percentage	73.5	26.5	100
When the lecturers are teaching you on project idea generation, do they insist it should have any environmental greening approach?	Frequency	80	22	102
	Percentage			
		78.4	21.6	100
Should the institution of TVET introduce this course unit to enhance environmental awareness?	Frequency	100	2	102
	Percentage	98	2	100
Have you ever heard of public procurement and disposal act?	Frequency	59	43	102
	Percentage	57.8	42.2	100

Recyclability of Projects

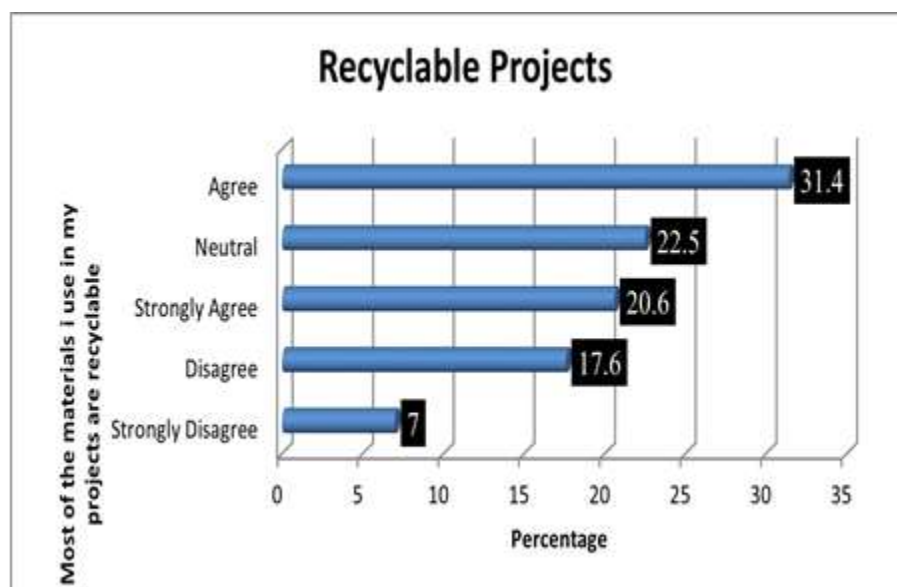


Figure 1: Recyclability of project

Source: Field survey results, 2017

Findings in figure 1 revealed that majority 31.4% of the students agreed that their projects materials were recyclable and strongly supported by 20.6% who strongly agreed. However, 17.6% and 7% disagreed and strongly disagreed that their projects materials were recyclable respectively.

Sustainability of the Environment

Study results in table 3 showed there are numerous green areas in TVET institutions such as special green areas - school gardens, botanical gardens, green playgrounds (53.9%). however, findings established TVET institutions has not implemented energy plan (60.8%) and noise barriers (76.5%).students also reported that there are few number of waste treatment and waste disposal facilities in the institutions (49%). TVET institutions were observed to have no recycling facilities as evidence of 96.1%

Table 3 *Sustainability of the Environment*

		SA	A	N	D	SD
The colleges has Implemented Environment Energy Plan	Frequency	14	1	4	21	62
	Percent	13.7	1.0	3.9	20.6	60.8
The college has high number of public green areas (e.g. special green areas green playgrounds, etc)	Frequency	55	12	10	17	8
	Percent	53.9	11.8	9.8	16.7	7.8
The institute has implemented noise barriers	Frequency	2	2	3	17	78
	Percent	2.0	2.0	2.9	16.7	76.5
There is high number of waste treatment and waste disposal facilities in the institute	Frequency	14	10	7	21	50
	Percentage	13.7	9.8	6.9	20.6	49.0

Correlation Results

Correlation analysis aids in the determination of the existing relationships among the study variables. In this case, the existing relationship between the independent factors, that is, the characteristics and the dependent factor, lecturer support was established. The correlation does not imply a causal-effect relationship. The results were summarized and presented in table 4 and findings indicate that the correlation between sustainability of the environment and availability of recyclable project materials was positively significant by $r = 0.312$ and a p-value of 0.000 at $\alpha = 0.01$. Sustainability of the environment and compliance of the projects with public procurement and disposal act had positive and significant correlation of $r = 0.753$, p-value of $0.000 < 0.05$. This represented the largest correlation. Also, NEMA awareness accounted for 55.5% of sustainability of the environment with correlation of 0.555 which was significant with a p-value of 0.000 at $\alpha = 0.01$. The interrelationships among the independent variables were also significant at $\alpha = 0.01$.

Table 4 *Correlation Results*

	Sustainability of the Environment	Availability of recyclable project materials	Compliance of the projects with public procurement and disposal act	NEMA awareness
Sustainability of the Environment	1			
Availability of recyclable project materials	0.312** 0.000	.1		
Compliance of the projects with public procurement and disposal act	0.753** 0.000	0.558** 0.000	1	
NEMA awareness	0.555** 0.000	0.502** 0.001	0.481** 0.002	1

** Correlation is significant at the 0.01 level (2-tailed).

Conclusion

The results pointed out the following: that student's project materials pollute the environment since there was no established means of dealing with the projects once they were done with; that most students were not aware of and did not follow public procurement and disposal act requirements. It was also established that students felt that the material they used in the project could be recycled and this implies that the waste generated disposal could be planned. Further, the study found that students were well aware of NEMA regulations, with this level of awareness, it is easy to integrate recycling activities in the curriculum and that it would involve students. The TVET institutions had not sustained their environment with exception of having green areas as the only environmental sustainability indicators. There is positive significant relationship between Sustainability of the environment and availability of recyclable project materials and compliance of the projects with NEMA awareness. It can be concluded that there is obvious hazards lurking if the TVET institutions do not mitigate environmental problems posed by lack of practicing sustainable development, especially in integrating greening activities in learning and training.

Recommendations

The study recommends that TVET institutions implement sustainable programs such as energy saving plan to save on energy consumption and install noise barriers in all work stations. TVET institutions should endeavour to ensure that most of the materials used by students in their projects are recyclable and can be used to generate income for the institutions by doing thorough cost- benefit analysis and

purchasing recycling equipment for some project materials to sustain environment for posterity. It is also important that the institutions integrate holistic approach to greening the institutional culture, greening learning and training (curriculum) experience and environment, greening the curriculum, and research and the workplace.

References

- Alexander, S. (2008). *Green hotels: opportunities and resources for success, zero.* Wastle Alliance.
- Business Dictionary. (2009). www.emeraldinsight.com/doi/abs/10.1108/09504120910935183
- Laws of Kenya. (2010). *Constitution of Kenya*, 2010. National Council for Law Reporting. www.kenyalaw.org
- Donaldson, T. P., & Lee, E. (1995). The stakeholder theory of the Corporation: Concepts, Evidence, and Implications. *Academy of Management 20 (1)*: 71. DOI: 10.2307/258887. JSTOR 258887.
- Ecotourism Kenya. (2014). *Linking communities tourism and conservation*. <http://www.ecotourismkenya.org/page.php?id=2>
- Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). *Stakeholder theory, State of the Art*. United States of America, New York: Cambridge University Press. www.cambridge.org.
- Friedman, A. L. & Miles, S. (2002). Developing stakeholder theory. *Journal of Management Studies*, 39 (1): 1–21. doi:10.1111/1467-6486.00280
- Gakungu, N. K., Gitau, A. N., Njoroge, B. N. K. & Kimani, M. W. (2012). Solid waste management in Kenya: A case study of public technical training institutions. *ICASTOR Journal of Engineering*, 5, (3). 127 – 138.
- Gullen, G. (2008). *Wood preservation properties of Zinc and Mn containing solution obtained by battery recycling process*. <http://www.tandfonline.com/doi/full/10.1179/>
- International Energy Agency. (2012). *Emission from fuel consumption highlights*. Paris: IEA Publications.
- Lyon, P. T., & Maxwell, J. W. (2008). Corporate social responsibility and the environment: A theoretical perspective. *Review of Environmental Economics and Policy*, 2, (2), 240-260
- Majumdar, S. (2007). *Integrating sustainable development in TVET curriculum*. Paper presented in the 11th UNESCO – APEID International Conference on “Reinventing Higher Education: Toward Participatory and Sustainable Development” Bangkok, Thailand

- Majumdar, S. (2011). *Developing a greening TVET framework*.
http://www.unevoc.unesco.org/fileadmin/user_upload/docs/Greening_TVET_Framework.
- Nassiuma, D. K. (2000). *Survey and sampling methods*. Nairobi: University of Nairobi press.
- NEMA. (2017) *National environmental management authority regulations*, Nairobi
<https://www.nema.go.ke/index.php?option=comcontent&view=article&id=135&Itemid=236>.
- Otieno, T. (2010). Storm clouds of our solid waste may blow us away if we don't act now. *Daily Nation Newspaper*, 25 October 2010.
- UNESCO-UNEVOC. (2013). *Greening TVET: Qualifications needs and implementation strategies*. Report of the UNESCO-UNEVOC Virtual Conference, 12 to 26 November 2013.
- UNESCO. (2014). *Roadmap for implementing the global action programme on education for sustainable development*. Paris: UNESCO.