

# Solid Waste Management at University Campus (Part 4/10): Perceptions, Attitudes, and Practices of students and vendors.

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## Abstract.

This-study is a-fourth-piece in a-series of 10. At a-general-level, this-research can be-regarded as a-descriptive-case-study of the-social-perception on solid-waste-management (SWM). The-Social Ecological-Model (SEM), the-Panarchy-framework, and the-Pred's Behavioral-matrix informed the-study. The-main-instruments utilized, are: document-analysis (of over 250 published-materials), a-structured- questionnaire (sample-size of 374, for students), and an-interview (of 37 vendors). Discrete-Choice Experiment-technique, which originated from mathematical-psychology for investigating *individual* preferences, was employed. A-preliminary-study/testing of both-instruments, for validity and reliability, was conducted according-to ISO 20252:2006 (E): Market, Opinion and Social-Research-Standard. The-data-analysis was done *via* Minitab and Microsoft Excel-software. The-Statistical-Package for Social-Sciences (SPSS-17, version 22) computer-software-program was used to-compute the-Cronbach's alpha co-efficient. Cronbach's-alpha-test of internal-consistency was performed, and demonstrated high- inter-item-consistency (Cronbach's for students'- questionnaire  $\alpha = 0.828$ ; and for the-interview-guide, for vendors  $\alpha = 0.713$ ). The-study revealed, that both; students and vendors: (i) have-recognized SWM as a-major-problem, at-the-campus; (ii) perceived the-campus as-dirty and very-dirty; (iii) do *not* currently pay for WM-services rendered, to-them, but would-be willing to-pay, *only* for drastically-improved SWM-services; (iv) demonstrated relatively-good level of awareness of health and environmental-effects of improper-waste-disposal-behaviors; (v) do recycle few-materials, at a-limited-extend; majority of recyclers are females; and (vi) exhibit '*knowing-doing-gap*', which is the-gap, between knowledge and practices, on wastes-disposal. The-respondents have also-approximated, that they generate from 0.14 to 1.4 kg/day/ per-student, and 1.7 kg/day/per-vendor, on-average, which is comparable-with estimations for waste- generation-rates, in-sub-Saharan-Africa. It-is also-evident, that the-knowledge, attitudes, and practices, of the-respondents, need to-be-improved, requiring significant and sustained-behavioral-change, which can-be achieved by Environmental-Education (EE). The-state of EE in-Kenya, and the-level of Environmental- Sustainability reporting, by Kenyan-universities, was examined. From the-specifics of EE, in-Kenya, it-is revealed, that its-main-efforts are directed towards wildlife- and natural-habitat-conservation; in-contrast, SWM is yet to-receive due-attention. Several-recommendations were also-made, at different-levels of the-SEM, *via* C4D-strategy-approachers, and including areas for further-research. The-study hopefully contributes (in-its small-way) to the-body of knowledge, on the-subject-matter, and may add insight on the-relevance of EE in-SWM. The-findings might also-help in-providing-information that is of practical- value to-policy-makers and planners, such-as NEMA-Kenya, which is beyond the-university boundaries. The-research-findings are also potentially-helpful to the-local-community, as they highlight the-need for the-local-community, to-get involved in-SWM.

**Keywords:** SEM; C4D strategy; ESD; Environmental Education; Recycling; Performance Contracting; Social norms; Environmental Sustainability reporting; Kenya.

## 1. Introduction.

### 1.1. *Relevant-context on SWM.*

SWM is a-global-problem; throughout-history and throughout-the-world, cities have-struggled to-manage the-waste, produced by their-citizens (Starovoytova, 2018a; Columbus, 2006; Tsiboe & Marbell, 2004). Waste-generation and disposal have, over the-past-decades, become particularly-problematic, throughout the-world (see Starovoytova, 2018a), including Kenya. A-problem has been-created, by mankind, due-to thoughtless-act of consumerism, and bad-attitudes and practices, towards waste (Sebastian, 2010). Inadequate-WM has impacted, adversely, on public-health (Saffron *et al.*, 2003) and has caused environmental-degradation and resource-depletion (Emery *et al.*, 2003).

Recent-study, of-this-series, by Starovoytova (2018a), concluded, that waste is completely unavoidable in-any, and every-human-activity; however, the-way the-waste is handled, stored, collected, and disposed-off, will-determine the-quality of our-surrounding-environment, to-be-either; clean, pleasant, healthy, and sustainable, or filthy, disgusting, harmful, and wasteful. The-way *each*-individual, company/organization/government, and society, at-large, deal with their-waste, will-eventually-determine our-own future, as-humans.

Another-study, by Starovoytova (2018b), has also-exposed multi-dimensional, and complex-nature of

the-existent-challenge, of MSWM, in-Kenya. The-ever-increasing-amount of waste, produced in-Kenya, alongside-with its-uncontrolled-disposal, needs to-be-seen as part of unsustainable-lifestyles, of its-citizens, and poor-MSWM-attitudes and practices. Besides, Otieno (2010) argues, that *if* the-issue of sustainable- SWM, in-Kenya, is *not* considered urgently, all-the-towns, in-the-country, will-be overwhelmed-with-waste and submerged into-it. Widespread-littering, indiscriminate-dumping, and an-open-air burning of waste, were revealed, and therefore recommended to-be-minimized, and gradually, eliminated. This-particular-step will require much-effort, as changing of the-deeply-rooted and currently-prevalent-NIMBY and LULU- attitudes, as-well-as habits, and cultural-perceptions, towards waste, is *not* easy, *but* it-is realizable, with determination, application of appropriate-social-instruments, for SWM, and of course, sufficient-resources and time.

Yet another-study, by Starovoytova & Namango (2018) also-revealed that: the-current-SWM system, at-the-university, is largely *unacceptable*, as it-is characterized as: (a) of Inferior-Quality and accessibility of SWM; (b) Inefficient; (c) of Poor-Legitimacy and social-acceptability; (d) Potentially- damaging-to Health and Environmental-sustainability; and (e) Financially-incapable. In-particular, the-study has justified, that on-overall, the-open and uncontrolled-waste-dumpsite, at the-university, is making, all: environmental-pollution, health-impacts, and safety-violation, highly-probable. The-study also points-out on the-deficiencies/gaps, that need-to-be bridged, to-meet the-legal-obligations, towards SWM, as there is a-gross *non-compliance* with the-legal SWM-provisions (both; international and national).

In-particular, the-amount of litter, and indiscriminate-dumping, in-the-campus, suggest that there is a-poor waste-handling-attitude, among campus-residents, workers, and visitors. Negative-attitudes towards waste, and waste-handlers, as-well-as careless-habits, such-as indiscriminate-littering, observed at-the campus, can be seen as social-cultural-barriers to effective-waste-management (Starovoytova & Namango, 2018). The-possible-causes of littering include: (i) lack of social-pressure to-prevent littering; (ii) absence of realistic-penalties or consistent-enforcement; and (iii) lack of knowledge of the-environmental-effects of littering (Al-Khatib *et al.*, 2009). Other-causes are due-to-the number of waste-collection-bins, available, on a-site (McAllister, 2015). Many-studies have been-conducted, in the-developed-world, to-evaluate and apply, strategies to-reduce-littering, by means of behavioral-interventions (Al-Khatib *et al.*, 2009), but in-developing-countries, including Kenya, little has been done.

As-noted by Wilson *et al.*, 2006; Gyankumah (2004); and Medina (2000), efforts to-address SW-disposal-problems, in-developing-countries, have-failed, due-to the-negative-attitudes and perceptions, people have, towards waste and SW-disposal. It has-been also-suggested, that practices of basic-SWM are often-neglected at the-*individual-level* (Licy *et al.*, 2013).

Uncollected solid-waste-disposal and littering, is one of the-most-visible environmental-problems, in-the-university (see Starovoytova, 2018b). Perceptions by a-cross-section of people, in the-campus, regarding waste-management, might-contribute to such-problems. In-addition, Starovoytova & Namango (2018), proposed further-research on attitudes, perception, and knowledge on waste and its-management, among the-students, and the-local-community, of MU.

### 1.2. Perceptions, attitudes, beliefs, and social-norms.

Melissa (2002) sees *perception* as a-particular-way of understanding, or thinking, about-something. Adekunle *et al.* (2012) expands the-definition, elaborating, that it-as an-individual-mental-impression of something/a-given-phenomenon, or someone. Perception is the-primary-process, by which human-beings obtain knowledge of the-world. It involves the-actions of our-sense-organs (sight, hearing, touch, taste, and smell), in-responding to-external-stimulation (Barnhart, 2008; Gibson & Tierney, 2006). Perceptions are influenced by-our-knowledge, resources, beliefs, values, and norms, but can-be-created without experience and knowledge, of the-object, or person (Mariwah *et al.*, 2010). It also-involves insights, apprehension, discrimination, and comprehension. Perception is subjective, and it-varies from-person to-person, due-to highly-individual/unique perceptual-systems, and how individuals 'see' things, in-terms of one's awareness, understanding, beliefs, expectations, interpretation, impression, made by others, and knowledge of a-situation or a-phenomenon. Perception is duly-influenced by the-settings, that an-individual find themselves-in, and their-general-upbringing.

*Environmental*-perception is understood as the-relationship human-beings have with the- environment. This-relationship determines the-attitudes of the-people, in favor of, or against, the- environment (Taboada-González *et al.*, 2011; Leung & Rice, 2002). The-analysis of environmental- perception has-been-approached by means of environmental-behavior (Corraliza & Berenguer, 2000), and environmental-beliefs, or values (Stern, 1992). However, when analyzing the-literature it was found, that the-relationship is *not* so-simple, as there are several-factors that influence pro-environmental-behavior. Therefore, it-is-important to-understand, which factors promote, or inhibit environmental-behavior, for-example, values and beliefs (Bardi & Schratz, 2003, De Groot & Steg, 2007; Snelgar, 2006), cultural-values (Deng *et al.*, 2006), and environmental-activism (Dono *et al.*, 2010; Fielding *et al.*, 2008), among-others.

*Attitude*, on-the-other-hand, is a-hypothetical-construct, which represents an-individual's like, or

dislike, for a-phenomena/an-item/an-activity. Schultz & Zelezny (2000), define attitude as the-deeply rooted-concept in a-person's self, with a-perception of the-degree of bonding, between self and the-environment. Attitudes are also a-learned-tendency to-evaluate things, in-a-certain-way. Such- evaluations are often positive, or negative, but they can-also-be uncertain (neutral), at times. Warner & Åberg (2006) contends that there is *no* right or wrong-attitude, except within a-certain-cultural-context. But even within the-same-culture, our-behavior can-be-influenced, by a-number of factors, and these develop over-time.

Attitude consists of three-basic-components, which include: (i) perception (emotional-impression); (ii) cognition (thought); and (iii) behavioral-tendency-to-act (Mariwah, 2010). According-to Ajzen (2002), human-behavior is guided by three-kinds of consideration/beliefs about: (a) the-likely-outcomes of the-behavior and the-evaluations of these-outcomes (behavioral-beliefs); (b) the-normative-expectations of others, and motivation to-comply with these-expectations (normative-beliefs); and (c) the-presence of factors, that may promote, or hinder, the-performance of the-behavior (control-beliefs).

Attitude has-been-found to-be an-important-predictor, in-explaining intention, or behavior towards-SWM, and the-relationship are significant (Goh *et al.*, 2013; Kumar, 2012; Ifegbesan, 2010; Vicente & Reis, 2008; Klundert & Lardinois, 2005; Bernstein, 2004; Ajzen, 1991).

Bowersox with colleagues, in-particular, argue that waste-generation is conditioned, to an-important-degree, by people's attitudes towards-waste: their-patterns of material-use and waste-handling, their-interest in-waste reduction and minimization, the-degree, to-which they separate wastes, and the-extent, to-which they refrain from-indiscriminate-dumping and littering. People's attitudes influence *not* only the-characteristics of waste-generation, but also the-effective demand for waste-collection-services (Bowersox *et al.*, 2005).

In-addition, *beliefs*, both; religious and traditional, as-well-as practices, play a-crucial-role, for the-successful-conservation of the-environment. The-preservation of the-environment has a-direct-link to the-culture of the-people, which they pass it, from-generation-to-generations (Anoliefo *et al.*, 2003).

*Social-norms* refer to-the-perceived-standards, of acceptable-attitudes and behaviors, within formal and informal-networks. These are the 'unwritten-rules' that are adhered-to in a-person's family, or peer-group, and within a-community, or society, at-large. Norms can-generally-be-defined as-those regulating-factors, that determine how a-person-behaves, in a-particular-context. Individuals may engage in-specific-behaviors, as a-result of their-perceptions, about: (i) the-consequences of *not* conforming to-social-norms; (ii) what others, in-their social-network, are doing, and how-they-are-behaving; and/or (iii) what others, in their-social-network, think they should-be-doing.

Evidence shows, that strategies, that include social-networks, influencers, collective-behaviors, and social-norms, have large-impact on-social and behavior-change. Changing social-norms, or creating-new-social-norms, requires shifting: (1) people's paradigms about what they perceive to-be-right or true; and (2) people's expectations, regarding normative-behaviors. Social-norms, that are deeply-rooted in one's beliefs, are the-most-difficult to-change (Kempf & Hilke, 2012). Social-norms are usually understood, by measuring individual-attitudes (positive or negative-feelings, regarding an-idea or behavior), and beliefs (perceptions about what is true or false) (C4D, 2012). On-the-other-hand, efforts are still underway to-develop-ways, to-measure social-norms (Mackie, 2013).

### 1.3. Previous-studies and purpose of the-research.

In-relating to-change in-habits, behavior, and participation, 'what people think about waste' (Watch, 1999) is a significantly-important-aspect of SWM (Maddox *et al.*, 2011; Babitski, 2011; Pfeffer & Sutton, 2000), which require examination.

Numerous-studies have-been-conducted on the-subject-matter, all-over-the-world; for-example: Bom *et al.* (2017), Bernstein (2004), and CED (2003), in-the-U.S.A.; Sessa *et al.* (2009), in-Italy; Klundert & Lardinois (2005), in-the Netherlands; Warner & Åberg (2006), in-Norway; Beinstein (2004), and Watch (1999), in-the-U.K.; Vencatasawmy *et al.* (2000), in-Sweden; Deng *et al.* (2006), in-Canada; Al-Khatib *et al.* (2009), in-Palestine; Desa *et al.* (2012), in-Malaysia; Kumar & Nandini (2013), in-India; Rahman *et al.* (2005), in-Bangladesh; Thanh *et al.* (2012), in-Vietnam; Janmaimool (2017), in-Thailand; Ortiz (2001), and Eveth *et al.* (2016), in-Philippine; Buenrostro *et al.* (2014), in-Mexico; Boadi (2016), in-South-Africa; Njagi *et al.* (2013) in-Kenya; Essuman (2017), Abagale *et al.* (2012), and Mariwah *et al.* (2010), in-Ghana; McAllister (2015), in-Botswana; Banga (2013), in-Uganda; as-well-as: Adekunle *et al.* (2012), Mbalisi & Offor (2012), Dango *et al.* (2010), Longe *et al.* (2009), and Banjo *et al.* (2009), in-Nigeria; among-others.

Review of the-studies, listed above, revealed lack of research, on the-attitudes, perceptions, and practices in-SWM, at a *university-context*. Besides, *no* topical-reports on studies, at-the-Kenyan universities-context, had, so-far, being-traced, by the-authors. In-the-view of the-above, this-study is to-explore attitudinal-dimensions, and behaviors, towards waste and its-management, at an-*individual-level*, among students and vendors, of-the-subject-university.

## 2. Materials and Methods.

### 2.1. Background-information and study-area.

Interested-readers can access the-following-background-information, from the-previous-studies, of-this series:

Relevant-background-information, on Kenya (including Geography, Climate, Population, Economy, Political-structure; Legal-Foundation to-SWM, in-Kenya; Kenya's Environmental-Performance and waste-generation-rates) can be-accessed *via* Starovoytova (2018b).

This-study (as all-studies in-the-series) is conducted at the-Moi-University (MU), situated at Kesses-Constituency, the-Uasin Gishu-County, Kenya (the-geographical-position/maps, on the-subject university, is provided - see Starovoytova & Namango, 2018). MU is the-second-largest-public-university, after the-University of Nairobi. As of 2007, it had over 20,000 students, including 17,086 undergraduates. It operates eight-campus and two-constituent-colleges (Starovoytova & Cherotich, 2016b). This-study is limited to-the-*main*-campus, of MU. In-addition, SWOT-analysis of the-current SWM-system, including waste-generators and waste-disposal-practices, in the-subject-university, is provided in-Starovoytova & Namango (2018).

Analogous to Starovoytova (2017), interested-readers could-refer to Starovoytova *et al.* (2015) to-find informative-synopsis regarding Kenya, and its-educational-system. Besides, study by Starovoytova & Cherotich (2016a), provides valuable-particulars, on the-MU, where the-study was conducted.

### 2.2. Research-design.

*Research-design* is a-plan, for conducting research, which usually-includes specification of the-elements, to-be-examined, and the-procedures, to-be-used (Agbesinyale & Anoff, 2010). Research-design helps to-*seek*-information, and to-analyze the-evidence of research-findings, to-answer initial-study-questions.

This-study employed a-cross-sectional study-design; and at a-general-level, the-whole-research can be-regarded as a-case-study of the-social-perception on SWM. According to Yi (2010), a-case-study is "an empirical-inquiry that investigates a contemporary-phenomenon, within its real-life context". The-advantages of case-studies are summarized by Yi (2010), as follows: (1) They may aid the-researcher in-getting a-holistic-view of a-situation, a-view that includes the-context, as-well-as the-details; (2) They are full of details and may, therefore, lead to a-more-complete-understanding of some-aspect of an-event or a-situation. They, consequently, satisfy the-three-parts of a-qualitative-method, i.e. describing, understanding, and explaining; and (3) They may assist in-getting effective-information, that *cannot*, otherwise, be collected. Case-studies are suited to-situations, where context matters; hence, it-is the-dominant motive, to-use them, in-this-study.

Yin (1994) divides case-studies into three-categories, namely *exploratory*, *descriptive* and *explanatory*; which could-be either; single, or multiple-case-studies. Exploratory-studies are often undertaken as an-introduction to-social-research, and aim to-guide the-development of research-questions and hypotheses (NSEU, 1997). Explanatory-case-studies are suitable for the-study on-causal-relationships. Descriptive-case-studies require that the-investigator begin with a-descriptive-theory. This-study is of case-study-type, which could be labeled as *descriptive*.

The-cross-sectional-study-design was adopted, according-to Guidelines for targeted-communities, given by Kaliyaperumal *et al.* (2004).

### 2.3. Theoretical-framework.

According-to Pickett *et al.* (2007), the-goal of scientific-theory is to-facilitate-understanding. Understanding, in-science, can-be-defined as: "an objectively determined, empirical match between some set of confirmable, observable phenomena ... and a conceptual construct". Theorizing is the-process of identifying a-core-set of connectors, within a-topic, and showing how they fit-together. Theoretical- framework plays an-important-role in guiding the-entire-process of the-research-study.

Many-theories and models have-been-formulated to-explain complex-human-behavior. For-example: Deterrence-Theory; Diffusion of Innovation (DoI) Theory; Social-Learning-Theory; Huntington's Political-Institutionalization-Theory; Bolman and Deal's Four-Frame Organizational-Theory; Neutralization-Theory; Theory of Planned-Behavior (TPB); Piaget's Theory of Cognitive-Development; Kohlberg's Theory of Moral-Development; Self-Presentation Theory; Learning-Theory and Behavior Analytic-Theory of change; Theory of Reasoned-Action; The-Health-Belief Model; and Trans-theoretical Model, among-others. For-more-details on each, of the-listed-theories and models, see Starovoytova *et al.* (2016).

This-paper, on-the-other-hand, is guided by the-*Socio-Ecological-model*, which explains people's perceptions and behaviors, in-SWM.

*The-Social-Ecological-model* developed-out of the-work of a-number of prominent-researchers, such-as: (i) Urie Bronfenbrenner's Ecological-Systems-Theory (1979), which focused on the-relationship, between the-individual and the-environment; (ii) Kenneth McLeroy's Ecological-Model of Health-Behaviors (1988), which classified five-different-levels of influence on health-behavior; and (iii) Daniel Stokols's Social-Ecology-Model of Health-Promotion (1992, 2003), identified the-core-assumptions, which underpin the-Social-

Ecological-model (Glanz, 2008). The-work of these, and other-researchers, has been-used and modified, and resulted into what is referred-to as the-Social-Ecological-model.

*The-Social-Ecological-Model (SEM)* is a-theory-based-framework, for understanding exploring, and addressing the-multifaceted and interactive-social-determinants, of a-phenomenon, at many-levels (APPP, 2015; Elder, 2007), while ‘ecological’ means multiple-levels, beyond the-individual. There are five-nested, hierarchical-levels of the-SEM: Individual, interpersonal, community, organizational, and policy-enabling-environment (Figure 1). SEM recognizes individuals as-embedded, within larger-social- systems, and describes the-interactive-characteristics of individuals, and environments, that underlie the-outcomes/behaviors (Sallis *et al.*, 2008; Stokols, 1992). The-model assumes *not* only that, multiple-levels of influence do exist, but also that these-levels are interactive and reinforcing (Stokols, 1992).

*Individual* - is at the-centre of the-model. Individual-factors, which influence people’s action/practices include: knowledge, attitudes, behaviors, beliefs, perceived-barriers, motivation, level of education, socio-economic-status, self-efficacy, developmental-history, gender, age, religious-identity, racial/ethnic/caste identity, sexual-orientation, financial-resources, values, goals, expectations, literacy, stigma, and others.

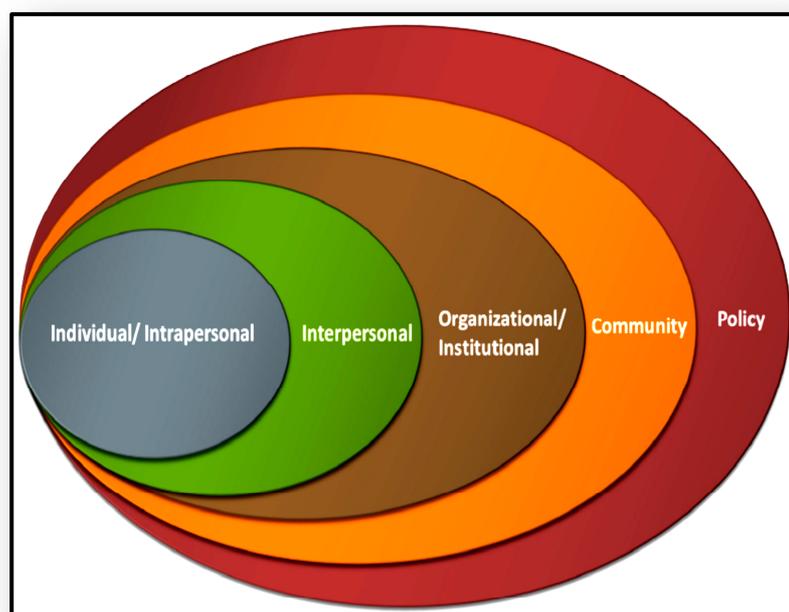


Figure 1: SEM (modified from APPP (2015), and McLeroy *et al.* (1988)).

*Interpersonal* - Relationships with-others, and effects on social-identity, such-as formal (and informal) social-networks, and social-support-systems, that can influence individual-behaviors, including: family, friends, peers, co-workers, cultural-background, religious-networks, customs, or traditions.

*Community* - Relationships, among organizations, institutions, and informational-networks, within defined-boundaries, including the-built-environment (e.g., parks), village-associations, community-leaders, businesses, and transportation.

*Organizational* - Organizations or social-institutions, with rules and regulations, for operations, that affect how, or how well, for-example, SWM-services are provided to an-individual, or group; and schools, that include SWM, in the-curriculum.

*Policy/Enabling Environment* - Local, state, national, and global-laws and policies, or lack of such-legal-provisions. In-particular, it refers-to legislation, regulatory, or policy-making-actions, that have the-potential to-affect waste-management. Policy includes education-policies, such-as mandating-time for environmental-education-classes, health-policies, environmental-policies, and funding-policies.

The SEM is based on four-core-principles (Mwiinga, 2014; and Elder, 2007):

(i) *Multiple-factors influence behaviors* - efforts to-change behavior, including SWM-behavior, should-be-based on the-understanding of the-interrelationship, between the-four-levels of the-SEM: individual, social-environment, physical-environment, and policy;

(ii) *Environments are multidimensional and complex* - Social or physical-environments can-be described as containing a-variety of features/attributes. Environments can also-be-described in-terms-of their-

actual or perceived-qualities. The-variable-nature of environments has a-direct-implication on the-design of initiatives to-promote residents-participation in-SWM. For-example, a-community may have disposal-waste-bins, in-place, however, their perceptions/ understanding about health-effects of ill-disposed- waste may prevent them from using this-aspect of their-physical-environment;

(iii) *Human-environment-interactions can be described at varying-levels of organization* (e.g., individual, small-group, organizational, community, or population-levels). The-SEM does *not* just focus on the-individual, but includes multiple-levels of human-interaction with-environments. For-example, interventions, promoting proper-waste-disposal-activity can-be-large, such-as whole-population mass-media campaigns, or may focus on organizations, such-as a-school, or workplace-settings, or may-be-based around a-local-community, which they are tailored-to; and

(iv) *The-interrelationships, between people and their-environment, are dynamic*. There is a-reciprocal-relationship, between people, and their-environments; the-social, physical, and policy- environments influence the-behavior of the-individual, while at-the-same-time, behavior of the-individual, group, or organization, also-impact on the-wellbeing of their-environments. The-environment can control, or set-limits to-proper waste-disposal-behavior, that occurs within-it. According to Stokols (1992), making a-change in the-environment can result in a-modification of behavior. For-example, lack of environmental- education, and access-to facilities, such-as waste-collection-services, and waste-bins, limits the-number of people, who will-exhibit proper-waste-disposal-methods (so-called 'environment influencing behavior').

On-the-other-hand, Theory-Oriented-Frameworks are the-frameworks, which attempt to-define and connect different-pieces of theory, within the-domain, of a-particular-area of research. There have-been a-number of attempts at producing general-frameworks, which either deal-directly with-SES-theory, or with relevant-aspects of related-theories (e.g., see Schwaninger, 2006). This-study is informed by the-*panarchy framework* (Cumming & FitzPatrick, 2014; Holling & Gunderson, 2002; Holling, 2001) which proposes that social-ecological-systems are driven by a-series of interconnected-adaptive-cycles on-different-scales. The-adaptive-cycle offers a-model of the-process of change, in a-generic-SES. The-underlying-philosophy, of the-framework, is one of continual, nonlinear, episodic-change, in linked social-ecological-systems. Panarchy proposes that complex-systems follow adaptive-cycles, interactively, at several-different-scales (Holling & Gunderson, 2002; Gunderson & Holling, 2002; Holling, 2001). Cycles may be-out of synchrony, with-phases, complementing one-another, to-increase system-resilience, or less-commonly, in-synchrony.

#### 2.4. *Main study-instruments: a-questioner and an-interview-guide, and the-steps of the-research.*

The-choice of a *questioner* instrument, was due its-inherent-advantages, of it being-less-expensive and time-consuming, over other-tools, such-as: focus-group-discussion and observations (Sarantakos, 1998). The-semi-structured-questionnaire (for students), and an-interview-guide (for vendors) was constructed, based on the-research-topic, its-objectives, and a-target-group. A-semi-structured-questionnaire included respondent's demographics, perceptions, attitudes, knowledge, awareness, and practices, in-SWM, at an- individual level. The-study implemented a-style of projective-technique, by asking questionnaire- respondents questions about SWM and associated-issues. Discrete-Choice-Experiment-technique, which originated from mathematical-psychology for investigating individual-preferences (Proefschrift & de Bekker-Grob, 2009), was employed, for some-questions, since it helps to-simulate the-preferences of individuals, through market-based-choices. With-the-vendors, the-data was collected, through face-to-face-interviews, for which an-interview-guide was prepared. By acquiring information, directly from the-students and vendors, the-authors anticipated to-discover their-perceptions, attitudes, and practices on SWM, at-the-subject-university.

*Ethical-considerations* were also-taken into-account. Ethics means conforming to-accepted standards and being-consistent-with agreed-principles of correct-moral-conduct (Strydom *et al.*, 2005). In-this-regard: (i) the-purpose of the-study was explained to the-potential-respondents; (ii) it was also explicitly-stated, that their-participation is voluntary, and the-data/information will-be-treated confidentially (*no* names or affiliations will-be-revealed); and afterwards (iii) informed-consent was sought, from the-respondents, before the-actual-data-collection.

This-cross-sectional-survey was conducted to-capture the knowledge, attitude, and practices (KAPs) on solid waste management (SWM) from an-undergraduate students, of MU. Students are particularly-targeted, since they-are-regarded, as the-future of the-nation, and universities are expected to-develop their-potential, as-advocates of sustainable-environment (Ahmad *et al.*, 2015).

*Sample-size* answers basic-questions, such-as how-large, or small, must the-sample-be, for it to-be-representative (Creswell, 2003; Sarantakos, 1998). The-sample-size was determined *via* Checkmarket survey-sample-size-calculator. Table 1 shows the-relation of Confidence level, Margin error and Population size on sample-size. For this-study, confidence-level of 95%, and margin-error of 5% were adopted.

Table 1: Sample-size-matrix (*Checkmarket.com*).

Population size	Confidence level = 95%			Confidence level = 99%		
	Margin of error			Margin of error		
	5%	2,5%	1%	5%	2,5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1.000	278	606	906	399	727	943
10.000	370	1.332	4.899	622	2.098	6.239
100.000	383	1.513	8.762	659	2.585	14.227
500.000	384	1.532	9.423	663	2.640	16.055
1.000.000	384	1.534	9.512	663	2.647	16.317

At the-time of this-study, the-student-population, at the-main-campus, was approximately 14,000; the-sample-size of 374, with Confidence-level of 95%, and Margin of error 5%, was calculated. For vendors (with approximate-number of 40, at the-main-stage-market), the-sample-size of 37, with Confidence-level of 95%, and Margin of error 5%, was-computed.

This-study was superficially-divided into 3 sequential-parts, which shown in-Figure 2.



Figure 2: Sequential-parts of the-study (Starovoytova & Namango, 2016a).

The-subject-sensitivity, relative-position of questions, the-minimization of excess-length, the-visual-impact, and ease of comprehension and completion, were all-considered, when designing the-questionnaire. To-ensure-credibility, a-principle of qualitative-inquiry, for ascertaining that the-analysis and findings, are legitimate, was used, according-to Lincoln & Guba (1985). This-research also-complies with the ISO 20252:2006 (E) Market, Opinion and Social-Research Standard; hence a-preliminary-study testing was conducted at-the-MU, main-campus, using an initial-version-questionnaire. The-findings from the preliminary-study were used to-come-up with a-final-version of the-questionnaire, which was designed and administered in-both; English and Swahili-language.

### 2.5. Methods for Data Analysis.

The data-analysis was conducted using Minitab, and Microsoft-Excel software. Software-validation and post data-entry-checks were conducted to-ensure data-integrity, before analysis. Descriptive-statistics was used to-analyze both; qualitative and quantitative-data; data was represented as: mean, range, relative-frequency, and percentage-values.

The-questionnaire and the-interview-guide were pre-tested, to-ensure their-validity and reliability. The-primary-purpose of pre-testing validity and reliability is to-increase the-accuracy and usefulness of findings, by eliminating, or controlling as many-confounding-variables as-possible, which allow for greater-confidence in the-findings, of a-given-study (Hardy & Bryman, 2004).

*Validity* indicates the-degree, to-which an-instrument measures what it-is-supposed to-measure. For a data-collection-instrument to-be considered as valid, content, selected and included in-the- questionnaire, must-be-relevant to the-need or gap-established (Starovoytova, 2018c; Field, 2009). In-order to-demonstrate internal-

validity, in the-questionnaire, it had to-be-constructed, in-such-a-way that the- resulting-data made sense, in the-context of the-research-questions. Descriptions such-as authenticity, cogency, credibility, and confirm-ability, are amongst the-concepts considered, when confirming internal- validity.

*Reliability* refers to the-degree of consistency of scores, obtained by a-tool, or consistency the-procedure-demonstrates. The data-collection-instruments were subjected to-statistical-analysis to determine their-reliability. The most-commonly-used technique, to-estimate-reliability, is the-correlation- co-efficient, often termed as reliability-co-efficient or Cronbach's alpha-co-efficient (Kothari, 2004).

Cronbach's alpha is the-most-common-method of estimating reliability of an-instrument (Hardy & Bryman, 2004), and it-is useful for the-item-specific-variance in a-unidirectional-test (Cortina, 1993). The-Statistical-Package for Social-Sciences (SPSS-17, version 22) computer software-program was used to-compute the-Cronbach's alpha co-efficient, for both-instruments.

### 3. Results and Analysis.

#### 3.1. Validation of the-instruments.

According to ISO 20252:2006(E): Market, Opinion and Social Research, it-is mandatory to-carry-out a-pre-testing of the-self-completion-questionnaires. This helps to-ascertain the-nature of respondents, minimize errors, associated with misinterpretation of questions, and also identify questions, which are less/ more-significant, for the-effectiveness of the-study.

To-fulfill this-mandate, a-preliminary-study, targeting the-identified-stakeholders, at Moi University-main campus, was conducted. The-respondents were randomly-selected, from a-sampling-frame of undergraduate-students, and vendors/shop-keepers, within the-university. From the-validation (so-called "pre-testing") it was found, that both-instruments have sufficient-information, which would answer all-the-research-questions. The-instruments were found adequate-enough; the-length of the-entire instruments were found appropriate and the-content was logically-organized. The-general-recommendation made, is that the-instruments were acceptable with very-minor-editing. Results from the-preliminary-study were then used as a-basis, for developing the-final-questionnaire and interview-guide, which were used in-the-survey of the-subject-study-area.

After-preliminary-pilot-testing, two-questions (on the-income-range and on the-educational-level) were observed/considered-as sensitive (manifesting in strong-hesitation, while responding), and hence, these-questions were removed, from the-final-version of the-interview-guide. The-final-questionnaire, hence, consisted of 12 questions, some of which were in-binary-form, while some open-ended.

The-final-interview-guide also consisted of 12 questions. Simple-interview-guide was prepared in-both; English, and Kiswahili-language. Interviews targeted vendors and shopkeepers, who carry-out business, at the-Stage-market-area, of the-campus. Some-vendors have claimed that they are very-busy, hence refused to-participate; a-total of 37 vendors were interviewed; their-answers were recorded, by the-researchers. On-average, an-interview took about 15minutes. 10 questions (Q1 - Q9; and Q12) were similar-with the-students' questionnaire, and the-remaining-two-questions were tailored.

The-study targeted a sample-size of 374 respondents; and achieved a response-rate of 100% (as respondents were offered a small-reward, in-exchange-to fully-completed-questionnaire). This-response rate was judged-as excellent and representative, and also conforms to Mugenda & Mugenda (2003) stipulation that: "a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent".

Questionnaire-data were coded, entered into SPSS and checked for errors. Data were analyzed list-wise, in-SPSS, so that missing-values were ignored. Cronbach (1951) states, that "one validates, *not* a test, but an interpretation of data arising from a specified-procedure". Cronbach's-alpha-test of internal- consistency was performed, demonstrating high inter-item-consistency; Cronbach's  $\alpha=0.828 > 0.8$ , for the-students-questionnaire, and  $\alpha = 0.713 > 0.7$ , for the-interview-guide-instrument. Most-authors recommend that a-value of 0.6 to 0.85 as an-acceptable-value for Cronbach's-alpha; values substantially- lower indicate an-unreliable-scale (either the-questioner is too-short, or the-answers have *nothing* in- common). The-computed-Cronbach's  $\alpha$ , for-both-instruments, was deemed acceptable, according to a-standard-scale (see George & Mallery, 2003).

The-questionnaire-surveys and interviews were carried-out, during four-months of 2017 calendar-year.

#### 3.2. Data on the-responses to the-questionnaire.

##### 3.2.1. Demographic-nature of the-respondents (students).

All the-respondents were Moi-University, main-campus undergraduate-students. 57% (213 students) were males, while females account for 43% (161). With the-random-sample-collection, the-distribution of the-sample within the-years of study is as-follows (from max to min): 3<sup>rd</sup> year – 127 students (34%); 5<sup>th</sup> year - 94 (25%); 4<sup>th</sup> year - 67 (18%); 1<sup>st</sup> year - 45 (12%); and 2<sup>nd</sup> year - 41 (11%); the-age-bracket, of the-respondents, was  $23.4 \pm 2.1$ .

### 3.2.2. Responses to the-questionnaire.

The-following-narrative presents a-summary on the-major-findings, from the 12 questions, asked.

Q1) First, the-respondents were asked to-indicate three-most-serious-problems, they are faced with, in-the-campus (including social and environmental-issues). This-question was open-ended. WSM was indicated as-the-second-biggest-problem, faced by 76% (284 students), after the-lack of hostel- accommodation-spaces, which was indicated, as the-major-problem, by 91%. 63% (340) indicated that another-significant (interconnected)-problem is power-surges and irregular and slow-internet-connection. The-rest of the-problems (indicated by limited-number of students) include: Lack of hot-water-provision; *no* kitchen in the-hostels; Noise-pollution, as some-students are inconsiderate of others, playing music very-loudly, even at night-hours; Lack of security, manifesting in theft-cases, especially when students are out of the-hostels, attending classes, studying at the-library, playing sports-games, or dancing at-disco, among other-activities; ‘boring’-menu, in-the-canteens; and high-bus-fare from the-campus to the-nearest-town-Eldoret, among-others.

Q2) The-majority of the-respondents (cumulative 88%), perceive the-campus as-dirty (228 students - 61%) and very-dirty 27% (101 students); 45(12%) perceive it as-relatively-clean, while *none* perceive campus as very-clean or clean.

Q3) The-attitude of respondents, towards WM, was also-measured by attitudes, towards deciding whose-responsibility should-it-be to-keep campus clean. The-majority of the-respondents 97% (363) thought that the-MU-administration, was solely-responsible to-keep the-campus clean, the-rest provided *no* answer.

Q4) On-the-question ‘*Do you pay any fee for waste-collection?*’. Absolute-majority provided a-negative-answer. 54% (202 students) said that they would-be-willing to-pay for the-waste-collection, but only if the-collection-frequency and efficiency will drastically-improve.

Q5) Another-question was on the-awareness of health and environmental-effects of improper-waste-disposal-behaviors; this-question was also-open-ended. Health-effects stated, by the-majority 63% (236), were: cholera, and diarrhea-diseases, particularly during rainy-seasons. Many- respondents 58% (217) also-stated, that solid-waste, which was *not* properly-disposed-off, makes the-place stinking and visually-unpleasant (eye-sore), and also-attracts flies, cockroaches, and rats, which can transmit many-diseases, and are dangerous and disgusting. Majority of the-respondents, however, found it difficult to-indicate other-environmental-impacts, of improper SWM, implying lack of awareness on the-environmental-effects, of improper waste-disposal-behaviors and waste-management.

Q6) On-the-issue of the-storage of waste, before the-disposal, 100% stated that *no* dustbins were provided to-them, for storing their-waste, in-their-rooms. Majority 79% (295) reported that they store their-waste in-reused-shopping-bags, 12% (45) – in-cardboard-boxes; while the-rest 9% (34) used metal- tins.

Q7) On-the-question: *Approximately how many kilograms of waste do you (personally) generate/dispose-off every week?* The-weight of waste, generated per-week was-reported within a-wide-range: from 1kg to 10kg, while 10% (37) indicated ‘I do *not* know’. The-highest 36% (135 students) indicated that they generate approximately 5kg of waste, per-week; 27% (101) - 3 kg; 14% (52) - 2 kg; 7% (25)-1kg; 2% (8) - 7 kg; and 4% (16) - 10 kg.

Q8) Students were also-asked *where is the-waste taken for disposal?* Only 18% (67) answered correctly, that the-waste is taken to-the-MU-dumpsite; 32% (120) indicated that the-waste is taken to a-pit for burning; 16% (60) stated that collecting-center is the-destination, while 34% (127) declared ‘I do *not* know’.

Q9) On-recycling-practices, majority 66% (247) declared that they do *not* recycle, while the-rest 34% (127) said, they do. Out of these, who recycle, 60% (76) were females. Except for glass-bottles, and electronic-waste, students do *not* segregate/separate waste, and dispose-off it in-a-mixed-form.

Q10) On the-frequency of waste-collection, majority - 56% (210) stated that waste is collected more-than-twice, per week, but *not* daily; 14% (52) equally-declared, that waste is collected once-a-week, and twice-a-week, while 16% (60) indicated that ‘I do *not* know’.

Q11) On-the-question: *What do you do about waste you find/see on the-streets of the-university, e.g., outside-your-hostel?* Majority of students - 251 (67%) said, that they will do *nothing* or ignore the-waste, while the-rest 123(33%) indicated, that they will pick it and put it in a-nearby-waste-container.

Q12) Lastly, the-students were asked to-propose how to-improve the-current SWM-situation, at the-campus. Some of the-answers-given include: Implementation of effective-waste-collection-system; Employ more-workers to-manage the-waste and provide proper-waste-collection-equipment; Waste-sorting; Recycling of waste; Increase the-number of street-dust-bins, within the-school; Renovation of hostels, to-avoid silt and sand-collection, at the-potholes; Outsourcing cleaners from-outside/private-sector; and periodic-cleanliness-awareness-campaigns, and regular-cleaning-exercises.

### 3.3. Data on the-interviews.

#### 3.3.1. Demographics of the-respondents.

All-the-respondents were Moi-University, main-campus-vendors. Convenience-sampling were utilized to-select the-sample-size of 37 vendors, where 47% (17 vendors) were males, while 20 females account for 53% of the-subject-sample. Age-spectrum, of the-respondents, was as-follows: 25-35 years of age - 7(19%); 35-45 years of age - 22 (60%); 45-55 years of age - 7 (19%), and 55-65 years of age-1 (2%). 90% (33) were married, one identified himself as-single, while the-rest have *not* indicated their-marital-status. Primary family-size was reported ranging from 12 to 4 people. The-majority (60% - 22 vendors) stated, that this-job/business (at MU) is the-only-income-generating-activity they are involved-in, while the-rest indicated, that they are also involved-in farming, and husbandry. On-the-years of experience, the-range was rather-wide; from a-minimum of 1 year to a-maximum of 27years; two-respondents (5%) even stated, that they are the-second-generation of vendors.

#### 3.3.2. Responses to the-interview.

From the-analysis of the-coded-information, obtained *via* interviews, it was revealed, that:

Q1) Analogues to-students-questionnaire, the-question on the-problems/difficulties, experienced, while working, as a-vendor, at MU, was asked. The-majority (71% - 26 vendors) have identified the-most significant-problem as lack of tarmac-roads, inside the-market-area, making it impassible at rainy-seasons, and forcing the-vendors to-come-out the-market, to the-main-road, where students can easily-access and buy the-goods. Lack of water-mains-supply, was the-second-biggest-problem, identified by 56% (21). The-vendors usually buy clean-water in 20 liters plastic-containers, water from the-small bore-hole is dirty, and probably contaminated with human-waste, flowing from the-pit-latrines, build on the-shallow underground-water-table, as several-severe-cases of dysentery and hepatitis, were reported, in-that-area. However *no* proper-investigations were conducted on the-quality of bore-hole-water, to-confirm such- claims. The-third-problem was indicated by 41% (15), as *no* regular-waste-collection, so the-waste is regularly burned, to-reduce its-volume. In-addition minor-problems were stated, e.g., *No* public-toilet at the-stage-market; *No* power-supply in-the-open-market, so after 7 pm, such-vendors are losing customers, due to poor-visibility, and have *no* other-alternative, but to-stop their-sales; The-place is poorly planned, and hence very congested; and Lack of storage-space, for keeping their-vegetables and fruits, overnight, among-others.

Q2) The-majority 58% (22), perceived the-campus as-dirty; and 31% (11) perceived it as-relatively clean, and the-rest indicated 'I do *not* know', while *none* perceive campus as very-clean, clean, or very-dirty.

Q3) It-is-important to-explain, that although the-stage-market is situated within the-MU, it-is apparently a-private-property, meaning that MU is actually *not* responsible for the-waste-collection, from the-premises of the-market, Nevertheless, 87% (32) indicated that MU is solely-responsible to-keep the-campus clean, the-rest said 'I do *not* really know'.

Q4) On-the-question '*Do you pay any fee for waste-collection?*'. Absolute-majority provided a-negative-answer. Besides, 68% (25), said that they would-be-willing to-pay for the-waste-collection, by either; an-NGO, or any-other-private-entity.

Q5) Another-question was on the-awareness of health and environmental-effects of improper waste-disposal-behaviors; this-question was also-open-ended. Health-effects stated, by the-majority 73% (27), were: cholera, hepatitis, and diarrhea-diseases. Many-respondents 51% (19) also-stated, that solid-waste, which was *not* properly-disposed-off, it can block drainage and hence lead to-flooding.

Q6) 100% of the-respondents, stated that they had to-buy their-own-waste-bins, to-store their-waste, before the-disposal. Majority 61% (23) reported that they store their-waste in-the-large plastic-containers, 30% (11) used large-metal (alumina)-tins, while the-rest (3) used large-cardboard-boxes.

Q7) On-the-question: *Approximately how many kilograms of waste do you (personally) generate/discard-off every-week?* The-vendors reported, that they generate about 12kg, per-vendor, on-average.

Q8) Vendors were also-asked *where is the-waste taken for disposal?* Majority 89% (33) stated that they throw their-waste into open-pits, situated all-around-the-stage, Only-small-fraction 8% (3) sell their-biodegradable-waste to to-pig-farmers, the-rest just throw-it-out, mixed with other-wastes. One-vendor (3%) said, 'I don't know exactly, as I pay somebody to-deal with the-waste, produced by my-shop'.

Q9) On-recycling-practices, majority 61% (23) declared that they do *not* recycle, while the-rest 39% said, that they do some-recycling. Out of these, who recycle, 53% (12) were females.

Q10) 39% (14), of the-respondents, believe, that they can reduce their-waste-generation-rates, hence, improving current-state of the-waste-management, at the-campus. The-majority 53% (20), however, said, that they are already doing their-best, and usually very-busy, to-do any-additional time-consuming- tasks. And the-remaining 3 vendors said 'I don't know'.

Q11) On-the-question: "*Do you think the residents/traders/market vendors are capable of managing the-waste, they generate without help from the-university waste-management-team?*" 82% (30) vendors said 'No, that is their-job', while the-rest said 'Maybe'. The-respondents, who responded on the-negative, did *not* believe

that all-the-vendors and shopkeepers could effectively-work-together.

Q12) Lastly, the-vendors were asked, how to-improve the-current SWM-situation. Some of the-answers-given include: Recruit outside-party, to-deal with the-waste, and to-collect modest-waste collection-fee, to-cover the-costs of the-operations.

#### 4. Discussion.

##### 4.1. Analysis of the-research-findings.

The-major-results, presented in-sections 3.2 and 3.3 are analyzed, as-follows:

(1) The-issue of what constitute a-problem, varies, from-person-to-person (Suleman *et al.*, 2015), nevertheless, both; students and vendors have-admitted, that WM is one-of the-main-problems, at the-campus. In-particular, SWM was identified by 76% of the-students, as the-second-most serious-problem, while 41% of vendors acknowledged it as the-third-most-serious-problem, experienced at-the-campus. Identifying/recognizing a-problem is the-first-step to-its-solution, hence, it can be considered as positive-step.

(2) The-majority (88% of the-students and 58% of the-vendors), perceived the-campus as-dirty and very-dirty. According to Sun (2016): “We all know the bad things of dirty environment: infectious diseases and public health burden”. Dirty-environment is a-key-factor in the-pathogenesis of chronic diseases, such-as inflammatory-bowel-diseases (IBD) (Liu, 2015; Sartor, 2008). Now scientists have added new-evidence about the-role of dirty-environment and genetics, in-the-development of the-human immune-system. Interested-readers can access the-details *via* Sun (2016). Besides, the-effect of living, in an-unhygienic and untidy-environment may lead people to-become demoralized, and less-motivated to-improve-conditions around-them. Similar-to-situation, described by Minn *et al.* (2010), the-students and vendors, participated in this-survey, were seems to be almost totally unaware, that the-crisis-SWM-situation in-SWM, was-basically caused by their-behaviors; instead, they saw-themselves as the-victims of that-crisis.

(3) The-majority, 97% of the-students and 87% of the-vendors, stated that the-MU-administration, was solely-responsible to-keep the-campus clean. This-finding is an-indicator of the-need for environmental-education (EE), to-change this long-held-belief, that our-waste supposed to-be-managed by somebody-else. To-change this-viewpoint, EE should be-offered to the-people/MU-residents, to-help-them understand-to-see a-problem of SWM, as a-shared-responsibility, of both; individuals in-communities, and the-MU-administration. Proper-waste-management is a-public-obligation, as-well-as a-benefit. It-is, therefore, the-responsibility of every-individual and institutions, to-ensure clean-environment.

(4) Absolute-majority of both; students and vendors, have declared, that they do *not* pay for the-waste-collection and disposal. 54% of the-students said that they would-be-willing to-pay for the-waste-collection, but only if the-collection-frequency and efficiency will drastically-improve. 68% of the-vendors said that they would- pay for the-waste-collection, if it-is provided by either; an-NGO, or any-other-private-entity.

According-to Kumar & Nandini (2013): “People’s perception on waste-collection-services and on waste-disposal is primordial for its-willingness to-pay”. The-willingness of the-students and vendors to-pay, for improved-WM-services, shows that they do value the-environment, they operate-in, and they want it to-be decent/clean. This-result corroborates the-findings of Salequezzaman *et al.* (2001), in their-study of the-willingness to-pay for community-based SWM, in-Bangladesh. People’s perceptions on fees, waste-collection-procedure, and health-effects of ill-disposed-waste, are important for their-willingness to-pay, and even, in-exercising environmentally-friendly waste-behaviors (Mwiinga, 2014). On-the-other hand, unwillingness-to-pay could lead to-eliciting burning, careless-dumping, and indiscriminate-littering.

Willingness to-pay, or *not* to-pay, for WM-services or facilities, could have direct-impact (positive or negative) on the-reliability and success of any-SWM-strategy (Rahman *et al.*, 2005; Epp & Mauger, 1989). A-number of models have-been-proposed on this-issue (see Atri & Schellberg, 1995; Jenkins, 1991; Skumatz & Beckinridge, 1990), while a-general-Equilibrium-model have-been-commonly-used to- determine the-optimal-fees for waste-collection (Sigman, 1995; Jenkins, 1991). In-their-models, the- consumers had two-disposal-options; garbage or recycling. The-optimal-fees for waste-collection equal the-direct-resource-costs plus external-environmental-costs. Linderhof *et al.* (2001), has based household waste-collection-charge on weight-based-pricing, in-Oostzaan, Holland. Such a-pricing, however, *cannot* be used in-developing-countries where the-actual-volume of household-waste arising is *not* known (Longe & Ukpebor, 2009).

The-study recommends that a-system of payment of service-charges by the-MU, should be-developed (see for-example Isa *et al.*, 2005; and Majid & McCaffer, 1997). Beside, waste-collection and disposal-fee should be included into fee-structure, for students, as they will have more-rights to-demand for effective-WM. Vendors, on-the-other-hand, should outsource WM-services for a-negotiated-fee.

(5) Both, students and vendors, demonstrated relatively-good-level of awareness of health and environmental-effects of improper-waste-disposal-behaviors. When people understand the-connection, between their-behaviors and environmental-harm, they are more-likely to-engage in pro-environmental behaviors (O’Connell, 2011; Dango *et al.*, 2010; Mrayyan & Hamdi, 2006).

(6) The-respondents approximated that they generate from 1 to 10 kg of waste, per-week, per-student (0.14-1.4 kg/day/per-student), and 12 kg, per-week, per-vendor (1.7kg/day/per vendor), on-average. The-respondents were asked to-approximate, making an-error highly-possible, therefore provided-figures could-possibly-reflect either; over or underestimation, on their-waste-generation-rates. Nevertheless, the-generation-rates are comparable with waste-generation, in-sub-Saharan-Africa, per-capita, which is generally-low, with an-average of 0.65 kg/capita/day, *but* spans a-wide-range, from 0.09 to 3.0 kg/capita/day, depending on economic-status (see Starovoytova, 2018a). According to Alshuwaikhat & Abubakar (2008), educational-institution are similar to-small-towns, based on their-large-size, population, and wide-range of activities, taking place, within them. MU-main-campus is characterized as a-mixture of residents with different-economic-status, age-groups, gender, diverse-social and ethnic-groups; these individually, or cumulatively, may affect their-consumption-patterns and waste-generation-rates.

(7) Students were also-asked *where is the-waste taken for disposal?* Only 18% answered correctly, that the-waste is taken to-the-MU-dumpsite, pointing-out on lack of awareness on SWM-practices, among the-students. Lack of education and awareness of effective-waste-management-practices is one of the-major issue in-developing-countries (Essuman, 2017). According to McAllister (2015), a-study in-Gaborone, Botswana, found that when people lack interest in-environmental-issues, it means that they are *not* well-informed, which affect their-actions and also-makes-them feel *not* included in WM-decision-making. On-the-other-side, only-small-fraction (8%) of vendors sells their-biodegradable-waste to-pig-farmers, the-rest just throw-it-out, mixed with other-wastes; the-mixed-waste is regularly-burned, to-reduce its-volume. These-practices show the-lack of consideration on sustainable-SWM-practices. For-example, burning of wastes, contributes considerably to urban-air-pollution, emitting particulate-matter, and persistent-organic-pollutants (POPs); greenhouse-gases (GHGs), generated from the-landfills and untreated leachate, pose-threat to-humans, as-well-as to the-environment (Hornweg, 2001), and hence, should-be discouraged.

(8) 34% of the-students reported, that they do recycle some-waste. Out of these, who recycle, 60% (76) were females. Except for glass-bottles, and electronic-waste, students do *not* segregate/separate waste, and dispose-off it in-a-mixed-form. They have explained that they do *not* see the-importance of separating-waste, since all-the-waste is dumped at the-MU-dumpsite. Metal-scrap-dealers usually buy metals, by weight/per kg, so students just-throw-away *small*-metal-waste-items, as they do *not* have sufficient-storage-space in the-hostel, for the-waste to-accumulate and reach at least 1kg.

39% of the-vendors also do some-recycling, where 53% are females. The-vendors reported that they do *not* throw-away papers/cardboards, unless it-is heavily-soiled, because they use it, mainly for lighting-charcoal-stoves, and for some-other-purposes, for-example they use cardboards for vehicle carpet-protection, especially during-rainy-seasons. They re-use sound-plastic-containers for many-purposes, such-as: poultry and animal-feeders, water-urns, or as seedlings-pots. They however do commonly-burn *broken*-plastic-materials containers, as there is *no* recycling-facility near-by. Empty-Coca-cola- and beer glass-bottles are usually kept by 100% of the-respondents, for deposit-return, when buying a-filled bottle. Glass-containers are usually reused as storage-containers, for many-different-items, such-as: water, milk, sugar, rice, salt, nails, and alike. Metal-scrap are always kept, by the-vendors, and sold to a-third party/scraper-dealer, for further-resell to a-recycling-company. These-findings are in-line-with a-recent study, by the-study of Banga (2013), in-a-Ugandan-context.

The-deposit-refund-system, for bottles, has been-working very-effectively. All-the-respondents (students and vendors) reported that they *never* throw-away glass-beverage-bottles. Thus *no* empty-glass bottles (beer and soda-bottles) are mixed with the waste-stream, unless broken.

In-this-study, with both; students and vendors, females constituted the-larger-share, of the-people who recycle. Several-findings suggest, that gender-difference could influence people's perception on SWM (Ehrampoush & Moghadam, 2005). A-study, by Meneses & Palacio (2005), determined that women are more-likely to-be-engaged in-household-recycling, than their-male-counterparts, probably, due-to their- traditional gender-roles. Besides, some-studies demonstrated that, compared to-men, women were more-aware of the-importance of good-behavior towards the-environment (Adeolu *et al.*, 2014; Mapa, 1997). According-to some-authors, such-as Arora-Jonssons (2011) and Guagnano *et al.* (1995), women are more-environmentally-oriented, than men. This-study is in-accord with such-findings.

Age is expected to-play a-significant-role, as-maturity could affect level of awareness on environmental-health and sanitation (Bradley *et al.*, 1999; Eagles & Demare, 1999). The-data on-the-age, of the-respondents, shows that subjects are matured-adults, whose reasoning-level, as regard household- waste and its-management, is expected to-be-high, and thus facilitate public-involvement, in-SWM-process. On-the-other-hand, even-though, recycling encompasses several-advantages, such-as: economical-rewards, and sustainable-use of natural-resources (Buenrostro *et al.*, 2014; Scheinberg *et al.*, 2011; Hazra & Goel, 2009; Hasnain *et al.*, 2005; Bolaane & Ali, 2004; Ostrom, 2000), the-formal-recycling has *not* been well established in-Kenyan-universities, including MU-campus. Youths could be disinterested, in-venturing in-SWM, because they consider it 'dirty and smelly business'.

Recycling-behavior is also-strongly-influenced “by the knowledge of where, when, and how to recycle” as stated by O’Connell (2011). The-findings of a-study, conducted in-over twenty-two developing-countries (Guerrero *et al.*, 2013) suggests, that when citizens receive information about the-benefits of recycling, and how to-sort the-waste, and they participate in the-designing of the-programs, they are more-likely to-participate in-recycling campaigns. In-terms of extrinsic (i.e., social-reinforcement and monetary-reward) and intrinsic-motivation (i.e., personal-satisfaction) both; were found to-affect recycling-behavior. However, having a-sufficiently-high-level of motivation, itself, and positive-attitudes, toward recycling, do *not* guarantee, that an-individual will act accordingly (Aini *et al.*, 2002).

On-the-other-hand, according-to Miller & Morris (2018):“there is a commonly held myth that providing individuals or groups with information will lead them to appropriate personal and organizational actions and performance, but this is far from true”. Besides, Pfeffer and Sutton, point-out, that while information and knowledge are ‘crucial to performance’, but knowledge is often *not* sufficient to-cause-action: “...there is only a loose and imperfect relationship between knowing what to do and the ability to act on that knowledge’. The-inability to-transfer knowledge of what needs-to-be-done into-action, or behavior, which is consistent-with that-knowledge, is referred as the ‘*knowing-doing-gap*’ or the ‘*performance-paradox*’. While it was believed that the ‘knowing-doing-gap’ was due to a-lack of *personal*-knowledge or skills, research conducted suggests, that while personal-knowledge is important in-ensuring-action, it is *not* as-important as having management-systems and practices, in-place (Pfeffer & Sutton, 2000).

More-recent-research-findings, on recycling-behavior and attitude, suggest that convenience, level of satisfaction, toward recycling-services, and economic-incentives also-influence individual-behaviors and attitudes toward recycling. Economic-incentives, such-as rebates, from containerized-beverage-deposits, or money, saved from the-costs of recycling-disposal, encourage participation. Convenience-factors, such-as proximity-to a-drop-off-center and frequency of collection-services, are strong-predictors of recycling behavior and attitude (Omran *et al.*, 2009; Saphores *et al.*, 2006). Typically, people are more-likely to-participate in waste-management-activities, for-example, recycling, when they observe others, in-their- vicinity, recycling (Lumbreras & Fernández, 2014). Besides, being-informed about an-issue is even more-likely to-influence-behavior, when knowledge is gained from first-hand-experience (Mariwah *et al.*, 2010). For-example, a-survey, done by-the-Custom-Research North-America, in-2011, respondents were motivated by family, friends, and neighbors, to-join recycling-efforts in-their-communities. All-the-above can call for the-active-sensitization of communities on the-benefits of recycling, of SWM, as an-alternative source of livelihood.

(9) Majority of students (67%) said, that they will do *nothing* or ignore the-waste, if they see it, anywhere, in-the-public-places, at-the-campus. In-particular, the-majority stated, stated that: ‘I do *not* care’; ‘Why should I do it?’ “My-single action *cannot* change the-situation of massive-litter all-over the-campus’; ‘If I pick the-waste, in-front of me, the-workers, assigned to-manage waste, will be doing nothing, and *yet* receiving their-pay’; Some said, they are ‘busy, so they just do *not* want to-waste their precious-time’; Yet some explained, that they ‘do *not* want to-get-dirty’; some said that ‘this is unusual- behaviors and they do *not* want to-be ridiculed/labeled as ‘Waco’/strange-person’. This-finding is *not* in-agreement-with (Klundert & Lardinois, 2005; Bernstein, 2004), that people are more-concerned, about waste when it-is at their-immediate-environs. This-study is more in-accord-with the-studies, which have also-shown, that students exhibit moderate to *unsatisfactory*-practice-level on waste-management (Desa *et al.*, 2011; Adeolu *et al.*, 2014; Ahmad *et al.*, 2015).

Some-researchers blame these-negative-attitudes on poverty. It-is quite-understandable, that improved-incomes allow people to-invest-more in waste-collection (Telfer, 2002). However, without demeaning the-poor, one does *not* have to-wait for income-improvement, before avoiding the-habits of littering, or ignoring the-waste ‘under one’s nose’. Besides, generally, people, who own property, have the-incentive to-take-good-care of it, unlike the-one, owned by a-large-number of people, or where there is non-ownership, like public-places. This-appears to be a ‘tragedy of the commons’ issue (Hardin, 1968), is applicable to-this-study.

This-situation is explained by the-socio-ecological-theory, which stipulated, that all-levels of society must be addressed, if peoples’ attitudes towards SWM can-be-improved. With highly-supportive structural-conditions, even individuals-with negative-attitudes tend to-behave in an-environmentally sound- way, while highly-restrictive. In-contrast, at MU, conditions were-able to-discourage even-the individuals with positive-environmental-attitudes, as the-waste-collection-services were *not* provided regularly and universally, in all-residential-areas. This is in-accord-with the-study by Edema *et al.* (2012).

The-majority of the-residents also did *not* realize the-risky-effect of their-waste-disposal-etiquette, and did *not* have a-sense of accountability. While littering, on public-spaces, was widely-practiced, it was *not* necessarily proper, within *personal*-household-space. This, therefore, would imply, that the-waste, left in-public-areas was *not* perceived as a-public-health-hazard. This-finding is in-accord with (Mwiinga, 2014); and

(10) Finally, both; students and vendors have provided some-reasonably-practical-suggestions, in-order-to-improve current-situation on-SWM, at-the-campus.

Analysis of the-research-findings, revealed, that despite the-relatively-satisfactory-level of awareness,

expressed by the-students and vendors, concerning the-effects on improper-SWM, their- behavior, practices, and their-willingness to-act-towards the-alleviation of those-problems, are largely inadequate, manifesting in so-called 'knowing-doing-gap'. The-gap, between knowledge and practices, on household-wastes, was also-indicated in the-studies, done by Eveth *et al.* (2016); Ortiz (2001); Olli *et al.* (2001); and Inglehart (1995).

It-is also-evident, that their-knowledge, attitudes, and practices need to-be-improved, which require significant and sustained-behavioral-change. Although many-students have already-developed principal-attitudes and habits, before entering the-university, campus is the-first time many-students are living on their-own, making-their-own behavioral-choices, where they are *not* regulated by their-parents/ guardians. Many-habits, that students create, during their-time in-university, will continue into-their adult-lives. The-university, hence, has a-unique-opportunity to-influence such-behaviors, towards responsible-environmental-behavior.

Behavioral-scientists, such-as Gagne and Skinner (see Curzon, 2003), explain that behaviors, opinions, and attitudes, which are rewarded and reinforced, are likely to-be-repeated and, ultimately, incorporated-into personal-value-set and routine-behavior. The-wise-use of rewards and reinforcements increases the-chance, that the-individual will repeat the-desirable-attitude and may serve also as an-example, for others, to-adopt the-attitude as-well. The-study, hence, recommends to-introduce some-competitions, for-example for the-cleanest-hostel, or the-floor/level, in a-multistory-hostel, etc., where students will be rewarded, for their-efforts, by means of public-acknowledgement of the-winner, and even by some-tangible rewards (subject to-sponsorship).

#### 4.2. *The-need for Environmental awareness and education.*

Since cultural-derivatives, beliefs, perceptions, and attitudes, are learned-response-sets, they can be changed-through education (Evison & Read, 2001). In-the-past, Environmental Education (EE) and behavior, were thought to-have a-linear-relationship. However, recent-studies have-proven that although knowledge-based-education is a-key-factor for environmental-behavior, the-relationship, between the-two is relatively-weak. Other-factors including: personality-traits, empowerment, knowledge of action-strategies, and situational-factors, all influence an-individual's behavior (Boadi, 2016; Sessa *et al.*, 2009; and Hungerford & Volk, 1990). Regarding the-analysis of environmental-behavior, variables, such-as: the-unselfish-behavior, have-been used, i.e., recycling, saving-energy, or other-activities, based-on personal-rules, economic-considerations, and feelings of moral-obligation (Brehm & Eisenhauer, 2006; Portinga *et al.*, 2004; Thanh *et al.*, 2012). However, self-efficacy is also-important, because it involves the-extent that an-individual believes how-much their-actions will matter (Ewerth *et al.*, 2005).

According-to McAllister (2015); Hoornweg & Bhada-Tata (2012); and Aini *et al.* (2002), it-is important to-create sustainable-waste-systems, as-well-as promoting environmental-citizenship, amongst community-members, through improved-public-awareness and community-participation in-waste management. Findings of previous-studies, by Olli *et al.*, (2001), and Diekmann & Preisendorfer (1998), also-suggest that the-level of consistency, between environmental-attitudes and behavior is affected by a-person's-knowledge and awareness, public-verbal-commitment, and their-sense of personal-responsibility. The-best-way-to-promote environmental-awareness-issues and raise-up environmentally-responsible citizens, is through increased-access to EE (Taylor *et al.*, 2009).

Fearon & Adraki, 2014; Mwiinga, 2014; Minn *et al.*, 2010; and Kasapoglu & Turan (2008), have also-revealed the-importance of public-awareness, for better-management of waste. Moreover, Kamara (2006), and Garmer (2001), state that success in-waste-management and disposal *directly*-relate to the-success of EE. In-addition, Mamatha (2011), states, that without proper-education, orientation, and public-awareness, at all-levels of society; it would-be-difficult to-effectively-manage solid-waste. Besides, increasing numbers of people, who are knowledgeable, about the-health-effects, of ill-disposed solid-waste, may influence their-behavior. The-WM-behaviors, of citizens, can play an-important role, in-solving WM problems, by-minimizing the-volume of solid-waste, and effectively-eliminating-waste, and in-turn, minimizing potential-impacts on the-environment (Xiao *et al.*, 2017; Budică *et al.*, 2015; James & Moseley, 2014; US-EPA, 2013; Castagna *et al.*, 2013; Matsui *et al.*, 2007). Several-environmental-problems (e.g., air-pollution, water-pollution, and odors), caused by improper-waste-disposal, are consequences of human behaviors; therefore, citizens' engagement in-sustainable waste-management behaviors (SWMBs) should-be widely-promoted (Wiwanitkit, 2016; 2014; Chinda *et al.*, 2012; Muttamara *et al.*, 2002).

On-the-other-hand, according-to [Kenya Country Report](#) (2005-2012) and NEMA (2008; 2004), Kenya is facing many-environmental-challenges, such-as: droughts, natural-disasters, floods, conflict and insecurity, in-resource use, food-insecurity, soil-erosion and land-degradation on-the-farmlands, desertification, acute-water-shortages, climate-change and variability, loss of biodiversity, proliferation of slums, human-wildlife conflicts in the-conservation-areas, the-loss of forest-cover, and *poor-waste management systems*. Moreover, about 88 % of the country's total-surface-area is comprised of arid and semi-arid lands (ASALs), while desertification is on-the-increase as a-result of the-fragility of ecosystems. These-problems are a-reflection of a-crisis, which *cannot* be resolved by-law-alone. There is need, for a-change, from within; in-so-far as-attitudes towards the-

environment are concerned. In-this-regard, UNESCO (2011) points-out that: 'Kenya's-education-system *must* play a-critical-role in-addressing these-challenges', in-particular, through Education for Sustainable-Development, and Environmental Education (UNEP& KOEE, 2000). These will be discussed in-the-next-sections.

#### 4.3. Education to create awareness, and change attitudes.

##### 4.3.1. Education for Sustainability.

UNESCO declared 2005-2014 as the-UN-Decade of Education, for Sustainable-Development (ESD) (UNESCO, 2005), with the-goal to-strengthen formal, informal, and non-formal-education, and learning-processes, for sustainability. The-purpose of ESD is to-re-orient education, in-order-to-contribute to a-sustainable-future, for the-common-good, of present and future-generations. The-decade was formed to-scale-up the-work, linked-to the-Agenda 21-document, from the-Rio-Summit (Agenda 21, 1992).

Education for Sustainability is often-positioned, as-additional, or even-ignored, in-national educational-reforms, and revisions of frameworks, for education (Wals, 2012), which instead tend to-push for cognitive and academic-knowledge-transmission (Inoue, 2014), and the-primary-task for early childhood-education is often-summarized as 'readiness for school' (Barratt *et al.*, 2014; UNESCO, 2014a).

ESD recognizes the-environmental, social/cultural, economic, and political-dimensions, of the-learning-processes, involved (UNESCO, 2005) and aims at creating change, focusing on rethinking and re-making educational-programs and pedagogies, to-support social and cultural-transformations, towards sustainable-development. Therefore, ESD can be-considered to-represent an-attempt to-provide equity-with, to and for future-generations (Ha"gglund & Johansson, 2014).

The OMEP-world-project is placed within a-child-oriented-perspective (Sommer *et al.*, 2010) and is designed to-especially-invite child-participation. This-child-perspective is of special-interest, within education for sustainability, which strives to-elevate also the children's rights, as citizens (Ha"gglund & Johansson, 2014; Dahlberg & Moss 2005). Young-children should be recognized as rights' holders and rights' partakers, in a-broader societal-perspective, that also includes collective, inter-generational, and rights, beyond those held by humans (Davis, 2009).

The-term 'Education for sustainability' or 'sustainability-education' complements a-number of other-fields, such-as: environmental-education, global-education, economics-education, conservation- education, development-education, multicultural-education, outdoor-education, global-change-education, and others.

##### 4.3.2.Environmental-education (EE).

Education has been-recognized, as-one of the-important-tools, for conserving the-environment, through the-cultivation of knowledge, skills, values, and positive-attitudes, towards the-environment (Burer, 2014).

According-to NEMA (2008), and Muthoka, *et al.* (1998), environmental-education (EE) is a-process of learning about the-environment, in-order-to-benefit from-it, sustainably. EE aims at developing environmentally-literate-citizens (citizens with skills, knowledge, and inclinations, to-make informed- choices, concerning the-environment). EE has-also-been-defined, as the-learning, that occurs in-habitats, that include wildlife-parks, nature-centers, museums, aquaria, arboretum, wildlife-refuges, camps, and many-others. It-includes the-mass-media, such-as: television, radio, newspaper, and magazines, when used away-from-schools, to-disseminate-information on-environmental-issues (Howe & John, 1988). Besides, the-International-Union for the-Conservation of Nature (IUCN) defines EE as a-process of recognizing-values, and clarifying-concepts, in-order-to-develop skills and attitudes, necessary-to understand, and appreciate, the-inter-relatedness, among-people, their-culture, and biophysical- surroundings (Panneerselvam & Ramakrishnan, 2005). According-to UNESCO (2014a), EE refers to organized-efforts to-teach how natural-environments function, and particularly, how human-beings can manage-behavior and ecosystems, to-live-sustainably.

EE has-been-defined differently, by several-scholars and organizations; however, the-UNESCO (2005) definition is appropriate for this-study, which states, that EE is a-process of achieving-environmental and ethical-awareness, values and attitudes, skills, and behavior, consistent-with sustainable-development, and for effective-public-participation, in solving-environmental-problems. According-to Mwiinga (2014), EE, therefore, refers to *any* education, aimed at behavioral-change, to-reduce SWM-problems.

EE is interrelated-with multiple-other-disciplines of education, which do complement EE, *yet* have their-unique-philosophies. For-example: Citizen-Science (CS) (see Bonney *et al.*, 2009); Education for Sustainable-Development (ESD) (see UNESCO, 2014b); Climate-Change-Education (CCE)(see Chang, 2014; and Beatty, 2012); Science-Education (SE) (see Wals *et al.*, 2014); Outdoor-Education (OE) (see Clarke & Mcphie, 2014); Experiential-education (ExE) ( see AEE, 2002; and ERIC, 2002); Garden-based learning (GBL); and Inquiry-based Science (IBS) (see Walker, 2015).

EE plays a-critical role, in-enhancing movement-upward, along the-Waste-Hierarchy, from mere disposal/dumping, through recycling, and re-use, to-prevention (Kamara, 2006), towards achieving and

maintaining, a-dynamic-equilibrium, between quality of life and quality of the-environment (Hungerford, 1980). UNESCO states, that EE is vital, in-impacting an-inherent-respect for nature, amongst-society, and in-enhancing public-environmental-awareness. UNESCO also-emphasizes the-role of EE, in-safeguarding future-global-developments, of societal-quality of life (QOL), through the-protection of the-environment, eradication of poverty, minimization of inequalities, and insurance of sustainable-development (UNESCO, 2014a).

The-challenge of EE is to-close-the-gap, between knowledge and ethics, to-internalize environmental-knowledge, so that it will-be-reflected in new-behavioral-norms (EPOSW, 1995).

#### 4.3.3. EE in-Kenya.

##### 4.3.3.1. Level of environmental-awareness.

Components of environmental-awareness can-be-classified into two-aspects: (a) the-perception of environmental-problems; and (b) the-behavioral-inclination to-protect the-environment. The-perception of environmental-problems involves people's objective-knowledge, opinion and environmental-realities. It includes two-major-aspects: (i) Perception of environment-protection (EP), which includes the-perception of EP-efforts and scientific-knowledge of EP; and (ii) Perception of environmental-conditions, which includes the-perception of general and local environmental-conditions and perception of various specific environmental-problems (Desa *et al.*, 2011).

Data on levels of environmental-awareness, in-Kenya, is scarce. But, going by recent-responses, by the-Kenyan-citizens to various-environmental-issues, one can conclude, that some-achievements have been-made; for-instance, over 35,000 people appended their-signatures in a-bid to-petition the-Minister of Environment, against the-proposed-excision of natural-forests, in-various-parts of the-country. Besides, the-formation of Neighborhood-Associations, in-the-urban-centers, to-look at environmental-issues, among other-things, is an-index of heightened-awareness to-protect the-environment. People are also-participating more in resisting-actions, either by the-government, private-sector or individuals, which are seen to-be a-threat to the-environment. This is especially in the-fight against-grabbing-public-land, or other-such-land, that is deemed to-be-ecologically or otherwise-significant (Kahumbu, 2014).

##### 4.3.3.2. Organizations, focused directly and indirectly on the-Environment, and providing EE, at different-levels.

Both; the-developed and developing-nations are implementing strategies, in-order-to-educate the-public about environmental-issues and concerns. Educating people, about the-environment, takes-place in-both; formal-settings (e.g., within the-structure of the-school-environment), as-well-as non-formal-settings (e.g., out in the-fields, within local-organizations) (Unger, 1993).

The-account on organizations, which focused on the-environment, and on the-participation, in-EE and in-SDE, in-Kenya, should definitely start-with the-Professor *Wangari Maathai*, who was an-internationally-renowned Kenyan-environmental-political-activist and Nobel-laureate. She was awarded the-2004 Nobel-Peace-Prize for her 'contribution to sustainable development, democracy and peace'. She became the-first-African-woman, and the-first-environmentalist, to-win the-prize. In-1977, Maathai founded the-Green-Belt-Movement, an-environmental non-governmental-organization, focused on the-planting of trees, environmental-conservation, and women's rights ([www.greenbeltmovement.org](http://www.greenbeltmovement.org)).

In-addition-to GBM, there are a-number of organizations, which focused on the-environment, in-Kenya, The-selected-list is as-follows (Peralta, 2014; Kahumbu, 2014; Flood, 2014):

*The-African-Conservation-Centre* -- a-non-governmental-organization, based in-Kenya, founded in-1995. In-2007, it received a USD 200,000 grant from the-Ford-Foundation. Their-work has focused on capacity-building 'to conserve wildlife through sound science, local initiatives and good governance'. One of its-projects, the-Shompole Group-Ranch, won the-2006 Equator-Initiative-Award, for community-driven biodiversity-based-business, from the-UNEP;

*The David Sheldrick Wildlife Trust* operates the-world's most-successful orphan-elephant-rescue and rehabilitation-program, and is one of the-pioneering conservation-organizations, for wildlife and habitat-protection, in-East-Africa;

*East African Wild Life Society (EAWLS)* -- a-membership-based non-governmental conservation-organization, founded in-1961, following the-amalgamation of the-Wildlife-Societies of Kenya and Tanzania.

*The-Kenya Wildlife-Service (KWS)* is a-Kenyan-state-corporation, that was established in-1989, to-conserve and manage Kenya's wildlife, and protect and conserve the-flora and fauna;

*The-Ishaqbini-Hirola-Conservancy* is a-community-based conservation-area, located in-Garissa-County, Kenya. The-conservancy covers approximately 72 km<sup>2</sup>. It-is located along the-eastern-bank of the-Tana-River, and borders the-former Tana-River-Primate-Reserve (1976-2007). Despite its-small-size, the-conservancy is a-core-refuge and breeding-ground, for the-endemic and critically-endangered *Hirola-antelope*. Together with the-Arawale-National Reserve, the-conservancy forms a-key-part of the- Hirola's habitat;

*Men of the-Trees* is an-international, non-profit, non-political, conservation-organization, involved in planting, maintenance, and protection of trees;

The-Tsavo-Trust is a non-profit wildlife-conservation-organization, which covers Tsavo-East National-Park, Tsavo-West National-Park, and Chyulu-Hills National-Park, in-Kenya;

WildlifeDirect is a-Kenya and U.S.A. registered-charitable-organization, founded and chaired by African-conservationist Richard Leakey, who is credited with putting an-end to the-elephant-slaughter, in-Kenya, in the-1980s. Its-main-office is located in Nairobi, Kenya ([www.gorilla.wildlifedirect.org](http://www.gorilla.wildlifedirect.org));

The William-Holden Wildlife-Foundation (WHWF) is a non-profit-organization, based in California, U.S.A., whose principal-project is the-William-Holden Wildlife-Education-Center, located near Nanyuki, Kenya. The-Education-Center is dedicated to wildlife-conservation and environmental-studies, for local-people, with occasional-visits from international-groups;

NEMA, Kenya is a-lead National-implementing-agency, for the-government, on all-issues, related to the-environment. It has collaborated with the-private-sector, formal, and non-formal education institutions, NGOs, CBOS, and religious-groups, among-others. In-addition, substantial-efforts, have-been made by several-UN-organizations, based in-Kenya, such-as:

UNESCO has participated in the-development of the-national ESD-implementation-strategy in Kenya, and the-ESD implementation-guidelines, for the-provincial and district-level;

UNEP's Directorate of Environmental Education ESD-activities focuses on-higher-education, and works-through universities. It has three-main-programs: education, networking, and training. In-education, the-UNEP inspires universities to-re-orient their-curricula towards-sustainability, by provision of tools – higher-Education-curriculum re-orientation guidelines, support workshops and provision of resource-persons. UNEP is also-repackaging the-concept of 'greening-universities', as a-reference-point for teaching and a-living-laboratory. The-networking-program provides a-platform for sharing-knowledge, expertise, and resources. It also facilitates the-MESA-program, whose membership comprises six-Kenyan public-universities. Training is mainly on scheduled-courses for university-dons, conducted in-selected 10 universities in the-World. UNEP also supports EE-activities in-Kenyan-schools and universities. It-is involved-in and provides-support to-community-education, for the-Nairobi-river rehabilitation and restoration-project. There are number of publications on ESD, including: (i) Higher Education curriculum re-orientation-guidelines; (ii) Greening-University tool-kit; and (iii) Graduate curriculum-development source-book on: (a) for ecosystem-management, and (b) green economy;

UNU (United Nations University) Education for Sustainable-Development for Africa Project (ESDA) is jointly implemented UNU-Institute for Sustainability and Peace (ISP), and Kenyatta-University, in-Kenya.

UN-HABITAT is a-member of the-ESDA-joint-project (between UNU-ISP and Kenyatta-University). It also-provides technical-support on urban-issues;

Waste management Association of Kenya (WEMAK) - is the-industry-umbrella-group, for waste-collection-companies, in-Nairobi. The-NAMA will support WEMAK, through capacity building-workshops, operational-support, in the-form of funding core-staff, as-well-as providing GPS- trackers to its-members; and

The National Climate Change Secretariat (NCCS) was established by the-Ministry of Environment and Natural-Resources (MENR) to-help it gather and collate input, and advice, from key climate-change-stakeholders, for its-use in the-coordination of Kenya's climate-change-activities.

On-the-other-hand, EE-centers, complement school-programs and provide students with an-opportunity to-study particular-aspects of environment-sustainability, in-the-areas, where the-centers are located (Ballantyne, *et al.* 2008). Conservation-education-centers, in-particular, provide the-necessary information that enables building-up of the-crucial-support for conservation (Packer & Wade, 2008; Indakwa, 2002). Some of such-institutions, in-Kenya, included: Nairobi-animal-orphanage, the-Butterfly Centre, Kisumu-Impala-Park, Mamba-Animal-Village in-Mombasa, National-Museums of Kenya, and the Elsamere (Gathuku, 2013). Other-organizations include:

The-African-Fund for Endangered-Wildlife - Kenya (AFEW-K), popularly-known-as the-Giraffe Centre, is a-charitable *not* for profit-making-organization, whose main-objective is to-educate the-Kenyan youth on the-importance of conserving-wildlife and the-environment. The-Centre was founded in-1979, as a-breeding-Centre for the-endangered Rothchild's-giraffes, and in-1984 conservation-education-programs were launched, with the-main-target being the-school-students (AFEW-K, 2010). This-program is of immense-popularity, with the-number of school-children, visiting the-centre, having risen from 800 in-1983 to 57,514 students, in-2008 (AFEW-K, 2009), while in-2011 the-numbers rose to 61,986 (AFEW-K, 2011).

Wildlife Clubs of Kenya (WCK) provides conservation-education to-youths, and support wildlife-clubs, through training, information-sharing and advocacy. This is supported through (i) a-teacher training-program; and (ii) an-annual-student-competition, on ESD-best-practices. WCK has also-published and distributed a-number of ESD-related-materials, including thematic-pack on: conservation of forests, energy, water, wildlife, and on combating climate-change. As part of awareness-creation, WCK carries-out an-annual community-conservation-day and support radio-programs on-Environment and the-Youth. WCK also has a-mobile-education environmental-outreach-program to-schools and tertiary-institutions.

Lake Victoria Catchment Environmental Education Program is coordinated by World-Wide-Fund for

Nature (WWF), the-program aims to-empower catchment-communities, schools, and regional-partners, in sustainable-use and management of natural-resources. This is done through a-whole-school-approach, looking at heath, sanitation, nutrition, and children-right to-education, which is infused-through-training.

*African Fund for Endangered Wildlife (AFEW)* -- provides support for environmental-education programs on wildlife-conservation, with a-special-emphasis on endangered-species. It has also established a-resource-centre and developed a-program, for training-trainers.

*Jacaranda Designs* – Chanuka-Express is an-ESD mobile-outreach-program on safety, peace, health, hygiene and sanitation, environment, youth, and community-development, for young-people, run by Jacaranda Designs, in-collaboration-with UNESCO.

More-details, on each of the-listed-organizations, can be-obtained *via* their-respective official-web-sites.

In-addition, more and more NGOs and CBOs, which are focusing exclusively on the-environment, have been registered, in-Kenya. These are: Eco-News; Uvumbuzi-Club; Mazingira-Institute; Kenya Organization of Environmental-Education (KOEE); East-African Wildlife-Society; Wildlife-Clubs of Kenya (WCK); Society for Protection of Environment in-Kenya (SPEK); Undugu-Society of Kenya; Kenya Consumer-organization; Sustainable-Community Development-Services (SCODE); Kenya-Institute of Organic-Farming (KIOF); Forest-Action-Network (FAN); Friends of the-Mangrove; Friends of Nairobi Arboretum (FONA); Learning and development, Kenya (LDK); World-Vision-Kenya (WV-K); Maendeleo-Ya-Wanawake Organization (MYWO); Kenya-Association of Adult-Learners (KALA); CARE Kenya; Intermediate-Technology Development-Group (ITDG); Kenya-Association of Adult-Education (KAEA); and Sustainable-Community Development-Services (SCODE), among-others. For-details, on-each, of the-listed-NGOs, see KOEE (2002).

#### 4.3.3.3. Specific-efforts of the-educational-sector:

Unger in-his-1993-study, on the-EE, in-Kenya: stated that:”EE, world-wide, is increasingly-seen as a-necessity”. This-statement is still-valid-today, after 25 years of its-first-proclamation, meaning, that EE is paramount as never-before. In-Kenya, several-attempts have been-made to ‘environmentalize’ the- curriculum, at-different-levels of education. In-particular:

*Kenya Organization for Environmental Education (KOEE)* is mainstreaming ESD into-the primary and secondary-school-curriculum, based-on an-environmental action-learning-approach in the-Eco-Schools Program, and ESD-teacher-training-programs. KOEE is also-working-with Faith-Based-Organizations (FBO), in raising-awareness and building-capacity on ESD. At early-childhood-education-level, EE is integrated in-the-curriculum, using a-thematic-approach. At the-primary and secondary-school-level, environmental-issues are mainstreamed in the-existing-subjects, using a-multidisciplinary-approach. Besides, all teacher-training-colleges are currently-offering courses in-EE. On-the-other-hand, Kenyan- universities are *yet* to-implement a ‘greening’ university-campus.

The-Ministry of Education has-already-initiated the-process of reviewing the-curriculum through; it-is hoped that appropriate-messages on the-environment will-be-incorporated in-each teaching-subject, to-make environmental-education, in-schools, a-reality. KIE in-collaboration-with PEEPSEA has developed textbooks, for primary-schools, on the-subject of environment, while teachers’ guides, on the-subject, have also-been-developed. In-addition the-Kenya-Organization of Environmental-Education (KOEE), has introduced a-new-approach of inculcating environmental-knowledge, known-as Environmental-Action- Learning (UNEP & KOEE, 2000).

*EE at tertiary-level:* This-sub-sector is composed of Teacher-Education, Polytechnics, Technical-Institutes, Institutes of Technology, and Universities. The-overall-goal of this-sub-sector is to-train environmental-experts.

EE is offered in the-Kenya-polytechnic and Kenya-Science-teachers-college. Some-elements of EE are taught in-specialized-training-institutions, such-as: Naivasha-Wildlife and Fisheries-Institute, Water Training-Institute, Londiani-Forest-College, Medical-Training-Institute, and Agricultural-Colleges and Institutes.

At the-level of universities, EE is offered at both; undergraduate and graduate-level; as a- full-course, in-some-universities, and as a-unit, in-others. For-example: at the-University of Eldoret (former Moi-University) and Kenyatta-University, fully-fledged-Schools, focusing on EE, planning, and management, have been-established. Private-Universities are also-offering environmental-courses (KOEE, 2002). In-addition, EE is being-taught as a-full-three-unit-course in-Moi and Kenyatta-Universities. At Kenyatta-University, students pursuing Bachelor of education-degree must take a-core-cause in-EE. At Moi University, at the-School of Engineering, EE-courses are taught at undergraduate-level at the-department of Chemical & Process Engineering; Civil & Structural-Engineering, and Manufacturing, Industrial & Textile Engineering. Besides, Jomo-Kenyatta-University of Agriculture and Technology (JKUAT) has developed an-ESD-policy to-guide its-programs and operations, assisted by the-Environmental-Program-Support (EPS), within NEMA, and funded by the-Danish-Development-Agency (DANIDA) and the-Swedish International-Development-Cooperation-Agency (SIDA) (MOEST, 2005a; 2005b).

#### 4.3.3.4. Initiatives and approaches.

Two-key higher-education-initiatives, in-Kenya, include the-network of Mainstreaming-Environment & Sustainability into African-Universities (MESA), and the-Education for Sustainable-Development in-Africa Project (ESDA). Besides, Nairobi-City Council-Directorate of Environment has-developed a-SWM strategy, based on community-training on sustainable-SWM, including waste for wealth-creation. The-project is expected to-connect with the-ESDA-training, that will-take-place at the-Kenyatta-University (NEMA, 2008a; 2008b).

Moreover, according to UNESCO, some-organizations and universities, such-as the-UNU; Sustainability Institute for Community-Development, at the-Kenyatta-university; the-Commonwealth Scholarship Commission-East; African-Breweries-Limited; SIDA; and different-governmental-ministries offer scholarships for MSc. degree-courses, in-the-area of sustainable-development and ESD. UNESCO and DANIDA have both-provided-funding for the 'Eco-schools Program' in Kenya, in-its-ESD-work with-schools. The-UNESCO, Nairobi-Office supported the-establishment and subsequent-launch of RCEGN, in-2007. Testing of an 'ESD-Media-Training-Kit' also received both; technical and financial-support from UNESCO. Since then, the-media has undertaken some-activities, including critical- advocacy and public-awareness-campaigns. UNEP is also-supporting the-World-Environment-Day activities (UNESCO, 2011).

*The-Higher-Education Sustainability-Initiative (HESI)* was created as a-partnership of UN-entities (UNESCO, UN-DESA, UNEP, Global Compact, and UNU), in the-run-up to the-United-Nations Conference on Sustainable-Development.

At a-local-context, in-Uasin-Gishu-County (where subject-university is positioned), the-following initiatives, started by various-groups, to-promote EE-programs: (i) An-environmental-group, called Itinerant-Group for Environmental-Amelioration (IGEA) has been involved with about 10 schools, in-Ntonyiri and Igembe-regions, in-nursery-establishment and tree-planting-programs; (ii) Various-schools, both; secondary and primary, have-initiated clubs, like Wildlife-Clubs of Kenya, 4K clubs, and Environmental-clubs, to-promote-conservation of the-environment, in and around-their- schools. There are over 50 schools with such-initiatives, and the-District-Environment-Officer is co-coordinating their- activities; and (iii) University of Eldoret, which is based in the-district, offers a-several-degree-programs in Environmental-studies at Masters' and PhD-level (Burer, 2014).

*Reporting of Performance-Contracting (PC) for Environmental-Sustainability, by public universities:* PC- targets, for Environmental-Sustainability, for Kenyan-Public-Universities, were introduced in-the-2012/2013 financial-year. The-objective of PC is 'to ensure that performance is measured using international best practices and that performance targets are grown to the extent of placing the country on the cutting edge of global competitiveness' (Republic of Kenya, 2014). Tertiary-institutions are required to-submit-quarterly performance-reports to the-government, for the-purposes of monitoring-progress of performance, and for annual-evaluation of performance.

The-performance-criteria consist of seven-broad-areas, each with several-sub-categories. Environmental-sustainability is a-sub-category, within the 'Non-financial category', of the-performance criteria. *Environmental-sustainability-reporting* is done-through the-National-Environment Management Authority (NEMA), which provides guidelines to-universities on-environmental-sustainability-targets in-each annual-cycle. The-Authority also-analyzes the-submitted-reports and gives-feedback to-the reporting institutions and the-Ministry of Devolution and National-Planning. The-universities and other-tertiary- institutions were required to-select four out of eight-environmental-sustainability-targets, for implementation, during the-annual PC-cycles. The-government, through NEMA, prescribed the-activities, for each-focal-area, and the-indicators, for verifying the-degree of achievement, of each-target (Kobia & Mohammed, 2006).

Although a-good-start to-encourage-universities to-embrace sustainability-initiatives, the-proposed indicators were rather-general, but more-importantly, it was *not* clear how incremental-environmental outcomes would-be-achieved.

A-recent-study by Mungai (2017), on 22 *public* universities, in-Kenya, for the-three-years, since the-introduction of PC, revealed that: (i) only 10-16 universities were submitting their-quarterly-reports; (ii) Besides, the-response-rate for submission of quarterly-reports, by the-universities, has-been-declining, from an-average of 60.2% in-2012/2013 to 44.3% in-2014/2015; and (iii) The-last four-targets (see Table 2), including waste-management-initiatives, were-selected by less than 41% of the-public-universities.

Table 2: Choice of targets to-implement (NEMA, 2012; 2013; 2014).

Target	Frequency	%
Planting trees	16	72.7
Environmental policy	14	63.6
Environmental awareness	14	63.6
Working with stakeholders to protect and conserve the environment	10	45.4
Climate change mitigation and adaptation measures	9	40.9
Waste management initiatives	8	36.4
Pollution	5	22.7
Protection of river banks	4	18.2

In-addition, Climate-change-mitigation and adaptation-initiatives involve installation of low-energy consumption-devices, installation of rainwater-harvesting-structures, and installation of alternative-sources of green-energy. The-likely-cost-implications, in-selecting this-target could have-discouraged most- universities. Target on waste-management-initiatives involved adoption of the 7Rs, installation of waste-bins, and segregation of waste, waste-collection, by service-providers, who are licensed by NEMA, and procurement of goods and services, that are environmentally-friendly. Some of the-measures, reported to-have-been-undertaken, included introduction of waste-segregation-bins, handling of electrical and electronic-waste, and reducing and reusing-waste. The-requirement on installation of waste-segregation-bins is in-line-with best-practice, but it needs to-be-supported, by requisite-policy and resource-recovery and recycling-infrastructure, which are underdeveloped, in the-country (Mungai, 2017).

It-is also-clear, that few-universities have a-budget-line for environmental-sustainability-initiatives. Most-universities lack baselines and continuity of initiated-activities. Hence, the-impacts of these-activities are difficult to-assess and report-on. The-level of involvement of students, and other-stakeholders, is weak, in-almost-all-universities. That-study also recommended expansion of the-scope of the-environmental sustainability PC-targets, to-address the-post-2015 global-sustainability-agenda, by aligning them-with the-Sustainable-Development-Goals (Mungai, 2017). Besides, it was also-pointed-out, that the environmental-sustainability PC-targets, have-so-far, being-directed only to-the-public-universities yet, according to Starovoytova *et al.* (2015), Kenya has 14 Chartered-Private-universities and 12 universities with Letter of Interim-Authority (LIA); some of which, are probably undertaking sustainability-initiatives, and hence, should be included in-the-PC-process.

From the-specifics of EE, in-Kenya, it-is revealed, that its-main-efforts are directed towards wildlife-and natural-habitat conservation. This however, is *not* at-all, a-surprise, as Kenya is one of the-top-tourist-destination, in-Africa. The *direct* contribution of Travel & Tourism to GDP was KES 294.6bn (USD 2,847.5mn), 3.7% of total. The *total* contribution of Travel & Tourism to GDP was KES 769.1bn (USD 7,432.9mn), 9.7% of GDP in-2017, and is forecast to-rise by 5.5% in-2018, and to rise by 5.1% pa to KES 1,338.3bn (USD 12,933.6mn), 9.1% of GDP in- 2028. In-2017 Travel & Tourism *directly* supported 429,500 jobs (3.4% of total-employment). This is expected to-rise by 2.8% in-2018 and rise by 2.7% p.a. to 574,000 jobs (3.2% of total-employment), in-2028. Visitor-exports generated KES 194.5bn (USD 1,879.8mn), 18.1% of total-exports in-2017. Travel & Tourism investment in-2017 was KES 84.9bn, 5.7% of total-investment (USD 820.1mn). It should rise by 7.1% in 2018, and rise by 4.4% pa over the next ten-years to KES 139.3bn (USD 1,345.9mn) in-2028, 5.5% of total (WTTC, 2018). In-contrast, SWM is given little, if *any*-attention, in-EE, in-Kenya.

On-the-other-hand, according to the-Kenya-Organization for Environmental-Education (KOE):”both; the-formal and non-formal-sectors, in-Kenya, have-clearly-lacked a-strategy, to-guide the-proper-implementation of EE” (KOE, 2005). The-following-actions/the-way forward have also-been proposed, by the-KOE: (i) Review the-education-policy, with a-view to-strengthening EE, in the-formal curriculum, and in-the-national-examinations; (ii) Involve the-mass-media in-providing environmental- information; Develop an-appropriate-communication- strategy, that includes: radio, TV, documentary-films, newspapers, magazines, and posters, to-disseminate information, emanating from environmental-activities; Produce newsletters and magazines, to-promote networking on EE and training; (iii) Formulate a-national-environmental education-strategy; and (iv) Develop specific environmental-education-curricula for *all levels* of education.

Notwithstanding the-efforts, already made, at the-National-level, the-SWM-situation, at the-MU, should change, dramatically, and this will defiantly require EE, in one-form or the-other. If people have negative-perception, about SW, and it's-disposal, little or *no* attention, will be-given to-it and *vice-versa*.

#### 4.4. Behavioral-change.

People have succeeded, indeed, during the-last 30-40,000 years, in-restructuring many-ecosystems (e.g., through the-use of fire, to-alter assemblages of plants; by the-domestication of animals; and by the-harnessing of various-kinds of energy). But, today, we are operating in a '*no* analogue' unprecedented- state, in-which human-actions have-driven major-planetary support-systems beyond the-bounds, of what is observable in the-paleo-climatic-record (Steffen *et al.*, 2004; Crutzen & Stoermer, 2000; McNeill, 2000), manifesting as Global-warming.

The-contribution, of the-indiscriminate-waste-dumping, massive-littering-habits, open-burning of waste, and unsatisfactory MU-dumpsite, to the-Global-warming, may-be-perceived as negligible and even, inconsequential, but there are many-such-dumpsites and similar-practices, all over the-developing-countries, and their-cumulative-effect could-be rather-significant, therefore the-situation should-be-changed/improved, at every-one of even-presumably insignificant-contributors, to the-Global-warming.

Moreover, to-avoid dramatic-increase in-Global-warming, and impacts of indiscriminate-dumping and littering of waste, our-behaviors should change, starting at *individual*-level, requiring individuals to-develop the-attitudes, which will guide them to environmentally-supportive-behavior (Ahmed & Mohammed Al-Mekhlafi, 2009). Since individuals exist in a-social-ecological-system, changing individual level-behaviors, and creating new-social-norms, collectively, requires creating a-supportive and an-enabling environment, that is, an-environment that is conducive-to and facilitative of change, and removes bottlenecks, that inhibit change at the-household, community, organizational, and policy-levels.

Besides, many-researchers have argued, that the-waste-problem is caused by human-behavior, and therefore, the-solution lies in-changing that behavior (Milea, 2009; Zhu *et al.*, 2008). Formation and change of attitude are interwoven; people are always adopting, modifying, and relinquishing attitudes, to-fit the-ever-changing-needs and interests. Often our-attitudes about the-environment come from information and persuasive-communications/education (Johnston, 2010).

Perceptions and attitudes, towards waste and its-disposal, according-to Njagi *et al.*, 2013; Browne & Allen (2007); Bernstein, 2004; and Kaseva & Mbuligwe, 2003), may be positively-influenced, through awareness-campaigns, and education, on the-negative-impacts of inadequate-waste-collection, with regard to-public-health and the-environment, and also on the-potential-value of waste. Attitude, however, *cannot* be changed by simple-education. Acceptance of *new* attitude depends on who is presenting the-knowledge, how it-is presented, how the-person is perceived, the-credibility of the-communicator, and the-conditions, by which the-knowledge was received. Research has shown that with a-knowledge on a-topic, people may change their-attitudes, but the-step to improved-behaviors and practices is depending on a-complex-set of social and psychological-factors (Desa *et al.*, 2011).

For-example, incentives, both; economic and socio-psychological, can-be incredible-tools, to-help change-behavior, and are considered an-effective-social-intervention, in-developing-countries (see Bolaane, 2006; Mrayyan & Hamdi, 2006; Milea, 2009; O'Connell, 2011). Socio-psychological-incentives are referred-to as incentives that change attitudes and behavior, through disseminating information, persuasion by relating waste-minimization to the-achievement of valued-goals, and making-use of social-pressure, among-others (Milea, 2009; Bolaane, 2006).

The-following-section details on the-approaches to-behavioral-change.

#### 4.5. Approaches to change the-behavior: Communication for Development (C4D).

C4D is a-systematic, planned, and evidence-based-approach, to-promote positive and measurable behavioral and social-change. C4D is an-approach that engages communities and decision-makers at local, national, and regional-levels, in-dialogue toward promoting, developing, and implementing-policies and programs, which enhance the-quality of life, for all. C4D-approaches and tools facilitate-dialogues-between those who-have-rights to-claim, and those who have the-power to-realize these-rights (UNICEF C4D-Position-Paper, 2009).

Figure 3 shows the-communication-approaches that make-up the-C4D-strategy: (1) Behavior change-communication (BCC); (2) Social-mobilization (including strengthening an-enabling-media and communication-environment); (3) Social-change-communication; and (4) Advocacy. These-strategies do-correspond to-specific-levels of the-SEM, where they are most-effective (shown in the-Figure 3, in-the-same background-color). It-is-important to-note that the-different-approaches (right-side-tabs) can apply to levels, other-than the-one, they-are next-to. For-example, the-advocacy-approach can also be-used at the-community or organizational-levels.



Figure 3: The-SEM (left-side), and corresponding C4D Approaches (right-side) (modified from C4D, 2012).

The-following-C4D-approaches are interrelated and interactive, and using them in a-well planned-program produces a-synergistic-effect (C4D, 2009):

*Advocacy* focuses on policy-environment and seeks to-develop or change laws, policies, and administrative-practices; and works-through coalition-building, community-mobilization, and communication of evidence-based-justifications for programs; There are three-common-types of advocacy: (i) *Policy-advocacy*, to-influence policymakers and decision-makers, to-change legislative, social, or infrastructural-elements of the-environment, including the-development of equity-focused programs and corresponding-budget-allocations; (ii) *Community-advocacy*, to-empower-communities to-demand policy, social, or infrastructural-change, in-their environment; and (iii) *Media-advocacy*, to-enlist the-mass-media to-push-policymakers and decision-makers toward changing the-environment;

*Social-Mobilization* focuses on uniting-partners, at the-national and community-levels, for a common-purpose; Emphasizes-collective-efficacy and empowerment, to-create an-enabling-environment; and works-through dialogue, coalition-building, group/organizational-activities;

*Social Change Communication* focuses on enabling groups of individuals, to-engage in a participatory-process to-define their-needs, demand their-rights, and collaborate, to-transform their-social system; Emphasizes public and private-dialogue to-change-behavior, on a-large-scale, including norms and structural-inequalities; and works-through interpersonal-communication, community-dialogue, mass and digital-social-media;

*Behavior Change Communication* focuses on *individual* knowledge, attitudes, motivations, self-efficacy, skills-building, and behavior-change; and works-through interpersonal-communication, mass and digital-social-media. BCC is the-strategic use of communication, to-promote positive-outcomes. BCC is a-theory-based, research-based, interactive-process, to-develop tailored-messages and approaches, using a-variety of population-appropriate communication-channels, to-motivate sustained individual- and community-level-changes in-knowledge, attitudes, and behaviors. Using the-BCC-approach can help to: (i) Stimulate-community-dialogue and raise-awareness about-the-problem; (ii) Increase-knowledge and promote attitude-change, for-example, about the-health and environmental effects of indiscriminate littering and improper waste-disposal; and (iii) Reduce-stigma (Perry, 2012), for-example, around waste-scavengers/pickers; among-others.

*Media* (radios, televisions, newspapers, posters, magazines, etc.), can play an-important-role in-increasing public-participation and awareness, and can-serve as an-instrument for many-socio psychological-incentives. For-example, a-study conducted, in-Cuba (Mosler *et al.*, 2008) found that mass-media-involvement, through the-use of advertisement and campaigns, geared towards recycling and reusing products, was seen as a-useful-incentive, to-public-participation, in waste-management. In particular, posters, leaflets, and handouts, can be-distributed, among the-residents, and also can-be displayed in-visible/prominent positions. The-materials should-use catchy-words and slogans, to-convey their-message. Posters must-be-attractive, with good-photographs, and short-messages, that are readable, from a-distance. Pamphlets and handouts can give

instructions, in very-simple, understandable-language, showing actions, through-photographs and requesting public-participation, and they can-be-circulated, throughout the-community.

Developing a-C4D-strategy, to-influence, or reinforce, social and behavior-change, is a-step- wise-process, that begins-with a-solid-understanding of the-problem, and population of interest, in-order-to-ensure more-efficient-use of resources, and greater-behavior-change-impact. In-addition, particular-emphasis in-preparation for awareness-building-campaigns, should-be given to-the-quality of information, given, and on-the-messenger-choice (according to different-target-audience).

#### 4.6. Quality of information.

Behavioral-change does *not* happen overnight, and requires a-long-term and comprehensive-strategy, which, in-turn requires effective-communication and *quality*-information, to-be-disseminated to the-community, on a-regular-basis. According-to Storey *et al.* (2015): ‘the key issue here is pursuing incremental but meaningful changes in behavior and perception in order to achieve tangible results for waste management’.

Boadi (2016), pointed-out, that the *Pred’s Behavioral-Matrix* is useful, in-examining the-quality and quantity of information, available to-people, regarding SW-disposal, and hence, it will be elaborated upon, further (see Figure 4).

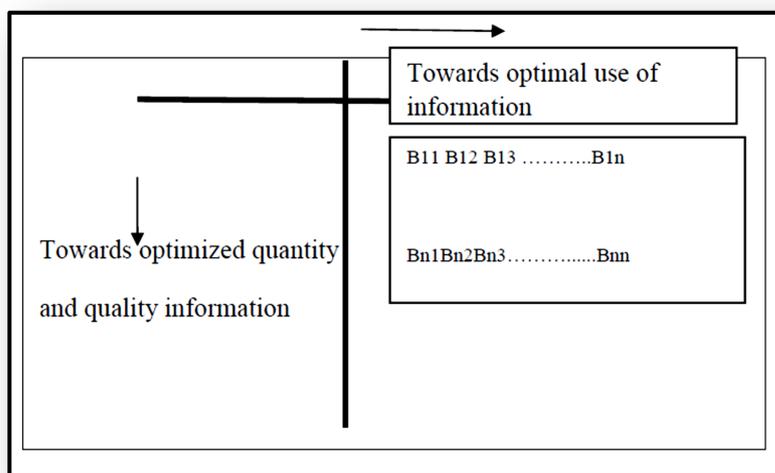


Figure 4: Pred’s Behavioral-Matrix (Pred, 1967).

Pred’s stipulates, that a-decision-making-situation is a-function of the-quantity and quality of information, available in-a-given-environment. That is, the-readiness of residents, to-practice proper-solid waste-disposal depends on the-quantity and quality of information they have, regarding proper-waste disposal. For-example, if residents have poor-quality-information about SW-disposal, such-as wastes are *not* harmful, or dirty-environment *cannot* make them sick, then they will-practice improper-waste-disposal, irrespective of their-educational-level. The-model also explains, that some-residents may-make good-use of the-quality of information, based on the-quality of information they have (Bnn). However, those-residents without quality-information may *not* be able to-make rational-decisions (B11, B 12, B13). On the-other hand, others may *not* have adequate-information, but would-be-able to-make rational-decisions (B1n, B2n), while others may-obtain optimal-information, but make irrational-decisions (Bn1, Bn2, Bn3). According-to Pred, in-between these-groups are a-countless of combinations of decision-makers, based on the-quality and quantity, of information, available to-them.

#### 4.7. Messenger-Choice.

Scientists, environmental, non-governmental organizations (NGOs), and the-media, have dominated Climate-change-communication, in the-past, resulting in a-perception of Global-Warming as a-scientific, (still) highly-uncertain, and controversial-environmental-issue. To-alter that-perception, effective communication should match the-messenger with the-message, and with the-audience. Different-audiences need to-be-addressed, in-audience- specific-ways, which match frame, message-content, and a-language that resonates, with their-specific-information-needs, pre-existing-knowledge, and concerns. ‘People like us’ (or PLUs) are important for an-audience’s personal-comfort, identity, and group-internal-norms and cohesion. Often, PLUs (especially if we know and trust them personally) have greater-credibility and legitimacy, than someone, who does *not* know an-audience’s circumstances as-well (The-encyclopedia of Earth, 2008).

For-example, for majority of the-42-communities/tribes, in-Kenya, *traditional knowledge* is inseparable from their-ways of life, and their-environment, natural-resources, cultural-values, spiritual- beliefs, and customary-legal-systems (Dei, 2002). The-Indigenous-knowledge is handed-down from-one generation to-another, through: symbols, art, oral-narratives, proverbs, and performance, such-as songs, storytelling, wise-sayings, riddles, and dances (Turay, 2002; Dei, 2002; Semali, 1999). In-most rural, arid, and semi-arid-parts of Kenya, especially in-communities, where formal-education has-had insignificant- impact, oral-art remains the-most-important-means, of transmitting knowledge and skills, as a-way of maintaining societal-continuity, from one-generation to-the-next.

To-reach different-audiences (for-example students or vendors), it-is important to-carefully-select the-messenger. As-such, at the-level of communities, what has-been-termed the '*symbo-type*' replaces the-genotype, as the-carrier of information to the-next-generation (Wilson *et al.*, 2013; Costanza, 2013). Symbo-types are occurring at-multiple-levels of organization, from the-specific-rules and norms, to the-basic 'world views', which guide the-behavior of entire-cultures. Selection, likewise, occurs, at-multiple-levels, both; within-levels and between-levels.

#### 4.8. Final-remarks.

From the-research-findings, it-is revealed, that there is a-need to-increase public-sensitivity to-the Environment, to-foster a-sense of personal-environmental-responsibility, greater-motivation and commitment, towards sustainable-environment and development.

SWM-interventions are more-likely to-be-successful, when they target multiple-components of the-SEM. According-to Schultz & Zelezny (2000), a-combination of socio-psychological and economic- incentives, along-with educational-awareness-campaigns, and increased-community-involvement, may just be the-winning-combination, for success, in-many developing-countries. People' awareness, about environmental-problems and solutions, can be-increased, through EE (Maddox *et al.*, 2011; Ballantyne *et al.*, 2006). EE, therefore, should be-incorporated, in-every-level of formal-education, in-Kenya, starting from early-childhood. For-example, Salhofer & Isaac (2002), recommended to-communicate the-information, to-young-children *via* paintings of cartoons, and story-telling. In-the-university, it-is-expected, that SWM-activities, involve the-students, as-part of their-learning-process *via* EE and interactive-sustainability trainings (Kelly *et al.*, 2006; GfK, 2011). The-particular-skills and knowledge, gained from EE, would help in-changing human-behavior, towards WM and the-environment, at large. Other-strategies, hence, should include: community-education, support-groups, awareness-programs, workplace-incentives, to participation in-proper-waste-disposal.

In-addition, awareness-building-measures, as-noted by Johansson (2006) and Bowersox *et al.* (2005), should be-coordinated with improvements in-waste-collection-services. For-example, the-SEM, is of the-view, that strategies, focusing on the-physical-environment e.g., sufficient-number of waste-bins are put in-place, before education or community-awareness-initiatives should be done first. For-example, campaigns, which encourage people to-exhibit-proper waste-disposal-behavior, will *not* be-effective, in-communities, where there are *no* waste-receptacles/bins (C4D, 2012; Sallis *et al.*, 1998). Besides, Thrift (2007), however, suggests, that such-campaigns should-inform people of their-responsibilities, as waste generators, and of their-rights, as citizens, to WM-services.

### 5. Conclusion and Recommendations.

In-summary, the-study revealed, that both; students and vendors: (i) have-recognized SWM as a-major problem, at-the-campus; (ii) perceived the-campus as-dirty and very-dirty; (iii) *do not* currently pay for WM-services rendered, to-them, but would-be willing to-pay, only for drastically-improved SWM-services; (iv) demonstrated relatively-good-level of awareness of health and environmental-effects of improper-waste disposal-behaviors; (v) do recycle few-materials, at a-limited-extend; majority of recyclers are females (vii) exhibit '*knowing-doing-gap*', which is the-gap, between knowledge and practices, on household-wastes. The-respondents also-approximated, that they generate from 0.14 to 1.4 kg/day/per-student, and 1.7 kg/day/ per-vendor, on-average, which is comparable with estimations for waste-generation-rates in-sub-Saharan Africa. It-is also-evident, that their-knowledge, attitudes, and practices, need to-be-improved, requiring significant and sustained-behavioral-change, which can be achieved by Environmental-Education.

It-is only logical, that the-authors, of this-paper, representing all-stakeholders in-SWM, see the-campus, in-the-very-near-future, as spotless, with effective, and sustainable-SWM-practices. Predicting the-future, accurately and precisely, however, is easier said than done, due to-complex-network of numerous-uncertainties. According to Costanza (2013), it-is even impossible to-predict the-future; but we can-help-guide and model, the-evolutionary-process, to-create the-future we want.

In-this-regard, the-study proposes/recommends:

- 1) EE should be incorporated in-every-level of formal-education, in-Kenya, starting from early- childhood;

- 2) The-Chartered-private-universities and universities, with Letter of Interim-Authority (LIA), should be included in-the-Reporting of Performance-Contracting (PC) for Environmental-Sustainability, by the-Kenyan-universities;
- 3) To-develop awareness-campaigns, for the-active-sensitization of campus-residents/communities on negative-impacts of indiscriminate-waste-disposal, on public-health, and on the-Environment, and on the-benefits, of SWM, as an-alternative source of livelihood. Design of the-message (quality, and level of difficulty of information; and language, in-which the-message will-be delivered), as-well-as the-selection of a-messenger, for different-target-groups, should be considered;
- 4) A-system of payment, of SWM-service-charges, should be-developed by the-MU, and waste collection and disposal-fee should be included into fee-structure, for students, as they will have more-rights to-demand for effective-WM. Vendors, on-the-other-hand, should outsource WM-services for a-negotiated-fee;
- 5) To-introduce some-competitions, for-example for the-cleanest-hostel, or the-cleanest floor/level, in a-multi-storey-hostel, etc.; and
- 6) Further-studies on Characterization and Quantification of the-solid-waste, at the-campus.

The-study-findings may add insight on the-relevance of EE in-SWM, by highlighting ways of how EE can-be-used to-facilitate proper-SWM. The-findings might also-help in-providing-information, that is of practical-value, to-policy-makers and planners, such-as NEMA, Kenya, which is beyond the-university boundaries. The-findings are also potentially-helpful to the-local-community, as it may highlight the-need, for the-local-community, to-get involved in-SWM. It-is also-hoped that results of this-survey will be helpful in-leading to-greater-levels of public-engagement in-SWM, through campaigns to-create-awareness, in a-scientific-manner, among the-campus-residents, to-foster a-sense of personal-environmental responsibility, and greater-motivation and commitment, towards sustainable-development, which is very- much needed, for making the-campus-clean, green, and sustainable.

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