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Consumer-Perception on Polyethylene-Shopping-Bags

Diana Starovoytova Madara*   Saul Sitati Namango   Charles Wetaka
School of Engineering, Moi University P. O. Box 3900, Eldoret, Kenya

Abstract

This-study is a part of a larger-research on potential-environment-friendly-alternatives to polyethylene shopping-bags. At a general-level, the whole-research can be regarded as an explanatory-case-study of social-perception on plastic-menace-problem in Rift Valley Province, Kenya. The-survey was mainly aimed at understanding consumers' perceptions on plastic-bags, through consumption-habits, the degree of awareness of environmental-impacts and the willingness to reduce their-consumption. In order to most-accurately reflect the social-perceptions of the Kenyan-population, regarding single-use-plastic-bags consumption, a questionnaire was selected as the most-suitable-method, which was pre-tested to ensure its validity and reliability. A cross-stratification-technique was used, to determine the subject-sample-size of 384 respondents from three-towns, in total. Discrete-Choice-Experiment-technique, which originated from mathematical-psychology for investigating individual-preferences, was employed. The data-analysis was conducted using Epi-Info 7 (version 3.5.1), Minitab, and, Microsoft Excel, software. The Statistical-Package for Social-Sciences (SPPS-17, version 22)-computer software-program was used to compute the Cronbach's alpha co-efficient. To check, whether there is an association between the variables, cross-tabulations was performed, while Chi-squared-test was used to test significance of the relationships. Cronbach's-alpha-test of internal-consistency was performed and demonstrated high inter-item-consistency (Cronbach's $a > 0.9$). The survey-results indicated that regardless of sex, educational-level, age-group and occupation, majority (80%) of the towns'-populace widely-used plastic-bags on a daily-basis in their-life-activities. Cheapness or free-distribution of these-bags, by retailers or supermarket-owners, are believed to be the main-reasons for the widespread-usage of polyethylene-single-use-shopping-bags, and, for the associated with their-disposal, problems. To combat these-problems, **p**lastic Waste Management initiatives were highlighted, in conjunction with relevant-recommendations. The findings and recommendations of this-study will, expectantly, contribute (in its small-way) resolving the environmental- problems, associated with plastic-bags and their-disposal. This-research may also be valuable for Government-authorities, non-profit organizations, private-bodies or individuals, in order to develop adequate-and tailored-strategies and take actions, according to the actual-consumer-attitudes and perceptions.

Keywords: polyethylene, shopping, bags, perception.

1. Introduction

1.1. Plastic bag: Background, reasons for popularity and ever-increasing-growth in consumption.

Before plastic-bags were created, the most-common-way of carrying groceries home was with paper-bags or carton-boxes. Plastic-shopping-bag (PSB) was originally-designed and made from plastic, by Swedish-Engineer Gustaf Thulin in 1960s (Petru, 2014). The design was patented, internationally in 1965 by Celloplast (well-established-company in plastics-processing), giving them virtual-monopoly on PSB and associated-materials-production. The company set up several-manufacturing-plants across Europe and in the USA (Cherrier, 2006). From the mid-1980s onwards, plastic-bags became widespread for carrying groceries from the shop to vehicles and to homes, throughout the world, step-by-step replacing the custom of using paper-bags (Aadland, 2006). Ultimately, plastic-bags have emerged, as one of the most-successful-consumer-products worldwide; they are characterized to be: functional, relatively-strong, cheap to manufacture, lightweight, small in volume, hygienic-way of transporting goods, versatile, convenient, and effortlessly-disposable (Australian DoE, 2008; UNEP, 2004).

Between 2007 and 2012, the world-population grew roughly 7% (World Bank, 2015), while the plastic products-market had an extraordinary-increase of 165%, during the same-period (EuroMonitor International, 2013). It was estimated, that 100 billion to 1 trillion plastic-bags are produced worldwide per-year (Spokas, 2007), while the average-family uses 400 plastic-bags per-year (USEPA, 2006). Worldwide, humanity is using plastic-shopping-bags a rate of 1 million bags every-minute (Cherrier *et al.,* 2006).

The terms single-use-bags or disposable-carrier-bags are defined by Zero Waste Scotland (2014) as "all-carrier-bags that are supplied with the intention that they are to be used *once*, as paraphernalia for transportation of shopping-goods from the point of sale" (Barnes, 2014). The fundamental-problem with plastic-bag is, that the bags, used by most-consumers, are designed for single-use (NEMA News, 2007; EPHC, 2002), and "after the bag has served its original-purpose (transportation of shopping-goods), consumers view the bags as undesirable- items" (Pro Europe, 2010).

A PSB is a polymer-carry-bag, provided or utilized at the retail-point of sale, for carrying and transporting retail-goods; this includes all single-use plastic-retail-bags, but excludes produce-bags used in-store,

dry-cleaning-bags, garbage-bags and other-primary product-packaging.

Plastic-bags can be either degradable or non-degradable. Degradable-plastics are often grouped into: biodegradable, photo/oxo-degradable, and compostable-plastics. *Biodegradable-polymers* are capable of undergoing decomposition into carbon dioxide, methane, water, inorganic-compounds or biomass by the actions of microorganisms**.** *The oxo-degradable plastic-bags* are not biodegradable, but are designed to break-down into small-pieces, after exposure to oxygen. Compostable-plastics, as materials, undergo degradation by biological-processes, during-composting, to yield carbon-dioxide, water, inorganic compounds, and biomass, at a rate consistent with other-known-compostable-materials and that leave no-visible-distinguishable or toxic-residue (CIWMB, 2007).

Non-degradable plastic-bags are made from polyethylene, derived from non-renewable natural-gas and petroleum. Polyethylene-High Density, Low Density, linear low-density-polyethylene (LLDPE) are the raw-materials widely used for the manufacture of plastic-bags (Lajeunesse, 2004). The shopping-bags used by supermarkets are ideally produced out of LLDPE. Since it is more-expensive and complex to recycle than to produce, given the fact that there are thousands of different-varieties of plastics, it is a more-complex-process to recycle these than other-materials, such as paper, glass or aluminum. Besides, for the plastics to be recycled, these have to be collected, sorted by type (every type of plastic is assigned a code), cleaned, processed and delivered to a manufacturer, that will convert them into another-product (Blumenfeld, 2015; Eureka Recycling, 2009). One of the main-problems of polyethylene is that without special-treatment it is not readily-biodegradable, and thus, it is accumulates on disposal.

Ninety-nine percent of carrier-bags used around the world, follow the cradle to grave cycle (Cliver, 2006). This use-pattern means that, plastic-carrier-bags, like most-other-consumer-goods, finish their very-short-lives, discarded in landfills (NEMA, 2005). Plastic-bags are indiscriminately-dumped into millions of landfills worldwide, which occupy trillions of hectors of lands and emit dangerous-methane and carbon-dioxide-gases, during their-decomposing-stages, as well as highly-toxic-leachates from these-landfills (Simmons, 2005).

The disposal-methods of plastic-bags pose serious-environmental-challenges, due to their non-biodegradable characteristics. Plastic-bags, as mentioned-earlier, do not *biodegrade*; they photo/oxo-degrade, meaning they breakdown into small-toxic-fragments due to UV-light, physical-abrasion (Barnes *et al,* 2009; Rich, 2008), wind or water. Bags disintegrate or erode, to the point, where there is "plastic-dust" or minute-pieces of plastic, that are left in the environment, which are known to take up to 1,000 years to photo-degrade into toxic-micro-particles, which leach into the soil and water-streams (Jacobsen, 2015; UNEP, 2005; PNSW, 2004;Williams 2004; Stevens, 2001). Plastic-bags take much-longer to break-down in water, than on land, thus compounding impacts from a plastic bag's persistence over-time (EPHC, 2007). This persistence of plastic-bags in the environment leads to increased manifestation of plastics-pollution.

1. 2. Environmental-impacts of plastic-bags

Plastic-pollution is a pervasive-global-environmental-threat. More than forty-years of records show that there is plastic-debris in ocean-samples, from the poles to the equator (Thompson *et al.,* 2004). Results from these-samples have demonstrated, that there was approximately three-times more-plastic in the water-column in the 1990s, compared with the 1960s, which is a significant-increase (Owen, 2004; Thompson *et al.,* 2004).

Environmental-impacts of plastic-bags can be ordered into three-groups: (1) aesthetic-disturbance, (2) ecological-impacts, and (3) socio-economic impacts.

(1) The negative *aesthetic impacts* are caused by the visibility of plastic-bags and the high-numbers of bags littered. Plastic-bags are disposed of, into the environment, by two-methods: *deliberate* and *inadvertent littering* (EPHC, 2007; ACG, 2006; Nolan ITU, 2002). Deliberate-littering can be everywhere: in the city, parks, beaches, roads, and in the open-spaces (Cherrier, 2006). The most accountable-agent that aid in inadvertent-littering is wind; because their-low-weight and fragility, plastic-bag-litter discarded in the environment, creating aesthetic-disturbance. Research has demonstrated that " the thickness and weight of a plastic-bag does not impact on the ease with which it may become litter, if placed in a waste-container and dispersed by the wind" (Verghese, 2006). Even when placed in a trash-can, these "urban tumbleweeds" can become airborne, during the collection and disposal-process. Once they enter into environment, plastic-bags can be carried by wind to distant-places, due to their lightness in weight, and can create serious-damages in large-urbanized-areas of the world (Macur &Pudlowski, 2009; Flores, 2008; Seema, 2008). In fact, plastic-bags are commonly referred to, by South-African-citizens, as the "*national flower*", due to the frequency with which these wind-blown-nuisances are seen scattered about and entangled in branches of trees and bushes (Williamson, 2003). As an illustrative-example, in the Cape Town, South Africa there were more than 3000 plastic-grocery-bags, at a certain-time, that covered each-kilometer of road (Ryan & Rice, 1996), which makes the environment very-ugly. Moreover, plastic-bags that exist as litter and pollution, can be seen as emblematic of our "throw-away", and "wasteful" society. PSBs also have become a politically-incorrect-symbol of the threat to the environment (PBWG, 2002).

(2) The majority of *ecological impacts* of plastic-bags are a result of the effects from PSB as litter and

pollution; plastic-pollution is having serious-implications on: human-health, agriculture, livestock, marine-environment, and overall-ecosystem-functioning.

The most destructive by-product of plastic-carrier-bag-litter, when incinerated, is the emission of "*dioxins*" and "*furans*", which are persistent-organic-pollutants (POPs) in the environment (Beychok, 1987); this in essence, is their-indirect-contribution to air-pollution: (1) as open-air-burning of Municipal Solid Waste is a common-practice and (2) as plastics (predominantly, bags) appear in excessively high-proportions in the waste-stream. The health-impacts include cancer and acting as "endocrine-disruptors" that affects the reproductive-system of human and other-living-organisms (NEEMA news, 2005; Spivey, 2003). On the other-hand, plastic-bags and the-printing-inks for bag-graphics are composed of toxic-chemicals, linked to changing hormone-levels in animals. In humans and other-animals, these irregular-hormones may be passed from the mother to child, via the womb and breast-milk and also stored in body-fat-tissue, which can lead to damage to nervous and immune-systems (Ritch *et al.,* 2009). In addition, scientists have been creating a vast-variety of artificial-materials and chemical-substances, which do not have natural-analogies. For this-reason it is especially-difficult to make predictions about the degradation-effects and the influence these-substances will have on aquatic or terrestrial-ecosystems.

Plastic-bags are also used for the storage of solid-wastes, generated within households, including human-excreta "*flying toilets*" (Tekola, 2006; Boadi & Kuitunen, 2005). Previous-publications (Starovoytova, 2012; WHO, 2010; Njeru, 2006; Cointreau, 2006; Tekola, 2006; ELCI, 2005) demonstrating that in several-cities and towns of developing (low-income) countries, human-fecal-matters often placed in plastic-bags and thrown to the surrounding-open-areas or, even, on the roof of the near-by house. This could be attributed to lack of adequate toilet-facilities. Similar-practices are also experienced in low-income areas of Rift Valley province. According to Legesse& Diriba (2011), a sanitary-survey of residential-areas showed that the living-yards of the households were seriously-contaminated with helminthes *Ascaris lumbricoides ova,* with prevalence of 41.5%, indicating ill-impact of plastic-bag-wastes on human-health.

As the plastic-bag is non-biodegradable and almost non-compostable (Stevens, 2001), it stays in the soil for an excessively-long-period of time, blocks, as well retards, the growth of agricultural-plants, thereby causing unimaginable-harms to the agricultural-sector. The agricultural-crops cannot grow, where the plastic-bags stay, because their-roots fail to pierce the bags, in order to move around the soil for natural-nutrients (despite the fact that the bags are very thin). The most-significant-negative-impacts of the plastic-bags on agriculture are: reduction in soil-fertility, decrease in nitrogen-fixation, huge-loss of nutrients in the soil, decrease in crop-harvest, and disparity in flora and fauna on soil, among others (Though, 2007). If plastic-bags get into agricultural-fields, they reduce percolation of water and proper-aeration in soil. This results in reduction of overall-productivities of such-fields (Njeru, 2006).

Livestock have been known to consume plastic-bags, causing illness and fatalities. Reports by Ramaswamy & Sharman (2011), showed the recovery of large-quantity of plastic-products, particularly PSBs, from domestic-animals, after they consumed plastic-bags and became sick. If not treated-timely, this could lead to the death of animals and economic-loss to their-owners, as it has been observed in many-developing-countries of Africa and India (Edwards, 2000). Moreover, ingestion of plastic-bags (along with other-foreign-bodies) by livestock was reported to cause reduction in milk-yield (Ramaswamy& Sharman, 2011).

According to the nonprofit Center for Marine Conservation, plastic-bags are among the top 12 types of trash found most-often in coastal-cleanup; and marine-mammals, sea-birds, and sea-turtles become entangled in the bags. Plastic-marine-debris affects at least 267 species worldwide, including 86% of all sea-turtle-species, 44% of all sea-bird-species, and 43% of marine-mammal-species (UNEP, 2005). Sea-turtles, for example, mistaking plastic-bags for food such as jellyfish, can die from starvation, due to intestinal-blockage (UNEP, 2005; Thiel *et al,* 2003; Spivey, 2003). Entanglement inhibiting movement and normal-behavior, on the other-hand, can lead to suffocation, starvation, drowning, increased vulnerability to predators, or other-injury. Plastic-debris can constrict an entangled animal's-movement, which results in exhaustion or development of an infection, from deep-wounds, caused by tightening-material (Thiel *et al,* 2003). This also reduces the ability of animals to hunt, feed, reproduce, and breathe, potentially leading to death. Furthermore, after the effected-animal dies, the plastic-bag (or marine-debris) is often freed, and able to entangle or be ingested by another-animal (EPHC, 2007), and the vicious-cycle continues.

(3) The *socio-economic implications* from the environmental-impacts of PSB are associated to the direct-damage caused by littered-plastic-bags. These are the impacts from floods, caused by blocked-drains and sewers, negative-impacts on tourism, and the damage to property and infrastructure, caused by plastic-bags-letter.

Damage to property and infrastructure is as large as flooding; littered PSBs are also identified as a threat to tourism, through both the environmental-effects of plastic-bags (such as the loss of biodiversity and damage to local-environmental-features) and the negative-aesthetic-impacts of littered PSBs. Plastic-bags in the environment are often washed into waterways. They can clog gutters and storm-drains, causing water and sewage to overflow; for instance, the 2005 Mumbai flooding-incidence, that killed over 1000 people and at least

1000 animals and livestock, was attributed to plastic-bags clogged the city's storm-drains and prevented the monsoon-rains from leaving the city (Smith, 2009). On the-other-hand, when plastic-bag-litter filled with rainwater, it creates foul-smells and favorable-habitats and a breeding-ground for pathogenic-viruses, bacteria, as well as vectors, such as mosquitoes and other-insects (KIPPRA, 2006), that could spread a large-number of diseases, such as encephalitis, dengue-fever and malaria, among others (Ellis *et al.,* 2005).

Littered-bags can also damage cars, as demonstrated during the V8 Supercar 2002 "Bathurst 100" race. Two-drivers were forced to stop, when plastic-bags blocked cooling-mechanisms, overheating the cars. The impact of littered plastic-bags on tourism was also noted; for example, in Ireland, and as a result the government introduced a tax of €0.15 on plastic-bags, commonly known as the "PlasTax". Factors leading to intervention in these-countries were: the large-number of bags, that are littered, each day to accumulate in trees, hedges, fences, and drains around urban and rural-areas, creating aesthetic and potential-economic disturbance to tourism. Plastic-bags are also problematic to the livelihoods of local-people and national-governments, both in terms of the loss of agricultural-potentials and negative-impacts on the tourism-industry, in addition to the high-cost of cleaning-up-process, which falls on the local and national-governments (Ellis *et al,* 2005).

In another-category of environmental-problems is depletion of non-renewable-resources, as present-day-bags are made of mineral-products, such as petroleum. Plastic-bags are manufactured with fossil-fuel which emits toxic-gas, which has become detrimental to the various-life-forms in the planet (Lajeunesse, 2004; ILEA, 1990). Overall, both developed and developing-countries can be regarded as to be dominated by a "throwaway-society", were the norm is to produce short-lived-products, in order to keep producing more and more. Natural-resources are relentlessly-exploited in order to satisfy the society's demand for use-and-toss products, where reusing and recycling-practices is, apparently, not a priority.

1.4. Legislative intervantions
In 2009, Achim Steiner, UN Under-Secretary-General and UNEP Executive Director suggested that, "…single-use plastic-bags should be banned, or phased-out rapidly, everywhere; there is simply zero-justification for manufacturing them anymore, anywhere" (UNEP/COBSEA, 2009).

1.5. Research purpose and significance
The utilization of plastic-carrier-bags by consumers is a form of social-change. Because plastic-bags are cheap, there is excessive-consumption and a tendency of mishandling. An article by Billy Kahora "*A plague of plastic*" (EcoForum, 2005), describes massive-volumes of plastic-bag-waste characterizing the capital of Kenya, Nairobi. According to this-article, the problem in the-city, is only an indication of what, has become a challenging-national-problem. It portrays a situation, in which all the major-roads, out of Nairobi, as being "lined with more-plastic, than grass" and all-major-urban-areas in the country covered "knee-deep in plastic". In urban-centers of Kenya, an individual-shopper uses about 3 new-plastic-bags per-day, because they are "given free". While it is "free" to the customer, the cost of plastic-bag is passed on to the consumer in the form of "consumption-cost" by the retailers and other-supermarkets (UNEP, 2005). It is estimated that in the capital of Kenya, Nairobi, alone, the release-level of plastic-bags is over 11 million plastic-carrier-bags per year, with supermarkets contributing 73% (Bahri, 2005). There is also an inadequate collection of waste, with only around 55% coverage (NEMA News, 2005); the uncollected-waste, including plastic-waste, is burnt, buried or dumped-haphazardly in unfit-places. These-disposal-methods have serious and long-term-consequences on the environment (highlighted above).

Development of a superior-alternative, to currently-wide-spread polyethylene-shopping-bag, a biodegradable-shopping-bag, for the Kenyan-market, will contribute in helping to fulfill the Sustainable-Development-Goals (SDGs) #11, and #15 (Osborn, 2015). For SDG 11, Target 11.6, the biodegradable-bags will make Kenya's cities more-conducive for settlement, through preventing waste build-up and the regular, and sometimes, devastating-floods, caused by plastic-bags, which clog the drainage-channels. On SDG 14, Target 14.2, the biodegradable-bags will prevent the accumulation of plastics in the oceans, consequently, the marine and coastal-ecosystems will be less-tampered and environmentally-sustainable.

Considering the large-scale damaging-effect of plastic-bags, many-countries, all over the world, have already prohibited the production and use of plastic-bags, by enacting parliamentary-legislations. However, the implementation of this-complete-ban on the use of plastic-bags has not been successful in Kenya, due to inadequate-research and unavailability of suitable-substitutes for the polyethylene plastic-bags. According to UNEP (2005), there are no satisfactory and affordable-alternatives to plastic-shopping-bags in Kenya, except for some-paper-bags. Although shopping-bags made of natural-fibers are present in the market, their use is limited, because of the accessibility of plastic-shopping-bags and their low-cost or "no-cost" to the consumer.

There are many-studies that have investigated the environmental-impacts of various shopping-bags, including plastic and paper-bags, however there has been a lack of research-articles published on the subject of public-perception towards shopping-bags; the only-article-published so far (the authors came across with) on

consumer-perception of shopping-bags written on the basis of the attributes of shopping-bags, is restricted to plastic and paper-bags by Prendergast *et al*, (2001).

Failure to integrate economic, social and environmental-policies and objectives, can result in a country's weakening-progress on poverty-reduction, increasing discrimination and, consequently, damaging the environment. Since more-than-half of the world's population now lives in cities, with a projected-share that will rise to 70% in 2050 (Loewe & Rippin, 2015), the perception of city-dwellers in Kenya is very-crucial for effective-management of the problem of plastic-bags. Studies considering consumers' perceptions and usage of shopping-bags in connection with respective-government's policies and implementation often show that the involvement of the public's point of view avails a more-positive-likelihood of success as opposed to a blanket-ban on plastic-shopping-bags (Muthu, 2012; Gupta, 2011).

Consumers'-perceptions and usage-behaviors in connection with respective-government's-policies and implementation of recycling-systems could be highly-influential in reducing the eco-impact of PSBs. This-survey, therefore, was mainly aimed at understanding consumers' perceptions of plastic-bags, through consumption-habits, the degree of awareness of environmental-impacts and the willingness to reduce their consumption.

Building up public-awareness and motivation to reduce, reuse and recycle these-bags will undeniably help to resolve the environmental-problems to a greater-magnitude. This-research may be also valuable for Government-authorities, non-profit-organizations, private-bodies or individuals, in order to develop adequate-strategies and take actions according to the actual-consumer-attitudes and opinions.

2. Materials and methods.

At a general-level, the whole-research can be regarded as a case-study of the social-perception on plastic-menace-problem in Rift Valley Province, Kenya.

According to Yi (2010), a case-study is "an empirical-inquiry that investigates a contemporary-phenomenon, within its real-life context, especially when the boundaries between phenomenon and context are not clearly-evident". The advantages of case-studies have been discussed by a number of authors; some 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, or risk the possibility that problems will occur during the project. Since this-research attempts to establish underlying-chains in perceptions of the general-public, on the single-use-plastic-bags, along with possible-solutions on reduction of their-consumption; the type of case-study could be labeled as *explanatory*.

The study was superfically-divided into 3 sequential-parts, which shown in Figure 1.

Figure1: Sequential-parts of the study (Starovoytova &Namango, 2016).

Both, electronic and printed-materials have been used. In particular, different-studies, publications, and workshop-reports, on the issue of international and local-problems of plastic-bag-waste and other-relevant-issues, were critically-studied. This-research is essentially meant to contribute to the ongoing-endeavors in Africa, and

in Kenya in particular, to bring about a pattern of sustainable consumption and production of SBs, which are more-environment-friendly.

2.1. Main study-instrument, the questioner

Previous-researchers have recommended questionnaire as a very-effective-instrument, which has the ability to collect a large-amount of information in a reasonably-quick-span of time. In order to reflect, the most-accurately-possible, social-perceptions of the Kenyan-population regarding single-use plastic consumption, a questionnaire was selected as the most-suitable-method. The study implemented a style of projective-technique, by asking questionnaire-respondents questions about plastic-shopping-bags and associated-issues.

Discrete-Choice-Experiment-technique, which originated from mathematical-psychology for investigating individual-preferences, was employed (Proefschrift & de Bekker-Grob, 2009), since it helps to simulate the preferences of individuals, through market-based-choices. Respondents were presented with a series of hypothetical-questions to obtain choice-based-responses, rather than opinions. These-questions were developed as a modification from the similar-studies conducted in Asia (Li *et al,* 2010), Township of Esquimalt (Guenter, 2011), Kingdom of Bahrain (Dutta, 2015), Larkana (Afzal, 2012), Himachal Pradesh (Kanwar, 2007), and Thailand (Sanglimsuwan, 2012).

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. This-research complies with the ISO 20252:2006 (E) Market, Opinion and Social-Research Standard; hence a preliminary-study was conducted at Moi University, main-campus, using an initial-version-questionnaire for determining current-consumer-perception on PSBs with 25 objective-questions. 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.

According to Kombo &Tromp (2006), the researcher must maintain privacy and confidentiality of the respondent at all-times, therefore, in the questioner, the introductory-instructions stated that respondents would remain anonymous, participation was strictly-voluntary and that the respondents were guaranteed confidentiality. To ensure credibility, a principle of qualitative-inquiry for ascertaining that the analysis and findings are legitimate was used, according to Lincoln & Guba (1985).

The data-analysis was conducted using Epi-Info 7 (version 3.5.1), Minitab, and, Microsoft Excel, software. *Epi Info* is public-domain statistical-software; it includes t-tests, ANOVA, non parametric-statistics, cross-tabulations and stratification, with estimates of odds-ratios, risk-ratios, and risk-differences, logistic-regression (conditional and unconditional), survival-analysis (Kaplan Meier and Cox proportional-hazard), and analysis of complex-survey-data. Software-validation and post data-entry checks were conducted to ensure data-integrity, before analysis. A descriptive-analysis was performed to produce graphs, tables and frequency-counts. Results were also presented with category-breakdown graphs.

2.2. Methods for Data Analysis

The questioner was pre-tested to ensure its 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, 2009). *Validity* indicates the degree to which an instrument measures what it is supposed to measure. For a data collection instrument to be considered valid, content selected and included in the questionnaire must be relevant to the need or gap-established (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 tool or consistency the procedure demonstrates. The data-collection-instrument was subjected to statistical-analysis to determine its 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, 2009), and it is useful for the item-specific-variance in a unidirectional-test (Cortina, 1993). The Statistical Package for Social Sciences (SPPS-17, version 22)-computer software-program was used to compute the Cronbach's alpha co-efficient. Descriptive-statistics was used to analyze both qualitative and quantitative data.

2.3. Study area and sample- size of the research

Figure 2 shows the study-area. The study focused on Nakuru, Eldoret and Kitale towns of the Rift Valley Province in Kenya, since most of the shopping-bag-consumers are in towns (Loewe & Rippin, 2015).
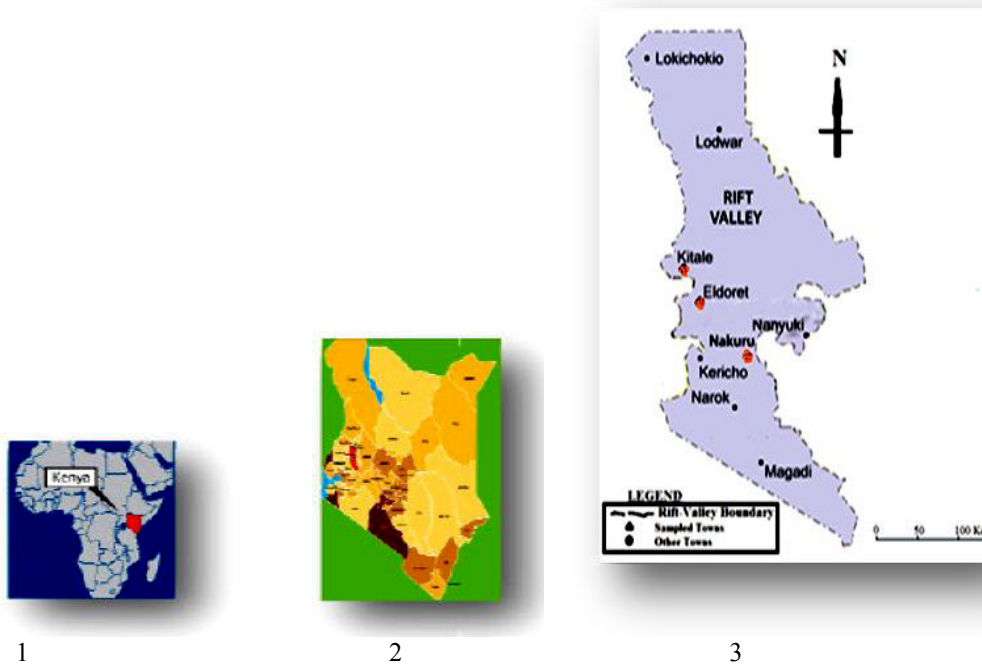
Key: 1- Position of Kenya in African-continent (in red); 2- Position of Uasin Gishu County in Kenya (in red); 3- Position of three-subject-towns in Uasin Gishu Province (in red);

Figure2: Study-area (*mapsworld.com*)

According to Kothari (2004), a cross-stratification-technique was used, when determining the sample-size, because of its-reliability in opinion-surveys. Each of the towns was stratified, based on a sampling-frame of drivers, shoe-shiners, market-shoppers/vendors, students, law-enforcers and general-populace. Based on the Kenya latest-census of 2009, the Rift-Valley-province had a population of 10,006,805 people, with Nakuru-town, Eldoret-town and Kitale-town had a population of 307,990 people; 289,380 people; and 106,187 people respectively (World Bank, 2015). This gives a total-target-population of 703,557 people from the three-major-towns.

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 selected, giving sample size of 384 respondents.

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

Distribution of the respondents, in each of the subject-towns, based on cross-stratification, was determined via following formula; the summary of distribution is presented in Table 2.

$$\text{Town sample} = \frac{town\ population}{total\ population\ of\ the\ towns} \times total\ sample\ size$$

Table 2: Summary of sample size distribution

Town	Population	Sample size	Percentage
Nakuru	307,900	168	43.75%
Eldoret	289,380	158	41.15%
Kitale	106,187	58	15.1%
Total	**703,557**	**384**	**100%**

3. Results

3.1. Validation of the instrument

According to ISO 20252:2006(E) (Market, opinion and social research-Vocabulary and service requirements), 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 key stakeholders, at Moi University-main campus, was conducted. The respondents were randomly-selected, from a sampling-frame of undergraduate/graduate students, teaching/non-teaching-staff and community, within the university. In order to obtain a representative-sample, at least four-respondents were selected, from each of the elements in the sampling-frame, without replacement; the response-rate of 93% was obtained. From the validation (so-called "pre-testing") it was found, that the instrument had sufficient-information, which would answer all-the-research-questions. The instrument was found adequate-enough; the length of the entire-instrument was found appropriate and the content was logically-organized. The general-recommendation made, is that the instrument was acceptable with very-minor-editing. Results from the preliminary-study were then used as a basis for developing the final-questionnaire, which was used in the survey of the subject-study- area.

The final-questionnaire consisted of 25 questions, out of which the first-seven questions were on demographic-nature of the respondents. The study targeted a sample-size of 384 respondents; and achieved a response-rate of 100% (as respondents were offered a small-reward in exchange to fully-completed-questioner). This response-rate was judged as excellent and representative, and also conforms to Mugenda & Mugenda (1999) 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". 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). Cronbach's-alpha-test of internal-consistency was performed, demonstrating high inter-item-consistency (Cronbach's $a > 0.9$).

3.2 Consumer-perception survey-results

3.2.1. Demographic-nature of the respondents

Personal-particulars of the respondents, from the three-towns in the Rift Valley Province of Kenya (chosen for this-study) are shown in the Figure 3. In summary; 56% of respondents were between 18 and 25 years old; 66% of respondents, interviewed, were males, while 34% were females; 42% of respondents had university-education followed by those with secondary-education at 32%; 60% of respondents were from the family of 2 to 5 members. Among the respondents 35% were employed and 30% self-employed, while only 10% of them were students. On profession, 50% reported to have other-occupations, like environmentalists, pharmacists, chefs, among other-professions, followed by 35% business-professionals.
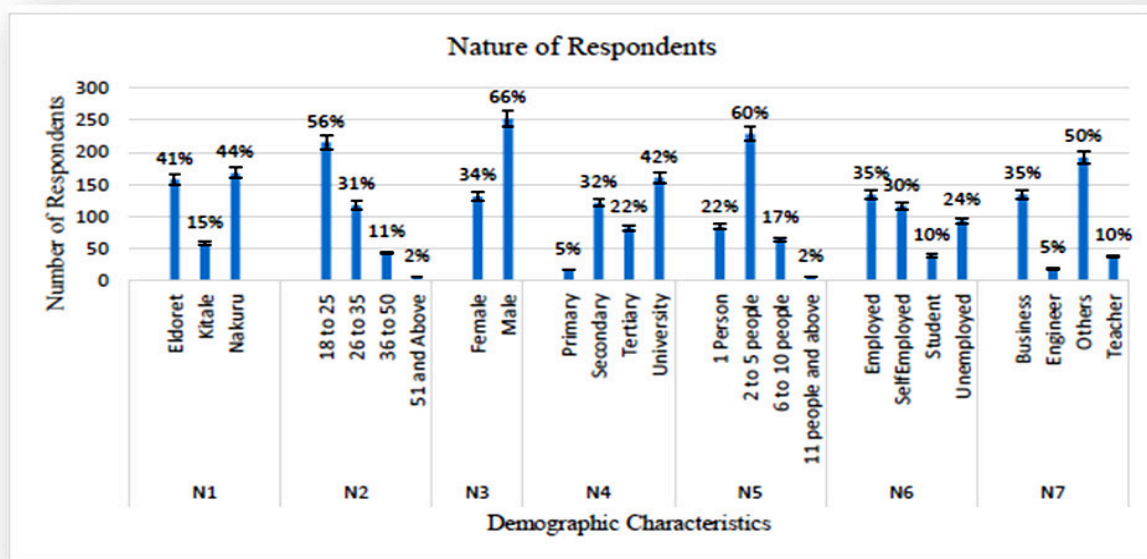
KEY: N1 – town, **N2** – age, **N3** – sex, **N4** – level of education, **N5** – size of the family,
N6 – employment status, **N7** – profession
Figure 3: Demographics of respondents

3.1.2. Shopping habits
The researchers also investigated shopping-habits of the respondents. Figure 4 shows 43% of respondents reported shopping weekly, followed by 32% shopping daily, and with only 2% shopping yearly. On the question of what they mainly shopped, 75% of respondents reported buying food-stuffs, followed by clothing at 19%, and 4% represented electronics-purchase.


KEY: N8 – frequency of shopping, **N9** – mostly shopped items
Figure 4: Shopping habits of respondents

3.1.3 Usage of shopping bags
On the question of usage of shopping-bags, 80% of respondents were using polyethylene-shopping-bags, because of their-availability, followed by woven-fabric-bags at 10%, mainly because of their-strength and reusability. On the question of the shopping-bag they preferred, 48% of the respondents said to prefer woven-fabrics-bags. Asked on the number of times they reused shopping-bags, 52% said they reused them 2 to 5 times.
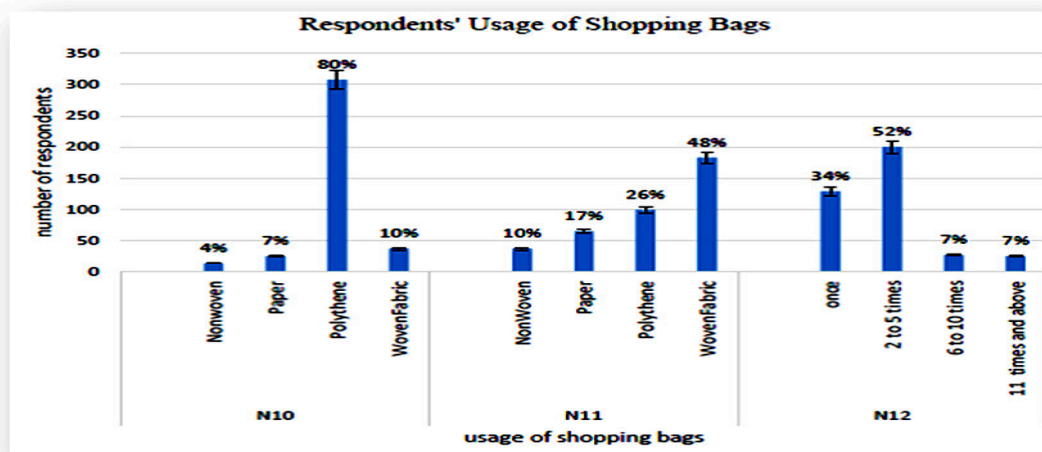
KEY: **N10** – shopping bag used. **N11** – shopping bag preferred.
N12 – number of times the shopping bag is reused.
Figure 5: How respondents use shopping bags

3.1.4 Disposal of the shopping-bags

The researchers also wanted to know the means used to dispose the shopping bags after use. 31% of the respondents said they burn the bags after using them. On the question how often they discarded house waste, 52% of the respondents discarded the waste on a daily-basis.
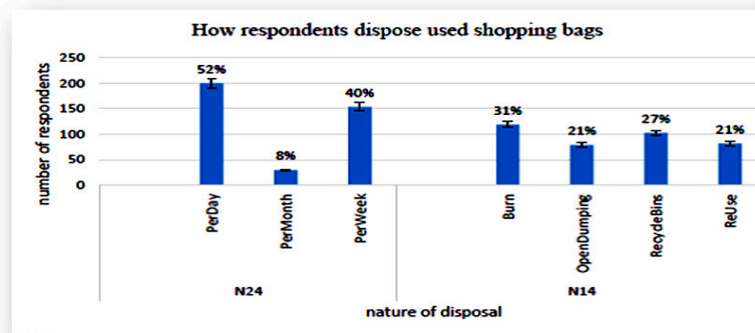

KEY: **N24** – frequency of disposing house waste, **N14** – method of disposing shopping bags
Figure 6: How respondents dispose used-shopping-bags

3.1. 5 Consumer perspective on polythene-bags

82% of respondents agreed that polythene-bags are a problem to the society, because they not only pollute the environment, but can also result in the death of both, livestock and, even, humans, such as small-children. 67% of the respondents supported the government's move to ban polythene-bags. The respondents also accused the government of taking too-long to realize the need to come up with more-viable-options. 64% of the respondents were willing to pay for any-other-bag, instead of using polythene-bags. 70% of the respondents were willing to support in the implementation government-regulations as regards shopping-bags for sake of environmental-sustainability.
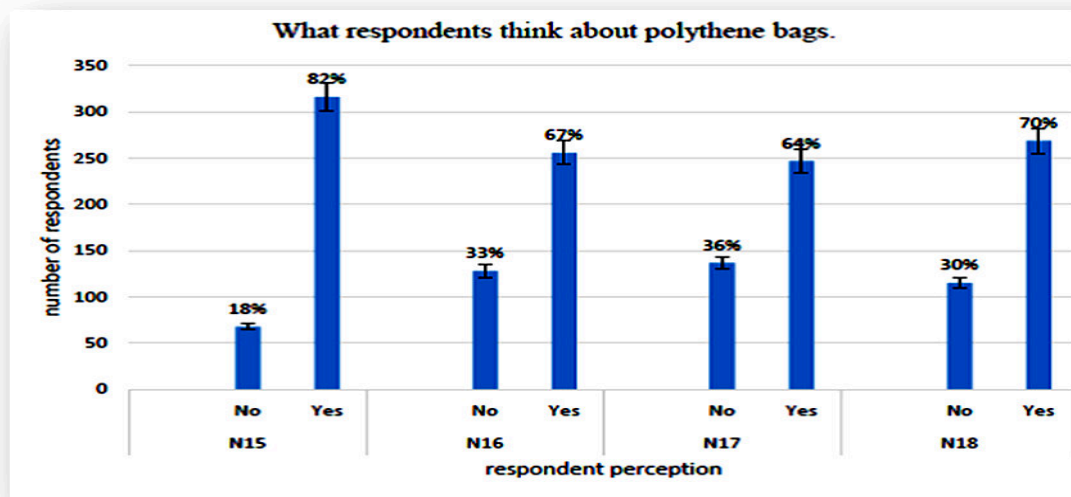
KEY: **N15** – think polythene bags are a problem to society; **N16** – is it right for government to ban polythene bags; **N17** – willing to pay for a bag instead of using polythene bags; **N18** – willing to support government regulations as regards shopping bags.

Figure 7: What respondents think about polythene shopping bags

3.1.6 Awareness towards policy and environment

The authors also wanted to investigate awareness towards policy and environment. From Figure 8 below, 52% of respondents said they were aware of government-regulations on the use of shopping-bags, especially as regards dumping. 60% of respondents agreed that they have never-discussed with their-friends about shopping-bags-menace. Of the interviewed respondents, only 16% had personal-cars. Asked on whether, if they had cars they will prefer using trolley carrying goods to their cars, rather than shopping bags, 51% of respondents said "Yes", while 49% said packing in shopping-bags is more convenient and hence giving answer as "No". Asked on whether the beauty of shopping-bags matters, 63% of the respondents said "Yes", because beauty of shopping-bags sometimes makes the shopping-experience more-exciting. Lastly, but not least, asked whether they had ever requested the shop-attendants to reduce number of shopping-bags (while packing goods), 61% of respondents agreed to have not requested, since most of the bags are not directly paid for.
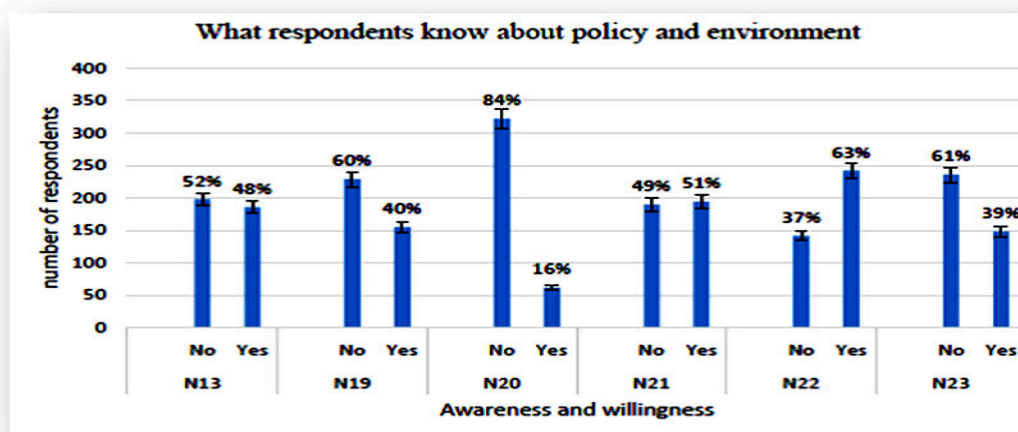
KEY: **N13** – aware of any government regulations about shopping bags; **N19** – ever discuss shopping bags with friends; **N20** – have a car; **N21** – prefer trolley in case of having a car; **N22** – beauty of shopping bag matters; **N23** – ever requested for fewer shopping bags.

Figure 8: Respondents' awareness

3.2 Cross tabulations

To check whether there is an association between the variables, cross-tabulations was performed. Chi-squared-test was used to test significance of the relationships. The study was conducted at 95% confidence-interval, therefore the criterion of rejecting null hypothesis was; Reject null hypothesis if probability value (p-value) for

chi-square is greater than 0.05 which is alpha level of significance. Table 3 shows the summary of results of the cross-tabulation.

4. Discussion

4.1. Cross-tabulation analysis

4.1.1. Relationship between frequency of shopping and age.

The hypothesis to be tested, at this point, is *Null-hypothesis*: there is no significant-relationship between frequency of shopping and age against *Alternative-hypothesis*: there is a significant-relationship between frequency of shopping and age.

From the cross-tabulation, of the daily-shoppers, 48.33% are aged between 18 to 25 years-old, with the lowest, being those aged 51 years and above, with a 7.5%. At a general-level, however, most (44.91%) of the respondents aged 18 to 25 do shop weekly. At 26 to 35 years, they tie (at 47%) for both, daily and weekly-shopping. Those 36 to 50 years-old, mainly shop weekly, with a 51.16%. Last, but not least; those 51 years and above, shop their-goods daily, with a percentage of 85.71%, this is the highest (as regards the relationship between age and frequency of shopping). The relationship between age and frequency of shopping was found to be statistically-significant, as chi-squared value of 23.4873 with a p-value 0.0052 which is less than 0.05 alpha-level of significance.

Table 3: Summary of the *p-test* for survey in Kitale, Eldoret and Nakuru

S. No.	Relationship	Chi sq. value	p-value	Commentary
1	Frequency of shopping and age	23.487	0.0052	Statistically Significant
2	Frequency of shopping and gender	4.3159	0.2293	Not Statistically significant
3	Type of Shopping bag preferred and education level	16.7337	0.0531	Not Statistically significant
4	Awareness of government regulations and education level	10.8647	0.0125	Statistically Significant
5	Size of family and mainly shopped items	3.2926	0.9616	Not Statistically significant
6	Frequency of reusing shopping bag and family size	14.7169	0.099	Not Statistically significant
7	Shopping bag used and shopping bag preferred	66.1003	<0.00001	Statistically Significant
8	Type of shopping bag used and frequency of reusing	45.6465	<0.00001	Statistically Significant
9	Type of shopping bag used and awareness of government regulations	0.623	0.8911	Not Statistically significant
10	Type of shopping bag used and opinion as regards usage of polythene shopping bags	56.53353	<0.00001	Statistically Significant
11	Method of disposing shopping bag and awareness of government regulations	6.3378	0.0963	Not Statistically significant
12	Usage of polythene bags and opinion as regards government banning polythene bags	89.3522	<0.00001	Statistically Significant
13	opinion as regards government banning polythene bags and supporting government regulations	45.9037	<0.00001	Statistically Significant
14	Ever discussed about polythene bags and thinking that polythene is a problem to society	9.7293	0.000768	Statistically Significant
15	Individuals with cars and preference of using trolleys instead of polythene shopping bags	9.7293	0.000768	Statistically Significant
16	Gender and opinion as regards the beauty of shopping bags	0.2966	0.2949	Not Statistically significant
17	Gender and requesting for reduction of shopping bags by attendants	3.5253	0.0304	Statistically Significant
18	Frequency of shopping and frequency of disposing house waste	27.0843	0.0001	Statistically Significant
19	Method of disposing shopping bags and frequency of disposal	6.485	0.3711	Not Statistically significant

4.1.2 Relationship between frequency of shopping and gender.

The researchers also looked at relationship between frequency of shopping and gender. From the cross-tabulation, both males and females mainly shop weekly, with males slightly-higher, than females, at rates of 47.04% for males and 36.64% for females. The relationship between sex and frequency of shopping was not statistically significant, chi-squared value of 4.3159 with p-value 0.2293, which is greater than the alpha-level of 0.05. This implies that both males and females have similar-frequency of shopping in the towns of Nakuru, Eldoret and Kitale.

4.1.3. Relationship between type of shopping-bag preferred and education-level.

Majority of respondents, with primary-education, prefer using polythene-bags (55.56%) compared to majority with university education who wishes to use woven-fabric-bags (50.31%). However, the relationship between level of education and choice of shopping bag material is not statistically-significant, because chi-square value is 16.7337 with p-value 0.0531, is slightly greater than the 0.05 alpha-level of significance. This implies that someone's level of education does not necessarily determine their choice of material for shopping-bag. It seems to be a matter of general-knowledge or exposure, when it comes to preference of material for shopping-bags.

4.1.4. Association between awareness of government regulations and education levels.

88.89% of respondents with primary-education were not aware of the government-regulations, while 50.31% of respondents with university-education were aware of the fact, that government regulates polythene-bags, based on their-thickness. The relationship between level of education and awareness of government-regulations was statistically-significant, chi-squared value of 10.8647 with p-value 0.0125 which is less than 0.05 alpha-level of significance. This implies that, those with higher-level of education are more likely to be aware of government-regulations. Therefore, there is need for sensitization-campaigns in Nakuru, Eldoret and Kitale, through which those with lower-education-levels can be informed of the prevailing-regulations.

4.1.5. Relationship between size of family and what is mainly shopped.

Almost all family-sizes shopped most on food-stuffs, with those of 2 to 5 family members having the highest rate (61.67%). However, the relationship between size of family and mainly-shopped-item was not statistically significant with chi-squared value of 3.2926 and p-value 0.9516 which is greater than p<0.05 alpha level of significance. This implies that the respondents' family-size does not influence what they mainly-shop for.

4.1.6. Association between re-use of shopping-bags and family-size.

Majority of respondents (62.50%) with family-size of 2 to 5 members re-used shopping-bags for at least 2 to 5 times. The relationship between family-size and re-use of shopping-bags was however not statistically-significant, chi-squared value of 14.7169 with p-value 0.099, which is greater than 0.05 alpha level of significance. This implies that there is no statistical relationship between family-size and frequency of re-using the shopping-bags. The chances of a single person re-using his/her bag are as likely, as those of a family of 10 people.

4.1.7. Relationship between shopping-bag-used and shopping-bag-preferred.

The researchers also sought to investigate whether there was a relationship between type of bag used and preferred shopping-bag. Majority of respondents (80%) used polyethylene-shopping-bags and (52%) preferred woven-fabric-shopping-bags. The association was statistically significant with chi-squared value 66.1003 and p-value <0.0001 which is less than 0.05 alpha level of significance. This implies that irrespective of the shopping-bag-used, most people (52%) in Nakuru, Eldoret and Kitale actually prefer woven-fabrics-bags because of their reusability, strength, durability and environmental-friendliness.

4.1.8. Cross tabulation of type of shopping-bag used and re-use of shopping bag.

Majority of respondents (57.14%), who use nonwoven-shopping bags re-use the bags more than twice. Those, who use polythene bags, mostly, use their shopping-bags once, at a rate of 89.15%. The relationship between type of shopping-bag and number of times of re-use is statistically significant with chi-squared value 45.6465 and p-value <0.0001 which is less than 0.05 alpha level of significance. This implies that polythene-bags are the most-wasteful-type of shopping-material with the least re-usability in the towns of Nakuru, Eldoret and Kitale. This is mainly because they seem to be given at no extra direct-cost to the buyer and hence the shoppers do not feel the need for carrying their-own-bags when going for shopping.

4.1.9. Relationship between type of bag used and awareness of government regulation.

57.14% of the respondents, who used nonwoven-fabric, said that they were aware of government regulations on polythene-usage. The relationship between type of bag used and awareness of government regulations was not statistically significant, chi-square 0.623 with p-value 0.8911. This implies that people do not consider the government-regulations, when using shopping-bags.

4.1.10. Association between types of shopping bag preferred and opinion on usage of polythene.

Majority of respondents, who use paper as their shopping bags (93.85%) accepted that polythene-paper usage is problematic to the society and the association was statistically significant with a chi-square value of 56.5353 and p-value <0.0001. This implies that people in Nakuru, Eldoret, and Kitale concur to the fact that polythene-bags are a problem to society. Some of the problems associated to polyethylene-bags were: blockage of drainage-

channels; chocking-animals when eaten; loss of soil-fertility and the pollution from burning-polythene, among others.

4.1.11. Relationship between ways of disposing shopping-bag and awareness on government regulations.

The researchers also wanted to know whether there was an association between ways of disposing polythene-bags and awareness of government-regulations. Majority of respondents (35.03%) who said they burnt the bags after using were not aware of government regulations, however the association between awareness of government regulations and method of disposal is not statistically-significant, chi-squared value 6.3378 and p-value 0.0963 which is greater than 0.05 alpha-level of significance. This implies that the people of Nakuru, Eldoret and Kitale do not reflect about government-regulations when deciding on how to dispose used-shopping-bags.

4.1.12. Relationship between opinion on whether polythene-bags are a problem to society and government ban on polythene-bag-usage.

66.67% of the respondents agreed with government banning polythene-bags. The association was statistically-significant with a chi-squared value of 89.3522 and p-value <0.0001. This implies that the majority of people of Nakuru, Eldoret and Kitale support the government-implementation of the ban on polythene-bags because they are a problem to their society.

4.1.13. Association between whether government should ban polythene usage and support of the government regulations regarding polythene bags.

81.25% of the respondents who agreed that the government should ban usage of polythene-papers are also willing to fully-support the government to implement the ban. This association is statistically significant with a chi-squared value 45.9037 and p-value <0.0001. Therefore, it is feasible from the survey results that the people of Nakuru, Eldoret and Kitale are willing to observe the enforcement of regulations imposed by the government as regards polythene-bags.

4.1.14. Relation between ever had discussion with friends about polythene-bags and agreeing that polythene are problematic to society.

The researcher also wanted to know whether there is a significant association between respondents who had ever had discussion with friends about polythene bags and those who agree that polythene are problematic to the society. Majority (77.29%) of respondents who had never had any discussions with friends about polythene-bags still considered polythene to be problematic to the society. This relationship was statistically-significant with chi-square value 9.7293 and p-value 0.000768 which is less than 0.05 alpha-level of significance. This implies that people do not need discussions with friends about shopping-bags in order to know that polythene-bags are a problem to society.

4.1.15. Association between individuals with cars and prefer using trolley to carry goods to their-car rather than polythene-bags.

80.65% of the respondents who owned cars preferred to use trolleys to carry goods into their cars in order to save/avoid shopping-bags. This relationship was statistically significant with chi-square value 9.7293 and p-value 0.000768 which is less than the 0.05 alpha-level of significance. Therefore, if supermarkets can avail alternative staff to assist in taking the client goods to their cars, the amount of shopping bags dispensed for most of these bulk shoppers can be minimized.

4.1.16. Relationship between gender and opinion on beauty of shopping-bags

The researchers also sought to know whether there was a relationship between gender and the beauty of shopping bag. Majority of female respondents (64.89%) agreed that the beauty of the shopping bag matters. The relationship is however not statistically significant, chi-squared 0.2966 and p-value 0.2949 which is greater than 0.05 alpha level of significance. Is therefore implies that both men and women are likely to perceive the beauty of shopping-bags equally without gender-prejudice.

4.1.17.Relationship between gender and request for number of packing bags reduced by attendants.

On the question whether the respondents had ever requested the attendants to reduce number of packing bags, 67.94% of female respondents said they had never requested for the same. Reason being the fact that most of the things shopped for by women often can be packaged in the same pack for example, soap and juice. The association was statistically significant with chi-square value 3.5253 and p-value 0.0304 which is below 0.05 alpha-level of significance. This implies that people dispensing the merchandise to women are the principal-deciders as regards the quantity of packaging handed out.

4.1.18. Relationship between frequency of shopping and discarding house-waste

Majority of the respondents (63.33%) who shopped on daily basis said they discard house wastes per day. The association between frequency of shopping and frequency of waste disposal was statistically significant, chi-squared value 27.0843 and p-value 0.0001 which is less than 0.05 alpha-level of significance. This coupled with the fact that polythene bags are the most dispensed implies that the level of polythene-bags build-up in the environment can only be expected to become much and much more with time if no potential-alternatives are devised in time.

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4.1.19. Association between methods of disposing shopping-bags and frequency of disposal.

Of the 119 respondents who burn their shopping bags, 53.78% discard them every day, 37.82% weekly and 8.40% monthly. At a rate of 32.16%, this implies that there is more air pollution because burning is higher than daily open dumping of 21.11%, daily recycle bins usage at 26.13%, and daily reuse of shopping bags at only 20.60%. At a general level of disposal, burning still scores the highest percentage of 31.07%, followed by recycle bins at 26.89%, reusing at 21.41% and lastly open dumping at 20.63%. However, the association between Methods and Frequency of disposing used shopping bags was found to be statistically insignificant with a chi-squared value of 6.485 and p-value 0.3711 which is greater than 0.05 alpha-level of significance. This therefore implies that there is no relationship between how often people dispose used-shopping-bags and the means by which they do that.

4.2. Discussion on survey-findings

The survey-results indicated that regardless of sex, educational-level, age-group and occupation, majority (80%) of the towns'-populace widely-used plastic-bags on a daily-basis in their-life-activities. Plastic-bags have become exceedingly-cheap to serve the profligate "use-and-throw" pattern of consumption and production. These-findings are consistent with other-reports describing that light-weight, cheap-price, excellent-fitness for use and resource-efficiency as main-reasons for widespread-utilization of plastic-bags by billions of customers throughout the world (Verghese *et al.,* 2006).

Throughout the course of the-study, the authors also witnessed, that many-shop-keepers and shop-attendants, open-market-sellers (also commonly known as "*mama mbogas*") and supermarket retailers, distributing plastic-bags free of charge, to their-customers, for carrying sold-items. This suggests that cheapness or free-distribution of these-materials by retailers or supermarket-owners are, believed to be, the main-reasons for the widespread-usage of polyethylene-single-use-shopping-bags, and associated with their-disposal-problems. This-argument is consistent with the results of similar-surveys in other big-towns of the world by Li *et al.* (2010); Ayalona (2009); TEC (2007); and by Environment Victoria (2006).

The disposal-phase of any-product, shopping-bags in particular, attracts more-importance in terms of its eco-impact, compared to other-phases in its entire-life-cycle. It is evident, that at the end of their-short-service-life, plastic-bags become wastes (Clapp *et al.,* 2008). Therefore, the respondents were also asked about the ways on how they used to dispose their-plastic-bag-wastes. The results indicated that burning accounts for highest-rate (31%) and hence can be considered the common-practices to dispose plastic-bag-wastes in Rift Valley. However, this burning, should not be encouraged for several-reasons, such as greenhouse gas-emissions, that in turn, cause climate-change (Muthu *et al.,* 2009; Vehrgese *et al.,* 2006) and release of toxic-organic-compounds into the environment, that cause different-health-risks, such as respiratory-health-problems (Rayne, 2008; Boadi & Kuitunen, 2005). Thus, the public should be educated or informed regarding the impact of burning of PSBs-wastes.

4.3. Summary of main-environmental-problems (due to PSBs and their- disposal) alongside with Interventions and strategies to combat the menace.

Main-environmental-problems due to PSBs and their-disposal (outlined in section 1.2) are also summarized in the Figure 9 below.
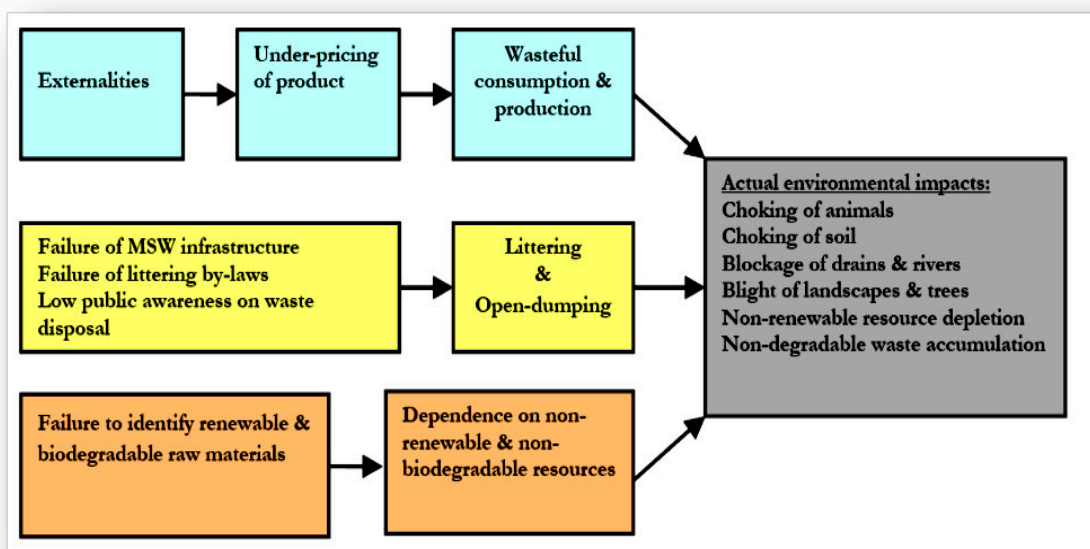
Figure 9: Plastic Bag Waste Environmental Problems: Causal Chains (Bahri, 2005).

To combat plastic-bags-waste and associated with it problems, interventions and strategies offered, will be highlighted as follows:

4.3.1. Interventions

Although, plastics provide humans with many-advantages; they play an opposite-role for the environment. Even, if all these-drawbacks are known, plastic-bags are still produced and used, in vast-amounts. One of the contributing-factors is the fact, that the trade in plastic-bag is a competitive-international-business for capitalists (Giddens, 2006). Giddens (2006), proposed that, capitalism was not created to save the earth; it was created to turn nature into wealth, as fast as possible, through the creative-dynamics of exploitation and non-preservation, which are both, disruptive to the society and to the natural-world. Capitalists belief in the culture of accumulation of wealth and do not believe they owe anything to nature (Waste Digest, 2006). In this-regard, those-engaged in the business of plastic-bag-trade are in pursuit of making profit from the business, and they disregard harmful-effects of plastic-bags to the ecosystem. The collective-outcome of capitalism has been creation of widespread-environmental-destruction, whose precise-cause is uncertain, and whose-consequences are similarly-difficult to calculate; a phenomenon, called "*technological disaster*".

Several-International-organizations recognize the impact of plastic-bag-waste, which has already become a major-environmental-issue in many-African-countries, including Kenya, more so in their-urban-centers. So profound was the concern on plastic-waste in African-cities, that it became one of the priority-issues in the First African Experts Meeting on the Ten Year Framework Program on Sustainable Consumption and Production. With the intent of developing a response to the problem, UNEP, consequently, facilitated the establishment of a Regional-Task-Force on Plastics, under the auspices of the African Roundtable on Sustainable-Consumption and Production (UNEP, 2004).

In Kenya, in particular, plastic-bag-waste has already become a grave-environmental-predicament. The initiative from UNEP namely, the Pilot Project on Sustainable Management of Plastic Waste in Nairobi, for example, deserves a brief-cite here, due to its relevance to this-research. It tries to find solutions to the growing-challenge of plastic-waste in African-urban-centers, as per the Johannesburg Plan of Implementation and the African Ten Year Framework Program on Sustainable Consumption and Production. It was officially-launched on July 19, 2005 and aims at gathering useful-experiences for subsequent replication in other African-countries and cities (UNEP, 2005).

4.3.2. Strategies to reduce single-use plastic bags

In order to reduce the usage of single-use-plastic-bags, the following three-strategies are reviewed:

(1) reusable-bags, (2) a ban, and (3) a taxation.

(1) Reusable bags; The terms reusable-bags, often called "bags for life", comprises bags, made of any-material, that are meant to be used from several to hundreds of times. Usually, these are commercially-produced in materials like cloth, woven, canvas, synthetics, and thicker-plastics, among-others (UK EA, 2006). There are also many-environment-friendly-alternatives to plastic-bags, such as: jute-bags, paper-bags, bio-degradable bags, and reusable-bags. The natural-fiber-alternatives, that are currently-popular are jute-bags, paper-bags and biodegradable or bio-plastics, in conjunction with the non renewable-alternatives, such as, heavier-plastic-bags,

woven-plastic-bags and renewable-calico, cloth-bags (Though, 2007). When comparing with single-use plastic-bags, these require more-energy and resources per-bag, but if used several-times, as intended, the environmental-footprint becomes lower and lower, after each-use (ICF International, 2010). While numerous-alternatives to plastic-bags exist, the currently favoured-alternatives can be categorized in four-main-groups, such as: jute, paper, bio-degradable and reusable-bags.

On the-other-hand, despite plastic-bags being designed to be used only once, they can often be reused in a number of ways. For instance, in a study carried out by the UK' WRAP (2005) several-different-reuses, that consumers give to plastic-bags are described, such as: trash-bin-liners, for pets-excrements, garden-refuse, reuse for supermarket or other-shopping, to store things at home, for packed-lunches, to carry other-things at home, and to keep bottles and cans in for recycling, among others. In such-study, the most-common use, among the respondents, was as a trash-bin-liner in kitchen (53%) (WRAP, 2005).

In the USA, California was the first state, where the Plastic Bag Recycling Act of 2006 was established. It forced stores to: "provide bins to collect used-plastic-bags; print on each bag the message: "Please Return to a Participating-Store for Recycling"; and maintain records for at least-three-years, documenting recycling-activities" (Food marketing Institute, 2010). After that campaign, many-states have changed their-plastic-bag-policy and implemented different-tools to decrease usage.

Australia, France and Belgium focused on voluntary initiatives, through awareness campaigns in supermarkets. Such-methods and mechanisms are used for reducing the production and consumption of plastic-bags. This-instrument can be successful only in a society with high-environmental-awareness. Those-actions helped to change the packaging-behavior of the customers.

(2) Ban on plastic bags is considered as the prohibition, from retailers to sale single-use plastic-bags, in a given-territory. Several-countries, around the world, have successfully-implemented bans and many-others are on their-way. For instance, Philippines implemented, in 2011, a "Total Plastic-Bag Ban", which entails a strict-system, where retailers can only offer paper-bags or biodegradable-bags, and those, who disobey the law, are punished through fines, revocation of business-license or, even, prison (Hogaza, 2014). In China, a ban was imposed in 2008, which has resulted in a decrease of PSBs-use of 60% for local-supermarkets, against 80% for foreign-owned-ones (Block, 2013).

Considering the large-scale damaging-effect of plastic-bags and the large-scale plastic-bags production-capacity, many-countries, all over the world, have already prohibited the production and use of plastic bags, by enacting parliamentary-legislations, for instance: Australia, Bangladesh, South Africa, Somalia, Ireland, India, Italy, United States of America, and Tanzania, alongside with some-other environmentally-concerned-countries (Ahmad, 2005; Brown, 2005; IRIN 2005; Chauhan, 2003; Reynolds, 2002). At least 20-nations and 88 local-governments have passed bans on distributing thin-plastic or other-types of disposable-plastic-bags, including the nations of Argentina, Mongolia, and Macedonia, among others. It has been reported that different-cities (for example, Karachi, Telluride, and Colorado) implemented *city-level-strategies* and policies, which ban the use and production of plastic-bags (AECOM, 2010; Watson, 2009; Clapp&Linda, 2009; KNCPC, 2006). In some-countries, bans are regional, for example, in Novomorsky, Dnipropetrovs'k region of Ukraine; polyethylene-bags are forbidden. Approximately 26-nations and many-local-communities have established fee-programs to reduce plastic-bag-use and/or increase the use of reusable-alternatives, including: Botswana, China, Hong Kong, Wales, Ireland, Israel, Canada's Northwest Territories, Toronto, Mexico City, and Washington, D.C. (UN, 2005).

This could be done through encouraging: (1) Shopkeepers and retailers (the main-distribution-source of plastic-bags), not to provide plastic-bags to their-customers; (2) the public to abstain from using plastic-bags; and (3) investors to manufacture and distribute of low-priced alternative-reusable-materials or bags made of natural-fibers, paper and clothes, which have low-impact on environment (Muthu *et al.,* 2010; Li *et al.,* 2010; Smith, 2009). These can potentially be adapted to the Rift-Valley-context of this-study.

 In Bangladesh, for example, it started with the anti-plastic-bag-campaign, in the early 1990s. In 2002, a law was enacted banning the production, sale and use of polyethylene-bags, starting from the capital Dhaka, before enforcing it nationwide (Clapp & Linda , 2009). Because of the ineffectiveness of the levy initially-imposed on the plastic-bags, countries like China, USA (California, Seattle and San Francisco) Australia, Rwanda, and Uganda, among-others, have decided to impose a complete-ban on the use of all-plastic-bags (Morris& Christensen, 2014; Romer, 2008). Ethiopia is one of the African-countries that successfully have, partially-banned plastic-bags, by setting a minimum-thickness of the bags, to be manufactured in the country and/or imported into the country (Solid waste management, 2007; UNEP, 2005).

Moreover, passing legislations, alone, is not sufficient-condition, to curb the problem of plastic-bag-wastes. Therefore, the central-government in collaboration with other-concerned-authorities of the cities/towns should encourage people to use environment-friendly alternative-materials, such as cloth-bags, paper-bags and natural-fiber-bags. These have been applied in Bangladesh, Eritrea and Somaliland. From the country-case-studies, it can be observed, that although outright-bans could resolve the problem, they under-perform in respect of other-criteria (they are not cost-effective). This was the-reason why they were not accepted in Australia,

Ireland and in South Africa. Availability of substitutes is also a determining-factor, which could lead to strong-public-opposition, as was the case in Somaliland. In addition, enforcement of outright-bans is very difficult, and, overall, costly, which was also the case in Somaliland. This research, therefore, disregards an outright-ban as a solution to the plastic-waste problem in Rift Valley.

4.3.3. Taxation or fees

Introducing taxes to plastic-bag-consumption is different than charging a fee. The first, will usually-consist in an imposition of taxes at a retailer-level, which will eventually be paid-indirectly by the consumers. The second, consists of a fee, which is charged-directly to the consumer, at the counter. In any-case, Poortinga *et al* (2012), suggest that voluntary-actions are half as effective, as fees, in order to reduce single-use plastic-bag-consumption and that, in England, for example, 54% of the population is in favor for a plastic-bag-charge.

London, England; Ireland and Scotland in Europe (Commons, 2014)**,** and South Africa and Botswana in Africa (Dikgang & Visser, 2010) now impose fines on single-use plastic-bags, in a bid to encourage the use of bio-erodible-bags, made from high-density-polyethylene (HDPE) with an addition of degradation-promoting-compounds (Cadman, 2006). The Japanese-government has also introduced a charge on plastic-bags, to reduce its production and usage. Consumers shifted their-preferences to cloth, paper, biodegradable or compostable-plastic-bags. Unfortunately, taxes on plastic do not solve the problem of pollution; they just help to shift to more-sustainable-plastics or other-materials.

Another-possible-way of dealing with the over-production of plastic-bags is the advertisement of eco-bag-campaigns, at particular-shops and supermarkets. For an example, the shoes store "INTERTOP" has a promotion for using eco-bags (textile) with the label "I am for clean life". All-money from sold-bags is used for environmental-events, such as planting-trees or sponsoring the organization of the "Earth Day" (Ruban, 2012).

Becker *et al* (2014), argue that individual-intentions are less-powerful, than habits, and that, institutional-regulation, incentives and supports have the ability to encourage such-behavior-change, by altering the value and intention of the behavior. Bans or taxation on plastic-bags, incentives to use reusable-bags are among these-regulations and incentives. In addition, several local-initiatives were emerged in Kenya.

4.4. Local-initiatives

4.4.1. Environmental Management and Coordination Act (EMCA, 1999)

In 1999, the Kenyan-parliament passed the Environmental Management and Co-ordination Act (EMCA), which came into force in January, 2000. The National Management Authority (NEMA), established by the Act, is the main-body, which coordinates environmental-management-activities in the country (ELCI, 2005).

The following are the relevant-sections of the Act (ELCI, 2005; UNEP, 2005): (1) Section 3, provides every-Kenyan with the right to a clean and healthy-environment; and grants citizens the duty to safeguard the environment, (2) Section 87, demands that every-person, whose activities generate waste, must ensure that the waste is minimized through treatment, reclamation, and recycling, (3) Section 142 part 1, stipulates that any-person, who pollutes the environment by discharging dangerous-materials into land, water, air or the aquatic-environment, is guilty of an-offence; it also lays down penalty-provisions, i.e. if justified, the court may demand the person in question to pay 'the full-cost of cleaning up the polluted-environment'; in addition, the court may order the polluter to pay any third-party, who has incurred-damages due to the-pollution, (4) Part V, Section 57, sub-section I, makes provisions for the use of, taxes and other fiscal-incentives, disincentives or fees "to induce or promote the proper- management of the environment and natural-resources or the prevention or abatement of environmental- degradation".

UNEP (2005) emphasized that the enactment of EMCA and the creation of NEMA, for its implementation, provide strong-institutional-base, for the use of economic-instruments, to manage environmental-problems, from plastic-shopping-bag-waste.

4.4.2. Public-concern on plastic-waste and consequent-reactions in Kenya

The 2003, Kenyan Nobel Peace Prize Laureate professor Wangari Mathaai, is , at one-time, reported as saying, "If they wrap your fish and chips in plastic-bags, please refuse the food". In a similar-tune, the president of the country, Mr. Mwai Kibaki, in the opening-speech, he gave, to the UNEP Governing Council Forum of February 21, 2005, said: "In our-major-cities, plastic-bags are used in large-quantities at the household-level. However, these-bags are not disposed of in ways that ensure a clean-environment; my country welcomes initiatives to address the problem" (NEMANews, 2005). One other-incidence of public-concern is that of the Wildlife Club of Kenya, which organized a march to urge the government to regulate plastic-bag-manufacturers (Wikinews, 2005). Kenya plans to implement regulations banning plastic bags under 30 microns thick, undertake a consumer and anti-littering campaign, introduce a plastic bag levy collected from suppliers, with the costs passed onto consumers. The levy would be partially targeted to support the development of reusable-bags, such as cotton, which would have the double-benefit of helping Kenya's cotton agriculture and industry. There is also support for a suitable-plastic-bag recycling scheme, and a new-body, known as the Plastics Levy Management Committee, is to be set up, to manage and implement the new measures

(www.unep.org/documents.mulitilingual). The 2005 Nobel Peace Prize winner, Wangari Mathaai, endorsed action for this-plan, as her research has linked discarded-plastic-bags with facilitating the spread of malaria.

In May 2003, plastic-industries under Kenya Association of Manufacturers (KAM), together with NEMA, came up with, what is known as, the Ten-Point Action Plan on Plastic Waste Management (Kimilu, 2004). It has the following provisions: (1) By 2006, plastic-manufacturers to recycle 15% of their-industrial output, (2) NEMA to instruct: local-authorities, retail-chains, hotels and restaurants, on their-obligation to recover 75% of plastics in the environment by 2006, (3) Production and purchase of flimsy-plastics to be phased out, immediately, (4) NEMA, to issue advisory to all-stakeholders, on the agreements and actions, on plastic-waste-management, (5) Government, to issue differential-power-tariffs for recycling, (6) KAM to lobby for investment tax-allowance of 140% on recycling-machinery, for incorporation in year 2005 finance-bill, (7) Develop new-standard to increase plastic-bag-thickness, by July 2004, (8) All manufacturers to apply new-plastic-thickness-standard by July, 2005, (9) Develop plastic-disposal guidelines by July, 2004, and (10) Formulate by-laws, on littering for cities and towns by July, 2005.

A discussion with manufacturers indicated, that the bags, most-responsible for littering, are carrier-bags of 6 microns (known locally as "*juala*") for which there is a very-high-demand, due to their-affordability. Although a shift has been made to 10 microns, as per the Kenyan-standard, littering still continues, owing to lack of effective-collection and recycling-infrastructure (Haria *et al.,* 2005).

The study of Wachira, 2016 also recommended the following-policy-package of seven-instruments to manage plastic-bag-waste in Nairobi, which are to be introduced gradually, over a period of two to three-years: (1) A ban on plastic-shopping-bags, that are less than 30 microns in thickness, (2) Consumer- awareness and anti-littering-campaign, (3) Promotion of voluntary-schemes, such as a national-code of practice for retailers, (4) A plastic-bag-levy, collected from suppliers, (5) Support for development of environmentally-friendly alternative-bags, (6) Support for development of an effective-plastic bags recycling-system, and (7) Support for development of a managed disposal-system, to cater for the plastic-bags that will enter the waste-stream, irrespective of the measures taken.

4.4.3. Plastic Bag Standard by KEBS (KS 1794:2003)

KS 1794:2003 was a response to the growing-plastic-waste-menace and manifested ever-increasing public-concern. It was developed in November, 2003 and gazetted in October, 2004. According to the standard-document, the corresponding Indian and South-African-standards were used to develop this Kenyan-equivalent. The need for such-standards to address the problem in Kenya is quite-justified. The importance has been felt already by all concerned stakeholders (e. g. Kenya Bureau of Standards (KEBS); Ministry of Transport and Infrastructure (MoTI); KAM; NEMA; and the Kenya Institute for Public Policy Research and Analysis (KIPPRA)). The major-question here is at what-level it should be set. KIPPRA and NEMA propose a 30 micron-regulation (a micron is 1 thousandth of a millimeter). KAM is opposed to this and prefers the current KEBS standard of 10 microns (HDPE) and 15 microns (LDPE and LLDPE).

Eventually, the consensus were reached, resulting in a local-standard, entitled "Polyethylene and polypropylene-bags for general-purposes-specification", KS 1794:2003 has the following major-provisions (KEBS, 2003): (a) In order to encourage re-use and hence to reduce the impact on the environment, a minimum-thickness is set for the various types of plastic-bags, i.e. LDPE & LLDPE (15μm), HDPE (10μm) and PP (20μm); (b) Bags manufactured for food-products, like bread and milk, should be printed with food-grade-pigments; (c) It applies for monolayer PE and PP film-bags for commercial and household-packaging of products; it does not cover multi-layer bags; and (d) The allowable printing-ink-types are specified along with the permissible-weight of printing-ink (dry-basis) compared to the un-printed bag.

Since the delicate-PSBs are normally made from HDPE, it can be assumed that the standard relevant to this-research is 10 microns. Theoretically, such-standards have to be set on the principles of marginal-analysis (practically difficult). In practice, a trial and error-approach has to be followed to see if the standards have brought acceptable changes and at affordable-cost. From the experiences, of India and South Africa, however, the authors are unconvinced as to whether a 10 micron-standard will lead to the desired-results. On the-other-hand, both KAM and the plastic-sector-group, claim that member-industries have-already complied with the minimum thickness-requirement for PSBs (Kimilu, 2005; Kantaria, 2005). However, no independent-evaluations are available (to the authors, at the time this-study was conducted) to justify the claims by industry.

5. Conclusion and Recommendations
5.1. Conclusion

In this-research, an attempt has been made, to elicit the consumers' attitude towards reuse, recycle and disposal of PSBs and to illuminate on the existing-relevant governmental-policies and interventions, as well as willingness of people to support-them.

The survey-results indicated that regardless of sex, educational-level, age-group and occupation, majority (80%) of the towns'-populace widely-used plastic-bags on a daily-basis in their-life-activities. The

statistics collected in this-research may be used for investigating subject-relations between specific localities regarding particular-social-phenomena; in this-study, it is behaviors and attitudes toward the plastic-shopping-bag, and the locality is of Rift Valley Province, Kenya; hence findings cannot be inequitably-generalized to other-locations.

From the regional-survey, it was discovered that age has a significant-influence on people's shopping-habits, especially frequency of shopping. The other-parameters of statistical-significance included the relationships between: educational-level versus awareness of government-policies; type of shopping-bag used versus type of shopping-bag-preferred; type of shopping-bag-used versus number of times the shopping-bag was reused; the usage of polythene as shopping-bag versus shopping-bag preferred; usage of polythene versus support of government to ban polythene-shopping-bags; people with cars versus willingness to use trolleys rather, than polythene; sex versus request to reduce the number of shopping-bags at the counter; and, frequency of shopping versus frequency of discarding house-waste.

It was also exposed that factors of no statistical significance as regards the use of shopping bags in the Rift-Valley province of Kenya include: Sex vs. frequency of shopping; type of shopping-bag used vs. level of education; size of the family vs. mainly shopped items; number of times the shopping bag is re-used versus family-size; type of shopping-bag-used vs. awareness of government-regulations; method of disposing used-shopping-bag vs. awareness of government-regulations; sex vs. the value attached to beauty of shopping-bag; and, method of disposing used-shopping-bag vs. frequency of disposing the used-shopping-bags.

Through this-research it was revealed, that most-respondents agreed to environmental-devastation and dangers to humanity, posed by the uncontrolled-use of polythene-shopping-bags. As noted by one respondent, some-people are compelled to use polythene-bags, because they are distributed at indirect-costs, but would not buy these-polythene-bags in the presence of other-alternatives, like woven-bags, for example. They tasked the government-organs, responsible for implementation of the ban; to expeditiously enforce the total-ban on polythene-bags.

Some skeptical-people argued that banning polythene-bags might increase the level of unemployment, which in turn, may lead to increased-crime in most-urban-centers. To this-end, the authors believe, that crime in urban-centers is a complex-issue, which cannot be directly connected to unemployment. To most-people, saving the environment for future-generations avails more sustainable-opportunities, as compared to the benefits, derived from employing a few-people. The authors therefore find it feasible to noticeably-reduce or, even, to eradicate polythene-shopping-bags on the Kenyan-market. This will, in the long run, oblige researchers, academicians and entrepreneurs to innovate-viable-alternatives, which are more-environment-friendly, as the general-public is ready and willing to embrace these-alternatives.

All in all, these-(previously-mentioned)-recommendations would contribute to steer the Kenyan society towards more-sustainable-practices, with aims to preserve their-environment and own-health, in line with the country's economic-interests. Risks caused by plastic-paper-bag-litter are controllable, when individuals, organizations, governments, countries, continents, and the world, as a united-entity, act responsibly!

5.2. Recommendations

The authors fully-concur with an array of different-possible-solutions to the problem of the Kenyan ever-increasing plastic-bag-usage and indiscriminate-disposal (as highlighted in Section 4 of this manuscript). In addition, the study recommends, that Government, as well as nongovernmental organizations, should arrange national and international-conferences, workshops and competitions to highlight and seek solutions to the negative-impacts, associated with plastic-bags. Also the government, in conjunction with UNEP, NEMA, and KNCPC (Kenya National Cleaner Production Centre) should organize regular-awareness-campaigns to publicize through radio, television and print-media on the short-term and the long-term harmful-effects of plastic-bags-litter.

The authors, furthermore, in accord with Ecomaine nonprofit-organization, stating in 2014, that: "…the best-plastic-bag is the-one you do not use". The long-term technical-solution, therefore, should address the very-nature of the materials from which the products are manufactured, which are non-renewable and non-biodegradable. Therefore, further-research on possible-environmentally degradable-alternatives to PSBs (including manufacture and testing of the prototype-bags) is recommended.

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